REGULATION
R2022

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REGULATION - 2022

PRIST

DEEMED TO BE UNIVERSITY

SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING

SKILL DEVELOPMENT	
EMPLOYABILITY	
ENTREPRENUEURSHIP	

PRIST
DEEMED TO BE
UNIVERSITY
NAAC ACCREDITED
THANJAVUR – 613 403 - TAMIL NADU

DEPARTMENT OF
MECHANICAL ENGINEERING

PROGRAMME HANDBOOK

M.Tech. – Manufacturing Technology
FULL TIME PROGRAMME
Regulation 2022

(For candidates admitted to M.Tech Manufacturing Technology Programme from June 2022 onwards)

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

COURSE STRUCTURE

Semester - 1

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
22248S11	Advanced Engineering Mathematics	3	1	-	4
22254C12	Theory of Metal Cutting	4	-	-	4
22254C13	Advanced Manufacturing Processes	4	-	-	4
22254C14	Advances in Casting & Welding	4	-	-	4
22254C15	Automated Computer Integrated Manufacturing Systems	4	-	-	4
22254E16 (A To C)	Elective – I	3	-	-	3
22254L17	CAD/CAM Laboratory	-	-	3	3
TOTAL NO. OF CREDITS					26

Semester – 2

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
22254C21	Tooling for Manufacturing	4	-	-	4
22254C22	MEMS and Nano Technology	4	-	-	4
22254C23	Manufacturing Metrology and Quality Control	4	-	-	4
22254E24 (A to C)	Elective – II	3	-	-	3
22254E25 (A to C)	Elective – III	3	-	-	3
22254L26	Automation Lab	-	-	3	3
222TECWR	Technical Writing/Seminar	-	-	3	3
TOTAL NO. OF CREDITS					24

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

Semester - 3

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
22254C31	Metal Forming Process	4	-	-	4
22254E32 (A to C)	Elective – IV	3	-	-	3
22254E33 (A to B)	Elective - V	3	-	-	3
22254E34 (A to B)	Elective - VI	3	-	-	3
22254P35	Project Work Phase I	-	-	10	10
TOTAL NO. OF CREDITS					**23**

Semester – 4

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
22254P41	Project Work Phase II	-	-	15	15
TOTAL NO. OF CREDITS					**15**

ELECTIVE –I

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
22254E16A	Materials Management and Logistics	3	-	-	3
22254E16B	Quality And Reliability Engineering	3	-	-	3
22254E16C	Manufacturing Information Systems	3	-	-	3

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

ELECTIVE –II

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
22254E24A	Finite Element Application in Manufacturing	3	-	-	3
22254E24B	Lean Manufacturing	3	-	-	3
22254E24C	Material management	3	-	-	3

ELECTIVE –III

Course Code	Title of Paper	L	T	P	C
22254E25A	Non-Destructive Testing And Evaluation	3	-	-	3
22254E25B	Maintenance Management	3	-	-	3
22254E25C	Optimization Techniques	3	-	-	3

ELECTIVE –IV

22254E32A	Process Planning And Cost Estimation	3	-	-	3
22254E32B	Instrumentation and Control Engineering	3	-	-	3
22254E32C	Research Methodology	3	-	-	3

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

ELECTIVE -V

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
22254E33A	Product Design and Development	3	-	-	3
22254E33B	Fluid Power Automation	3	-	-	3
22254E33C	Internet Of Things For Manufacturing	3	-	-	3

ELECTIVE -VI

22254E34A	Advanced Material Technology	3	-	-	3
22254E34B	Industrial Safety	3	-	-	3
22254E34C	Additive Manufacturing	3	-	-	3

Total No of Credits - 88

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

DEPARTMENT OF MECHANICAL ENGINEERING

M.Tech., MANUFACTURING TECHNOLOGY – FULL TIME PROGRAMME SYLLABI-REGULATIONS- 2022

I - SEMESTER

22248S11E - ADVANCED ENGINEERING MATHEMATICS 3 1 0 4

LAPLACE TRANSFORM: **9+3**

Laplace transform methods for one-dimensional wave equation – Displacement in a long string – longitudinal vibration of an elastic bar – Laplace equation – properties of harmonic functions.

FOURIER TRANSFORM: **9+3**

Fourier transforms methods for one – dimensional heat conduction problems in infinite and semi infinite rod – Fourier transform methods for Laplace equation.

PROBABILITY OF DISTRIBUTION: **9+3**

Probability – definition and introduction – random variable – probability density functions – study of standard distributions: Binomial, poisson, normal exponential and weibull distributions – Applications – Baye's theorem.

TESTING OF HYPOTHESIS: **9+3**

Testing of Hypothesis – Parametric test – Small samples – Test related proportion, Means, Standard deviation – Test based on chi-square, Goodness of fit and test of independence.

THEORY OF ESTIMATION **9+3**

Principles of least squares – Multiple and partial correlation and regression – Estimation of parameters – Method of moments.

TOTAL: 45+30 = 75 PERIODS

BOOKS FOR REFERENCES:

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

1. Sankar Rao.K., Introduction to partial differential equations, Pnentile Hall of India, New Delhi – 1995.
2. Sneddon.I.N., Elements of partial differential equations, MC Graw Hill, 1996
3. Engineering Statistics, Bowher and LIberman
4. Gupta.S.C. & Kappor, V.K. Fundamentals of Mathematical Statistics, Sultan Chand & Sons, Reprint 1999.

22254C12 - THEORY OF METAL CUTTING 4 0 0 4

OBJECTIVE:

To know about the mechanics of chip formation, to analyse the tool failure, and thermodynamics involved in metal cutting and evaluation of tool materials.

UNIT- I: Orthogonal Cutting: 12

Orthogonal Cutting – Theories of merchant – Lee and Shaffer – Merchant's circle diagram – shear angle relationship – chip velocity – force – velocity relationships

UNIT-II: Chip Formation: 12

Mechanism of chip formation – Types of Chips – discontinuous,continuous continuous with BUE – Chip Formation in drilling and Milling – effect of cutting variables of chip reduction coefficient.

UNIT-III : Tool Life and Machinability: 12

Tool Failure:Mode of Plastic failure – Measurement of tool wear – tool life tests – tool life equation for variable theories – variables affecting tool life – machinability – machinability index – problems.

UNIT-IV: Thermal Analysis in Metal Cutting: 12

Thermodynamics of orthogonal cutting – analysis of temperature at shear plane and tool face – experimental methods for temperature measurement.

UNIT-V: Chatter: 12

Chatter - Importance of Chatter in machining – types of chatter – avoidance of chatter.Tools materials – requirements – alloy tools - HSS – carbides –PCD and CBN- properties and application.

TOTAL: 60 PERIODS

BOOKS FOR REFERENCES:

1.
2. Juneja .B.L, "Fundamentals of Metal cutting and Machine tools", New Age International, 1995.
3. Bhattacharya.A, "Metal Cutting Theory and Practice", Central book publications.
4. Kuppusamy .G, "Principle of Metal Cutting", University Press,1996.
5. Shaw .M.C, "Metal Cutting Principles",I BH Publications,1992.
6. Armarego E.J.A and Brown R.H, "The Machining of Metals", Prentice Hall,1969

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22254C13 ADVANCED MANUFACTURING PROCESSES 4 0 0 4

AIM:

To expose the students in the art of manufacturing new products due to the development of new materials and processes. The students will totally get a feel of the relevant suitable process while evaluating and deciding.

OBJECTIVE:

• To inform the students about the various alternative manufacturing processes available.

• To develop an altitude to look for the unconventional manufacturing process to machine

• To make them to understand and appreciate the latest manufacturing process for micro fabrication and devices.

UNIT I NEWER MACHINING PROCESSES - I 12

(Non thermal energy) – Abrasive machining – water jet machining - ultrasonic machining – chemical machining – electro chemical machining – construction working principle – steps - types – process parameters – derivations – problems, merits, demerits and applications .

UNIT II NEWER MACHINING PROCESS – II 12

Wire cut EDM - Electro chemical machining – ECG - Electric discharge machining – construction – principle – types – control - circuits – tool design – merits, demerits & applications.

UNIT III NEWER MACHINING PROCESS – III 12

Laser beam machining – Electron beam machining – Plasma arc machining – Ion beam machining – construction working principle types – process parameter – derivations – problems, merits, demerits and applications.

UNIT IV FABRICATION OF MICRO DEVICES 12

Semiconductors – films and film depurification – Oxidation - diffusion – ion implantation – etching – metallization – bonding – surface and bulk machining – LIGA Process – Solid free form fabrication.

UNIT V MICROFABRICATION TECHNOLOGY 12

Wafer preparation – monolithic processing – moulding – PCB board hybrid & mcm technology – programmable devices & ASIC – electronic material and processing.–
steriolithography SAW devices, Surface Mount Technology,

TOTAL: TOTAL: 60 PERIODS

BOOKS FOR REFERENCES:

1. Serope kelpekijian & stevan r. schmid- manufacturing process engg material – 2003
2. Micro senors Mems & smart devices- Julian W.Hardner – 2002

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3. Brahem T. Smith, Advanced machining I.F.S. UK 1989.
4. Jaeger R.C., Introduction to microelectronic fabrication Addison Wesley, 1988.
5. Nario Taniguchi – Nano technology – Oxford University Press 1996.
6. Pandey P.C. & Shan HS Modern Machining Processes, Standard Publishing Co., 1980
7.More Madon, Fundamentals of Micro fabrication, CRC Press

22254C14

ADVANCES IN CASTING AND WELDING L T P C 3 0 0 3

OBJECTIVES:

 To study the metallurgical concepts and applications of casting and welding process.

 To acquire knowledge in CAD of casting and automation of welding process.

UNIT I CASTING DESIGN 8

Heat transfer between metal and mould –– Design considerations in casting – Designing for directional solidification and minimum stresses - principles and design of gating and risering

UNIT II CASTING METALLURGY 8

Solidification of pure metal and alloys – shrinkage in cast metals – progressive and directional solidification –– Degasification of the melt-casting defects – Castability of steel , Cast Iron, Al alloys, Babbit alloy and Cu alloy.

UNIT III RECENT TRENDS IN CASTING AND FOUNDRY LAYOUT 8

Shell moulding, precision investment casting, CO2 moulding, centrifugal casting, Die casting, Continuous casting, Counter gravity low pressure casting, Squeeze casting and semisolid processes. Layout of mechanized foundry – sand reclamation – material handling in foundry pollution control in foundry –– Computer aided design of casting.

UNIT IV WELDING METALLURGY AND DESIGN 10

Heat affected Zone and its characteristics – W eldability of steels, cast iron, stainless steel, aluminum, Mg , Cu , Zirconium and titanium alloys – Carbon Equivalent of Plain and alloy steels Hydrogen embrittlement – Lamellar tearing – Residual stress – Distortion and its control . Heat transfer and solidification - Analysis of stresses in welded structures – pre and post welding heat treatments – weld joint design – welding defects – Testing of weldment.

. **UNIT V RECENT TRENDS IN WELDING 11**

Friction welding, friction stir welding – explosive welding – diffusion bonding – high frequency induction welding – ultrasonic welding – electron beam welding – Laser beam welding –Plasma welding – Electro slag welding- narrow gap, hybrid twin wire active TIG – Tandem MIG- modern brazing and soldering techniques – induction, dip resistance, diffusion processes – Hot gas, wave and vapour phase soldering. Overview of automation of welding in aerospace, nuclear, surface transport vehicles and under water welding.

OUTCOMES:

At the end of this course the students are expected to impart knowledge on basic concepts and advances in casting and welding processes.

TOTAL: 45 PERIODS

REFERENCES:

1. ASM Handbook vol.6, welding Brazing & Soldering, 2003
2. ASM Handbook, Vol 15, Casting, 2004
3. Carrry B., Modern Welding Technology, Prentice Hall Pvt Ltd., 2002
4. CORNU.J. Advanced welding systems – Volumes I, II and III, JAICO Publishers, 1994.

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5. HEINELOPER & ROSENTHAL, Principles of Metal Casting, Tata McGraw Hill, 2000.

6. IOTROWSKI – Robotic welding – A guide to selection and application – Society of mechanical Engineers, 1987.

7. Jain P.L., Principles of Foundry Technology, Tata McGraw Hill Publishers, 2003

8. LANCASTER.J.F. – Metallurgy of welding – George Alien & Unwin Publishers, 1980

9. Parmer R.S., Welding Engineering and Technology, Khanna Publishers,2002

10. SCHWARIZ, M.M. – Source book on innovative welding processes – American Society for Metals (OHIO), 1981

11. Srinivasan N.K., Welding Technology, Khanna Tech Publishers, 2002

22254C15 AUTOMATED COMPUTER INTEGRATED MANUFACTURING SYSTEMS 4 0 0 4

AIM:

To stress the role of computers in production.

OBJECTIVE:

To teach the role of computers in processing the information knowing across the various Stages and various departments in a manufacturing concern.

UNIT I INTRODUCTION 10

Introduction to CAD, CAM, CAD/CAM and CIM - Evolution of CIM – CIM wheel and cycle – Production concepts and mathematical models – Simple problems in production models – CIM hardware and software – Major elements of CIM system – Three step process for implementation of CIM – Computers in CIM – Computer networks for manufacturing – The future automated factory – Management of CIM – Impact of CIM on personnel – CIM status.

UNIT II AUTOMATED MANUFACTURING SYSTEMS 14

Automated production line – system configurations, work part transfer mechanisms – Fundamentals of Automated assembly system – System configuration, Part delivery at workstations – Design for automated assembly – Overview of material handling equipments – Consideration in material handling system design – The 10 principles of Material handling. Conveyor systems – Types of conveyors – Operations and features. Automated Guided Vehicle system – Types of vehicles and AGVs applications – Vehicle guidance technology – Vehicle management and safety. Storage system performance – storage location strategies – Conventional storage methods and equipments – Automated storage/Retrieval system and Carousel storage system Deadlocks in Automated manufacturing systems – Petrinet models – Applications in Dead lock avoidance.

UNIT III GROUP TECHNOLOGY AND FMS 14

Part families – Visual – Parts classification and coding – Production flow analysis – Grouping of parts and Machines by rank order clustering method – Benefits of GT – Case studies. FMS – Components – workstations – FMS layout configurations – Computer control systems – FMS planning and implementation issues – Architecture of FMS – flow chart showing various operations in FMS – Machine cell design – Composite part concept, Holier method, Key machine concept – Quantitative analysis of FMS – Bottleneck model – Simple and complicated problems – Extended Bottleneck model - sizing the FMS, FMS applications, Benefits.

UNIT IV PROCESS PLANNING 12

Process planning – Activities in process planning, Information's required. From design to process planning – classification of manufacturing processes – Selection of primary manufacturing processes – selecting among casting process, forming process and machining process. Sequencing of operations according to Anteriorities – various examples – forming of Matrix of Anteriorities – case study. Typical process sheet – case studies in Manual process planning. Computer Aided Process Planning – Process planning module and data base – Variant process planning – Two stages in VPP – Generative process planning – Flow chart showing various activities in generative PP – Semi generative process planning.

UNIT V TYPES OF PROCESS CONTROL AND AUTOMATIC DATA CAPTURE 10

Introduction to process model formulation – linear feedback control systems – Optimal control – Adaptive control –Sequence control and PLC. Computer process control – Computer process interface – Interface hardware – Computer process monitoring – Direct digital control and Supervisory computer control. Overviews of Automatic identification methods – Bar code technology – Other Automatic data capture technologies.

TOTAL: 60 PERIODS

BOOKS FOR REFERENCES:

1. Mikell P.Groover, "Automation, Production system and Computer integrated Manufacturing", Prentice Hall of India Pvt. Ltd., 2008.
2. Radhakrishnan,P., Subramanian,S., and Raju,V., "CAD/CAM/CIM" New Age International Publishers, 2000.
3. James A.Retrg, Herry W.Kraebber, "Computer Integrated Manufacturing", Pearson Education, Asia, 2001.
4. Viswanathan,N., and Narahari,Y., "Performance Modeling and Automated Manufacturing Systems", Prentice Hall of India Pvt. Ltd., 2000.
5. Alavudeen and Venkateshwaran, "Computer Integrated Manufacturing", PHI Learning Pvt. Ltd., New Delhi, 2008.

22254L19 CAD / CAM LABORATORY 0 0 3 3

OBJECTIVES:

- To teach the students about the drafting of 3D components and analyzing the same using various CAD packages and programming of CNC machines
- To train them to use the various sensors

CAM LABORATORY

1. Exercise on CNC Lathe: Plain Turning, Step turning, Taper turning, Threading,

Grooving canned cycle

2. Exercise on CNC Milling Machine: Profile Milling, Mirroring, Scaling & canned cycle. Study of Sensors, Transducers & PLC: Hall-effect sensor, Pressure sensors, Strain gauge, PLC, LVDT, Load cell, Angular potentiometer, Torque, Temperature & Optical Transducers.

CAD LABORATORY

2D modeling and 3D modeling of components such as

1. Bearing
2. Couplings
3. Gears
4. Sheet metal components
5. Jigs, Fixtures and Die assemblies.

TOTAL: 60 PERIODS

OUTCOMES :

At the end of this course the students are expected

- To impart the knowledge on training the students in the area of CAD/CAM

LIST OF EQUIPMENTS S.NO	EQUIPMENT	QUANTITY
1.	Computer Server	1
2.	Computer nodes or systems (High end CPU with atleast 1 GB main memory) networked to the server	30
3.	A3 size plotter	1
4.	Laser Printer	1
5.	CNC Lathe	1
6.	CNC milling machine	1
SOFTWARE		
7.	Any High end integrated modeling and manufacturing CAD / CAM software	15 licenses
8.	CAM Software for machining centre and turning centre (CNC	15 licenses

	Programming and tool path simulation for FANUC / Sinumeric and Heidenhain controller)	
9.	Licensed operating system	adequate
10.	Support for CAPP	adequate

AIM:

To impart the knowledge on training the students in the area of CAD/CAM.

OBJECTIVES:

To teach the students about the drafting of 3D components and analyzing the same using various CAD/CAM software's.

CAM LABORATORY

1. Exercise on CNC Lathe: Plain Turning, Step turning, Taper turning, Threading, Grooving & canned cycle
2. Exercise on CNC Milling Machine: Profile Milling, Mirroring, Scaling & canned cycle.
3. Study of Sensors, Transducers & PLC: Hall-effect sensor, Pressure sensors, Strain gauge, PLC, LVDT, Load cell, Angular potentiometer, Torque, Temperature & Optical Transducers.
4. Mini project on any one of the CIM elements is to be done. This can be either a software or hardware simulating a CIM element. At the end of the semester, the students has to submit a mini report and present his work before a Committee.

CAD LABORATORY

2D modeling and 3D modeling of components such as
1. Bearing
2. Couplings
3. Gears
4. Sheet metal components
5. Jigs, Fixtures and Die assemblies.

TOTAL: 30 PERIODS.

SEMESTER II

22254C21 TOOLING FOR MANUFACTURING 4 0 0 4

OBJECTIVES:

 To study the various design considerations for tooling.

 Develop knowledge in tooling and work holding devices

UNIT I INTRODUCTION 12

Manufacturing Processes-objectives of manufacturing processes-classification of manufacturing process-Objectives of Tool design-tool design process-Nature and scope of Tool engineering-principles of economy for tooling-problems of economy in tooling-planning and tooling for economy-Manufacturing principles applicable to process and tool planning-tool control-tool maintenance-tool materials and its selection

UNIT II TOOLING FOR METAL REMOVAL PROCESSES 12

Traditional machining processes -work and tool holding devices-tool nomenclatures-Mechanism of machining-force temperature and tool life of single point tool-multipoint tools -tool design-tool wear-special processes-capstan and turret lathe-tooling layout of automats-tooling in NC and CNC machines-tooling for machining centres-CAD in tool design-Jigs and fixtures-design-Non-traditional material removal processes-mechanical, electrical thermal and chemical energy processes-principles-operation-equipment-tooling parameters and limitations

UNIT III TOOLING FOR METAL FORMING PROCESSES 12

Classification of Forming processes-Types of presses-design of -blanking and piercing dies-simple, compound, combination and progressive dies-Drawing dies-Bending dies-forging dies-plastic moulding dies

UNIT IV TOOLING FOR METAL CASTING AND METAL JOINING PROCESSES 12

Tools and Equipment for moulding-patterns –pattern allowances – pattern construction-die casting tools-mechanization of foundries. Tooling for Physical joining processes Design of welding fixtures – Arc welding, Gas welding, Resistance welding, laser welding fixtures-Tooling for Soldering and Brazing Tooling for Mechanical joining processes

UNIT V TOOLING FOR INSPECTION AND GAUGING 12

Survey of linear and angular measurements-standards of measurement-design and manufacturing of gauges- measurement of form-Inspection bench centre-co-ordinate measuring machine-tooling in CMM.

TOTAL: 60 PERIODS

OUTCOMES:

At the end of this course the students are well versed in

1. State of Art in Tooling in Manufacturing and Inspection
2. Design and Develop tooling for Flexible Manufacturing

REFERENCES:

1. Cyril Donaldson Tool Design, Tata McGraw Hill, 1976

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

2. Hoffman E.G Fundamentals of tool design SME 1984.

3. Kalpak Jian S., Manufacturing Engineering and Technology Addison Wesley 1995.

4. L E Doyle Tool Engineering Prentice Hall 1950

5. Wellar, J Non-Traditional Machining Processes, SME, 1984

22254C22 MEMS AND NANO TECHNOLOGY 4 0 0 4

AIM:

To inspire the students to expect to the trends in manufacturing micro components and measuring systems to nano scale.

OBJECTIVES:

• To expose the students to the evolution of micro electromechanical systems, to the various fabrication techniques and to make students to be award of micro actuators.

• Also to impart knowledge to the students about nano materials and various nano measurements techniques.

UNIT I OVER VIEW OF MEMS AND MICROSYSTEMS 10

Definition – historical development – fundamentals – properties, micro fluidics, design and fabrication micro-system, microelectronics, working principle and applications of micro system.

UNIT II MATERIALS, FABRICATION PROCESSES AND MICRO SYSTEM PACKAGING 14

Substrates and wafers, silicon as substrate material, mechanical properties of Si, Silicon Compounds silicon piezo resistors, Galium arsenide, quartz, polymers for MEMS, conductive polymers. Photolithography, photo resist applications, light sources, in implantation, diffusion process exudation – thermal oxidation, silicon diode, chemical vapour deposition, sputtering - deposition by epitoxy – etching – bulk and surface machining – LIGA process Micro system packaging – considerations packaging – levels of micro system packaging die level, device level and system level.

UNIT III MICRO DEVICES AND MATERIALS 12

Sensors – classification – signal conversion ideal characterization of sensors micro actuators, mechanical sensors – measurands displacement sensors, pressure and flow sensors, micro actuators – smart materials – applications.

UNIT IV SCIENCE OF NANO MATERIALS 12

Classification of nano structures – effect of the nanometer length scale effects of nano scale dimensions on various properties – structural, thermal, chemical, mechanical, magnetic, optical and electronic properties – effect of nanoscale dimensions on biological systems. Fabrication methods – Top down processes – bottom up process.

UNIT V CHARACTERIZATION OF NANO MATERIALS 12

Nano-processing systems – Nano measuring systems – characterization – analytical imaging techniques – microscopy techniques, electron microscopy scanning electron microscopy, transmission electron microscopy, transmission electron microscopy, scanning tunneling microscopy, atomic force microscopy, diffraction techniques – spectroscopy techniques – Raman spectroscopy, 3D surface analysis – Mechanical, Magnetic and thermal properties – Nano positioning systems.

TOTAL: 60 PERIODS

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

BOOKS FOR REFERENCES:

1. Tai – Ran Hsu, MEMS and Microsystems Design and Manufacture, Tata-McGraw Hill, New Delhi, 2002.
2. Mark Madou Fundamentals of Microfabrication, CRC Press, New York, 1997.
3. Norio Taniguchi, Nano Technology, Oxford University Press, New York, 2003
4. The MEMS Hand book, Mohamed Gad-el-Hak, CRC Press, New York, London.
5. Charles P Poole, Frank J Owens, Introduction to Nano technology, John Wiley and Sons, 2003
6. Julian W. Hardner Micro Sensors, Principles and Applications, CRC Press 1993.

22254C23 MANUFACTURING METROLOGY AND QUALITY CONTROL 4 0 0 4

AIM:

To expose the students, the importance of measurement and the various latest measuring techniques using Laser, Coordinate measuring machines and Optoelectronics devices. Also to stress upon the Importance of quality in manufacturing.

OBJECTIVES:

To impart through knowledge in various latest measurement systems such as laser metrology, coordinate measuring machines and electro-optical devices. Also to make the students to understand quality

UNIT – I LASER METROLOGY 11

Introduction – types of lasers – laser in engineering metrology – metrological laser methods for applications in machine systems – Interferometry applications – speckle interferometry – laser interferometers in manufacturing and machine tool alignment testing – calibration systems for industrial robots laser Doppler technique – laser Doppler anemometry.

UNIT – II PRECISION INSTRUMENTS BASED ON LASER 11

Laser telemetric systems – detection of microscopic imperfections on high quality surface Pitter NPL gauge interferometer – classification of optical scanning systems – high inertia laser scan technique – rotating mirror technique – laser gauging – bar coding – laser dimensional measurement system.

UNIT – III CO-ORDINATE MEASURING MACHINE 14

Co-ordinate metrology – CMM configurations – hardware components – software – Probe sensors – displacement devices – Performance Evaluations – Software – Hardware – Dynamic errors – Thermal effects diagram – temperature variations environment control – applications.

UNIT – IV OPTO ELECTRONICS AND VISION SYSTEM 12

Opto electronic devices – CCD – On-line and in-process monitoring in production – applications image analysis and computer vision – Image analysis techniques – spatical feature – Image extraction – segmentation – digital image processing – Vision system for measurement – Comparison laser scanning with vision system.

UNIT – V QUALITY IN MANUFACTURING ENGINEERING 12

Importance of manufacturing planning for quality – concepts of controllability – need for quality management system and models – quality engineering tools and techniques – statistical process control – six sigma concepts – Poka Yoke – Computer controlled systems used in inspection.

TOTAL: 60 PERIODS

REFERENCES:

1. John A. Bosch, Giddings and Lewis Dayton, Co-ordinate Measuring Machines and Systems, Marcel Dekker, Inc, 1999.

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2. Juran J.M. and Gyna F.M., Quality Planning and Analysis, Tata-McGraw Hill, New Delhi

3. Zuech, Nello Understanding and Applying Machine Vision, Marcel Dekker, Inc, 2000

4. Elanchezhian.C, Vijaya Ramnath.B and Sunder Selwyn, T., Engineering Metrology, Eswar Press, Chennai, 2004.

22254L26 AUTOMATION LAB 0 0 3 3

AIM:

To impart knowledge in the area of hydraulic and pneumatic components and its functions.

OBJECTIVE:

• To make the students to learn the basic concepts of hydraulics and pneumatics and its applications in the area of manufacturing process.
• To simulate the various hydraulics and pneumatics circuits.

EXPERIMENTS:

1. Simulation of single and double acting cylinder circuits
2. Simulation of Hydraulic circuits
3. Simulation of electro pneumatic circuits
4. Simulation of electro hydraulic circuits
5. Simulation of PLC circuits
6. Exercises on linear and angular measurements
7. Exercises on speed measurements
8. Exercises on Vibration measurements
9. Exercises on Motion controller using servo motors, encoders, etc.
10. Exercises on fiber optics transducers.
11. Exercises on stepper motor.
12. Exercises on microprocessor based data acquisition system.
13. Software simulation of fluid power circuits using Automation studio.

TOTAL : 30 PERIODS

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

222TECWR **Technical Writing/Seminar** **0 0 3 3**

Seminar should be based on the literature survey on any topic relevant to CAD/CAM/CAE. It may be leading to selection of a suitable topic of dissertation. The report shall contain some contribution by the candidate in the form of experimental results, deductions, compilation and inferences etc.

• Each student has to prepare a write-up of about 25 pages. The report typed on A4 sized sheets and bound in the necessary format should be submitted after approved by the guide and endorsement of the Head of Department.

• The student has to deliver a seminar talk in front of the teachers of the department and his classmates. The Guide based on the quality of work and preparation and understanding of the candidate shall do an assessment of the seminar.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

SEMESTER III

22254C31 METAL FORMING PROCESS 4 0 0 4

OBJECTIVE:

To study about the response of materials under plastic deformation and the various techniques for finding the stress for various metal working processes, and the recent developments in high speed forming.

UNIT-I: Stress and Strain: 10

Stress-State of stress in two dimensions – three dimensions – stress tensor-Mohr's circles – 2D and 3D state of stress – Description of strain at a point – Mohr's circle of strain- Hydrostatic and stress deviator component of stress- Plasticity- flow curve- true and true strain yield criteria for ductile loads combined stress test-plastic stress and strain relations- Levy Mises equations-Prandyl_Resus equations.

UNIT-II: Analysis of Metal Forming: 14

Work Load analysis – work formula for homogeneous deformation- rolling, rod drawing and extrusion processes -Determination of load by stress evaluation method-Determination of drawing load – strip drawing with wedge shaped dies and cylindrical rod drawing with a conical die.

UNIT-III: Stress Evaluation: 12

Stress evaluation method-Determination of forging load-plane strain forging of a thin strip and a flat circular disc- Determination of extrusion load for round band flat strip- upper bound analysis – plane strain indentation with frictionless interface

UNIT-IV: High velocity Forming: 12

Study of effect of high speed on stress strain relationships- High velocity forming equipment-Description of high speed forming machine – hot forging, pneumatic-mechanical, high velocity forging – Fuel combustion process- Electro magnetic forming –Introduction- Procedure - process variables-Applications

UNIT-V: Advanced Forming process: 12

Explosive Forming – Explosives – characteristics- stand off and contact operations- stress waves and their effects- process variables – properties of formed components- applications- Electro hydraulic forming – principles, requirements and characteristics – process variables- water hammer forming-principles and parameters- governing the process.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

BOOKS FOR REFERENCES:

1. George E.Dieter, "Mechanical Metallurgy", Mc Graw Hill International Edition, New York,1988
2. Rowe G.W,Edward , "An Introduction to the Principles of Metal Working", Edward Arnold publications.
3. Davies.R and Austin.E.R, "Developments in High Metal Forming", The Machinery Publishing Co.Ltd
4. Robert H.Wagoner and Jean Loup Chenot, "Fundamentals of Metal Forming", John Wiley and Sons Inc, New York,1992

List of Electives - Elective I

22254E16A MATERIALS MANAGEMENT AND LOGISTICS 3 0 0 3

AIM:

To introduce to the students the various functions of materials management and logistics

OBJECTIVE:

To make the students familiar with the various concepts and functions of material management, so that the students will be in a position to manage the materials management department independently.

UNIT I INTRODUCTION 6

Introduction to materials management – Objectives – Functions – Operating Cycle – Value analysis – Make or buy decisions.

UNIT II MANAGEMENT OF PURCHASE 7

Purchasing policies and procedures – Selection of sources of supply – Vendor development – Vendor evaluation and rating – Methods of purchasing – Imports – Buyer – Seller relationship – Negotiations.

UNIT III MANAGEMENT OF STORES AND LOGISTICS 12

Stores function – Location – Layout – Stock taking – Materials handling – Transportation – Insurance – Codification – Inventory pricing – stores management – safety – warehousing – Distribution linear programming – Traveling Salesman problems – Network analysis – Logistics Management.

UNIT IV MATERIALS PLANNING 10

Forecasting – Materials requirements planning – Quantity – Periodic – Deterministic models – Finite production.

UNIT V INVENTORY MANAGEMENT 10

ABC analysis – Aggregate planning – Lot size under constraints – Just in Time (JIT) system.

TOTAL: 45 periods

BOOKS FOR REFERENCES:

1. Lamer Lee and Donald W.Dobler, Purchasing and Material Management, Text and cases, Tata McGraw Hill, 1996.
2. Gopalakrishnan.P, Handbook of Materials Management, Prentice Hall of India, 1996.
3. Guptha P.K. and Manmohan, Problems in Operations Research, Suttan Chand & Sons, 2003.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

4. Dr.R. Kesavan, C.Elanchezian and B.Vijaya Ramnath, Production Planning and Control, Anuratha Publications, Chennai, 2008.

5. G. Reghuram, N. Rangaraj, Logistics and supply chain management – cases and concepts, Macmillan India Ltd., 2006.

22254E16B QUALITY AND RELIABILITY ENGINEERING 3 0 0 3

OBJECTIVES:

To make the students to understand the various quality control techniques and to construct the various quality control charts for variables and attributes and also the design concepts for reliable system and maintenance aspects in industries.

UNIT I QUALITY & STATISTICAL PROCESS CONTROL 8

Quality – Definition – Quality Assurance – Variation in process – Factors – process capability – control charts – variables X, R and X, - Attributes P, C and U-Chart tolerance design. Establishing and interpreting control charts – charts for variables – Quality rating – Short run SPC.

UNIT II ACCEPTANCE SAMPLING 8

Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling plans – OC curves – Producer's risk and consumer's risk. AQL, LTPD, AOQL, Concepts – standard sampling plans for AQL and LTPD – use of standard sampling plans.

UNIT III EXPERIMENTAL DESIGN AND TAGUCHI METHOD 9

Fundamentals – factorial experiments – random design, Latin square design – Taguchi method – Loss function – experiments – S/N ratio and performance measure – Orthogonal array.

UNIT IV CONCEPT OF RELIABILITY 9

Definition – reliability vs quality, reliability function – MTBF, MTTR, availability, bathtub curve – time dependent failure models – distributions – normal, weibull, lognormal – Reliability of system and models – serial, parallel and combined configuration – Markove analysis, load sharing systems, standby systems, covarient models, static models, dynamic models.

UNIT V DESIGN FOR RELIABILITY AND MAINTAINABILITY 11

Reliability design process, system effectiveness, economic analysis and life cycle cost, reliability allocation, design methods, parts and material selection, derating, stress-strength and analysis, failure analysis, identification determination of causes, assessments of effects, computation of criticality index, corrective action, system safety – analysis of down-time – the repair time distribution, stochastic point processes system repair time, reliability under preventive maintenance state dependent system with repair. MTTR – mean system down time, repair vs replacement, replacement models, proactive, preventive, predictive maintenance maintainability and availability, optimization techniques for system reliability with redundancy heuristic methods applied to optimal system reliability.

TOTAL: 45 PERIODS

Text Books:

1. Statistical Process Control, by Eugene Grant, Richard Leavenworth, McGraw Hill.
2. Quality Engineering in Production Systems, by G Taguchi , McGraw Hill, 1989.
3. Optimization &Variation Reduction in Quality, byW.A. Taylor,Tata McGraw Hill, 1991.

Reference Books:

1. Jurans Quality Planning and Analysis, by Frank. M.Gryna Jr. McGrawHill
2. Taguchi Techniques for Quality Engineering, (2ndEdition) by Philipposs, McGraw Hill, 1996,.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

3. Reliability Engineering, (3rdEdition), by LS Srinath, Affiliated East West Pvt Ltd,
1991.
4. Reliability Engineering, by E.Bala Guruswamy, Tata McGraw Hill, 1994

OUTCOMES :

At the end of this course the students are exposed to the various quality control techniques , to understand the importance and concept of reliability and maintainability in industries.

REFERENCES:

1. Amata Mitra "Fundamentals of Quality Control and improvement" Pearson Education, 2002.
2. Bester field D.H., "Quality Control" Prentice Hall, 1993.
3. Charles E Ebling, An Introduction to Reliability and Maintability Engineering, Tata-McGraw Hill, 2000.
4. David J Smith, Reliability, Maintainability and Risk: Practical Methods for Engineers, Butterworth 2002.
5. Dhillon, Engineering Maintainability – How to design for reliability and easy maintenance, PHI, 2008.
6. Patrick D To' corner, Practical Reliability Engineering, John-Wiley and Sons Inc, 2002

22254E16C **MANUFACTURING INFORMATION SYSTEMS 3 0 0 3**

AIM:

To impart the knowledge in manufacturing information system.

OBJECTIVE:

On completion of this course, the students are expected to be conversant with order policies, data base terminologies, designing, manufacturing considerations and information system for manufacturing.

UNIT I INTRODUCTION 5

The Evolution of order policies, from MRP to MRP II, the role of Production organization, Operations control.

UNIT II DATABASE 7

Terminologies – Entities and attributes – Data models, schema and subschema - Data Independence – ER Diagram – Trends in database.

UNIT III DESIGNING DATABASE 13

Hierarchical model – Network approach- Relational Data model concepts, principles, keys, relational operations – functional dependence – Normalization types – Query.

UNIT IV MANUFACTURING CONSIDERATION 10

The product and its structure, inventory and process flow – Shop floor control Data structure and procedure – various model – the order scheduling module, Input/output analysis module the stock status database – the complete IOM database.

UNIT V INFORMATION SYSTEM FOR MANUFACTURING 10

Parts oriented production information system – concepts and structure – Computerized production scheduling, online production control systems; Computer based production management system, computerized manufacturing information system – case study.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCES:

1. Luca G.Sartori, “Manufacturing Information Systems”, Addison-Wesley Publishing Company, 1988.
2. Date.C.J.,”An Introduction to Database Systems” Addison Wesley, 8th Edn,.2003
3. Orlicky.G., “Material Requirements Planning”, McGraw-Hill, 1994.
4. Kerr.R, “Knowledge based Manufacturing Management”, Addison-Wesley,1991.
5. Manufacturing Information & Data Systems Analysis, Design & Practice,CECELJA FRANJO, 2002.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

List of Electives - Elective II

22254E24A FINITE ELEMENT APPLICATIONS IN MANUFACTURING 3 0 0 3

AIM:

To impart knowledge in the area of finite element methods and its application in manufacturing.

OBJECTIVE:

To study the fundamentals of one dimensional and two dimensional problems using FEA in manufacturing.

UNIT I INTRODUCTION 6

Fundamentals – Initial, boundary and eigen value problems – weighted residual, Galerkin and Raleigh Ritz methods - Integration by parts – Basics of variational formulation – Polynomial and Nodal approximation.

UNIT II ONE DIMENSIONAL ANALYSIS 10

Steps in FEM – Discretization. Interpolation, derivation of elements characteristic matrix, shape function, assembly and imposition of boundary conditions-solution and post processing – One dimensional analysis in solid mechanics and heat transfer.

UNIT III SHAPE FUNCTIONS AND HIGHER ORDER FORMULATIONS 10

Shape functions for one and two dimensional elements- Three noded triangular and four nodded quadrilateral element Global and natural co-ordinates—Non linear analysis – Isoparametric elements – Jacobian matrices and transformations – Basics of two dimensional, plane stress, plane strain and axisymmetric analysis.

UNIT IV COMPUTER IMPLEMENTATION 9

Pre Processing, mesh generation, elements connecting, boundary conditions, input of material and processing characteristics – Solution and post processing – Overview of application packages – Development of code for one dimensional analysis and validation.

UNIT V ANALYSIS OF PRODUCTION PROCESSES 10

FE analysis of metal casting – special considerations, latent heat incorporation, gap element – Time stepping procedures – Crank – Nicholson algorithm – Prediction of grain structure – Basic concepts of plasticity and fracture – Solid and flow formulation – small incremental deformation formulation – Fracture criteria – FE analysis of metal cutting, chip separation criteria, incorporation of strain rate dependency – FE analysis of welding.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCES:

1. Reddy, J.N. An Introduction to the Finite Element Method, McGraw Hill,1985.
2. Rao, S.S., Finite Element method in engineering, Pergammon press, 1989.
3. Lewis R.W.Morgan, K, Thomas, H.R. and Seetharaman, K.N. The Finite Element Method in Heat Transfer Analysis, John Wiley, 1994.

22254E24B LEAN MANUFACTURING 3 0 0 3

AIM:

To introduce the concepts of lean manufacturing system.

OBJECTIVES:

- To study the various tools for lean manufacturing (LM).
- To apply the above tools to implement LM system in an organization.

UNIT – I INTRODUCTION TO LEAN MANUFACTURING 7

Conventional Manufacturing versus Lean Manufacturing – Principles of Lean Manufacturing – Basic elements of lean manufacturing – Introduction to LM Tools.

UNIT – II CELLULAR MANUFACTURING, JIT, TPM 9

Cellular Manufacturing – Types of Layout, Principles of Cell layout, Implementation. JIT – Principles of JIT and Implementation of Kanban. TPM – Pillars of TPM, Principles and implementation of TPM.

UNIT – III SET UP TIME REDUCTION, TQM, 5S, VSM 10

Set up time reduction – Definition, philosophies and reduction approaches. TQM – Principles and implementation. 5S Principles and implementation - Value stream mapping - Procedure and principles.

UNIT – IV SIX SIGMA 9

Six Sigma – Definition, statistical considerations, variability reduction, design of experiments – Six Sigma implementation.

UNIT – V CASE STUDIES 10

Various case studies of implementation of lean manufacturing at industries.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCES:

1. Design and Analysis of Lean Production Systems, Ronald G. Askin & Jeffrey B. Goldberg, John Wiley & Sons, 2003
2. Rother M. and Shook J, 1999 ‘Learning to See: Value Stream Mapping to Add Value and Eliminate Muda’ , Lean Enterprise Institute, Brookline, MA.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

1. Mikell P. Groover (2002) ‘Automation, Production Systems and CIM.

22254E24C Materials Management 3 0 0 3

OBJECTIVE :

To introduce to the students the various concepts of materials management

UNIT I INTRODUCTION 6

Introduction to materials management – Objectives – Functions – Operating Cycle – Value analysis – Make or buy decisions.

UNIT II MANAGEMENT OF PURCHASE 7

Purchasing policies and procedures – Selection of sources of supply – Vendor development – Vendor evaluation and rating – Methods of purchasing – Imports – Buyer – Seller relationship – Negotiations.

UNIT III MANAGEMENT OF STORES AND LOGISTICS 12

Stores function – Location – Layout – Stock taking – Materials handling – Transportation – Insurance – Codification – Inventory pricing – stores management – safety – warehousing – Distribution linear programming – Traveling Salesman problems – Network analysis – Logistics Management.

UNIT IV MATERIALS PLANNING 10

Forecasting – Materials requirements planning – Quantity – Periodic – Deterministic models – Finite production.

UNIT V INVENTORY MANAGEMENT 10

ABC analysis – Aggregate planning – Lot size under constraints – Just in Time (JIT) system.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course the students are

 Familiarized with the various concepts and functions of material management, so that the students will be in a position to manage the materials management department independently.

REFERENCES

1. Dr. R. Kesavan, C.Elanchezian and T.SundarSelwyn, Engineering Management – Eswar Press – 2005.
2. Dr.R. Kesavan, C.Elanchezian and B.Vijaya Ramnath, Production Planning and Control, Anuratha Publications, Chennai, 2008.
3. G. Reghuram, N. Rangaraj, Logistics and supply chain management – cases and concepts, Macmillan India Ltd., 2006.
4. Gopalakrishnan.P, Handbook of Materials Management, Prentice Hall of India, 2005.
5. Guptha P.K. and Heera, Operations Research, Suttan Chand & Sons, 2007.
6. Lamer Lee and Donald W.Dobler, Purchasing and Material Management, Text and cases, Tata McGraw Hill, 2006.

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List of Electives - Elective III

22254E25A NON-DESTRUCTIVE TESTING AND EVALUATION 3 0 0 3

OBJECTIVES :
To stress the importance of NDT in engineering.

UNIT I NON-DESTRUCTIVE TESTING: AN INTRODUCTION, VISUAL INSPECTION & LIQUID PENETRANT TESTING 6

Introduction to various non-destructive methods, Comparison of Destructive and Non destructive Tests, Visual Inspection, Optical aids used for visual inspection, Applications.
Physical principles, procedure for penetrant testing, Penetrant testing materials, Penetrant testing methods-water washable, Post – Emulsification methods, Applications

UNIT II EDDY CURRENT TESTING & ACOUSTIC EMISSION 10

Principles, Instrumentation for ECT, Absolute, differential probes, Techniques – High sensitivity techniques, Multi frequency, Phased array ECT, Applications.
Principle of AET, Instrumentation, Applications - testing of metal pressure vessels, Fatigue crack detection in aerospace structures.

UNIT III MAGNETIC PARTICLE TESTING & THERMOGRAPHY 10

Principle of MPT, procedure used for testing a component, Equipment used for MPT, Magnetizing techniques, Applications.
Principle of Thermography, Infrared Radiometry, Active thermography measurements, Applications – Imaging entrapped water under an epoxy coating, Detection of carbon fiber contaminants.

UNIT IV ULTRASONIC TESTING 10

Principle, Ultrasonic transducers, Ultrasonic Flaw detection Equipment, Modes of display A- scan, B-Scan, C- Scan, Applications, Inspection Methods - Normal Incident Pulse-Echo Inspection, Normal Incident Through-transmission Testing, Angle Beam Pulse-Echo testing, TOFD Technique, Applications of Normal Beam Inspection in detecting fatigue cracks, Inclusions, Slag, Porosity and Intergranular cracks - Codes, standards, specification and procedures and case studies in ultrasonics test.

UNIT V RADIOGRAPHY 9

Principle of Radiography, x-ray and gamma ray sources- safety procedures and standards, Effect of radiation on Film, Radiographic imaging, Inspection Techniques – Single wall single image, Double wall Penetration, Multiwall Penetration technique, Real Time Radiography - Codes, standards, specification and procedures and case studies in Radiography test.
Case studies on defects in cast, rolled, extruded, welded and heat treated components - Comparison and selection of various NDT techniques

TOTAL: 45 PERIODS

OUTCOMES:
At the end of this course the students are expected to have hands on experience on all types of NDT and their applications in Engineering.

REFERENCES:
1. Baldev Raj, Jeyakumar,T., Thavasimuthu,M., "Practical Non Destructive Testing" Narosa publishing house, New Delhi, 2002

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

2. Krautkramer. J., “Ultra Sonic Testing of Materials”, 1st Edition, Springer – Verlag Publication, New York, 1996.

3. Peter J. Shull “Non Destructive Evaluation: Theory, Techniques and Application” Marcel Dekker, Inc., New York, 2002

4. www.ndt.net

22254E25B MAINTENANCE MANAGEMENT 3 0 0 3

OBJECTIVE:

To understand the concepts of maintenance management and to have knowledge in developing a suitable maintenance system for any type of an organization.

UNIT I: Introduction to Maintenance Management: 7

Maintenance: Its role and scope in total Organizational contexts - role of Maintenance. Centralized and decentralized maintenance organization structures. Maintenance Economics – reliability and Availability – MTBF, MTTR.

UNIT II: Maintenance Categories: 10

Maintenance system– Categories - Design and its selection – Breakdown Maintenance –Routine Maintenance- Predictive Maintenance –Preventive Maintenance- Corrective Maintenance-Total Productive Maintenance –Maintenance Schedule – Repair Cycle.

UNIT III: Spare Parts Management: 8

Pareto's principles for repetitive breakdown analysis, spares management, planning considerations for each type of activities.

UNIT – IV: Condition Monitoring: 10

Condition Monitoring (CM) – Introduction- Economics of CM – On-load and off-load testing – Methods and instruments for CM – Temperature sensitive tapes – Pistol thermometers – wear-debris analysis.

UNIT V: Maintenance Manpower Cost, Performance Management: 10

Maintenance man power planning - Selection training - Scheduling maintenance costs - Budget preparation and budgetary control of maintenance expenditures Maintenance effectiveness various performance indices - evaluation, uses and limitations - Monitoring of Maintenance performance.

TEXT BOOKS FOR REFERENCES:

1. Gopalakrishnan P. and Sundarajan 1996. Maintenance Management. New Delhi, Prentice-Hall of India.
2. Srivastava S.K., "Industrial Maintenance Management", - S. Chand & Co.,1981.
3. Higgirs L.T and Morrow L.C., 1997, ``Maintenance Engineering Handbook``, McGraw Hill.
Armstrong, "Condition Monitoring", BSIRSA, 1988.

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22254E25C **OPTIMIZATION TECHNIQUES** **3 0 0 3**

UNIT I - INTRODUCTION TO OPTIMIZATION **7**

Formulation of an optimization problem- Classification of optimization problem – optimization techniques- Classical optimization technique – Single variable optimization – Multi variable optimization algorithms

UNIT II - MINIMIZATION METHODS **8**

One dimensional minimization methods: unimodal function – elimination methods: unrestricted search, exhaustive search, Dichotomous search, Fibonacci methods, Golden section methods, Interpolation methods: Quadratic and cubic interpolation methods.

UNIT III - CONSTRAINED OPTIMIZATION TECHNIQUES **10**

Optimization with equality and inequality constraints - Direct methods – Indirect methods using penalty functions, Lagrange multipliers - separable programming and Geometric programming.

UNIT IV - UNCONSTRAINED OPTIMIZATION TECHNIQUES **10**

Multi variable unconstrained optimization techniques: Direct search methods: Random search method, unvaried method, pattern search method, steepest descent method and Conjugate gradient method.

UNIT V - APPLICATIONS OF HEURISTICS IN OPTIMIZATION **10**

Heuristics-Introduction-Multi objective optimization: Genetic algorithms and Simulated Annealing techniques; neural network & Fuzzy logic principles in optimization.

BOOKS FOR REFERENCES:

1. Rao, Singaresu, S., "Engineering Optimization – Theory & Practice", New Age International (P) Limited, New Delhi, 2000.
2. Johnson Ray, C., "Optimum design of mechanical elements", Wiley, John & Sons, 1990.
3. Kalyanamoy Deb, "Optimization for Engineering design algorithms and Examples", Prentice Hall of India Pvt. 1995.
4. Goldberg, D.E., "Genetic algorithms in search, optimization and machine", Barnen, Addison-Wesley, New York, 1989.

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List of Electives - Elective IV

22254E32A PROCESS PLANNING AND COST ESTIMATION 3 0 0 3

OBJECTIVES: To introduce the process planning concepts to make cost estimation for various products after process planning

UNIT I INTRODUCTION TO PROCESS PLANNING 10

Introduction- methods of process planning-Drawing interpretation-Material evaluation – steps in process selection-.Production equipment and tooling selection

UNIT II PROCESS PLANNING ACTIVITIES 10

Process parameters calculation for various production processes-Selection jigs and fixtures election of quality assurance methods – Set of documents for process planning-Economics of process planning- case studies

UNIT III INTRODUCTION TO COST ESTIMATION 8

Importance of costing and estimation –methods of costing-elements of cost estimation –Types of estimates – Estimating procedure- Estimation labor cost, material cost- allocation of over head charges-Calculation of depreciation cost

UNIT IV PRODUCTION COST ESTIMATION 8

Estimation of Different Types of Jobs – Estimation of Forging Shop, Estimation of Welding Shop, Estimation of Foundry Shop

UNIT V MACHINING TIME CALCULATION 9

Estimation of Machining Time – Importance of Machine Time Calculation- Calculation of Machining Time for Different Lathe Operations ,Drilling and Boring – Machining Time Calculation for Milling, Shaping and Planning -Machining Time Calculation for Grinding

TOTAL: 45 PERIODS

OUTCOMES: At the end of this course the students are expected to use the concepts of process planning and cost estimation for various products.

REFERENCES:

1. Chitale A.V. and Gupta R.C., “Product Design and Manufacturing”, 2nd Edition, PHI, 2002.
2. Ostwalal P.F. and Munez J., “Manufacturing Processes and systems”, 9th Edition, John Wiley, 1998.
3. Peter scalon, “Process planning, Design/Manufacture Interface”, Elsevier science technology Books, Dec 2002.
4. Russell R.S and Tailor B.W, “Operations Management”, 4th Edition, PHI, 2003.

22254E32B INSTRUMENTATION AND CONTROL ENGINEERING 3 0 0 3

UNIT–I: Introduction to Instrumentation: 8

Mechanical Instrumentation- General concepts, General measurement system. Classification of Instruments - indicators, recorders and integrators- working principles, Precision and Accuracy: Measurement Error and calibration.

UNIT–II: Measuring Devices 10

Measurement of speed, frequency, acceleration - Vibrometer, Accelerometer etc. Pressure measurement: Gravitational, Bourdon, elastic transducers, strain gauge, pressure cells, and measurement of high and low pressure. Temperature measurement: Bi-Metallic, Resistance Thermometer, Thermocouples, Pyrometer, thermostats, Magnetic flow meter , Ultrasonic flow meter.

UNIT – III: Transducers: 8

Transducers – Introduction – Types -Variable resistance Transducers-Variable reactive transducers- Piezo Electric transducers- Fibre optic transducers- Laser instrumentation-analogue and digital type -incremental and absolute measurement.

UNIT – IV: Machine Diagnostic and Condition Monitoring: 10

Machine Diagnostics – Basic Concepts - Analysis of failure in machines-Distribution of fault occurrences-Objectives of monitoring-Monitoring techniques applied to Machineries.

UNIT – V: Computer Control System: 9

Data acquisition system-Introduction-Direct Digital control-Programmable Logic Controls (PLC) -Ladder diagrams-Communication used in PLC.

BOOKS FOR REFERENCES:

1. Thomas Beckwith, Lewis Buck N.Ray, D. Maragoni, “Mechabical Measurements”, Narosia Publishing House, NewDelhi.
2. M.P.Groover - " Automation, Production Systems and computer Intergrated Manufacturing ", Prentice Hall.
3. A.K. Sawhney, “Elecrical and Electronics Measurements & Instrumentation”, Dhanpat Rai & Sons, 1993
4. C.S.Rangan,V.S.V.Mani and G.R.Sarma - " Instrumentation Devices and systems", Tata McGraw Hill,1983

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22254CRM **RESEARCH METHODOLOGY**

AIM: **3 0 0 3**

To give an exposure to development of research questions and the various statistical methods suitable to address them through available literature, with basic computational operators.

OBJECTIVES:

- To understand the approaches towards and constraints in good research.
- To identify various statistical tools used in research methodology
- To appreciate and compose the manuscript for publication
- To train in basic computational and excel- skills for research in engineering.

OUTCOME:

Ability to develop research questions and the various research strategies, and compile research results in terms of journal manuscripts.

PREREQUISITES:

Research Methodology course in UG level or equivalent knowledge.

UNIT I **9**

Introduction to Research — Criteria of Good Research, Research Problem: Definition of research problem, selecting the problem - Necessity of defining the problem - Techniques involved in defining the problem-Basic principles of experimental designs-Descriptive and experimental design – different types of experimental design – Validity of findings – internal and external validity – Variables in Research – Measurement and Scaling – Different scales. Ethics & Misconduct in research, Plagiarism,

UNIT II **9**

Formulation of Hypothesis – Sampling techniques –Sampling error and sample size-Methods of data collection – Primary and secondary data – observation – Collection of literature, manual collection from library, usage of library, collection of literature from Scopus, Science Direct etc., compiling literature, software utilization in literature collection- Processing and analysis of data – editing – coding – transcription – tabulation –outline of statistical analysis.

UNIT III **9**

Data Analysis using Excel- Tabulation of Data in excel (Creating Master Table and Sub Table), Formulas and Functions, Filters and Sort and Validation Lists, Data from External Sources. Data Analysis Using Charts and Graphs(Pivot Table & Charts), Time Value of Money, Measure of central tendency: mean, median, mode, Measure of dispersion: variance, standard deviation, Coefficient of variation. Correlation, regression lines. Z-test, t- test F-test, ANOVA one way classification, Chi square test, independence of attributes. Time series: forecasting Method of least squares, Moving average method, Introduction to presentation tool, features and functions, Creating Presentation, Customizing presentation.

UNIT IV **9**

Various research methods-Design of Experiments, Response Surface Methodology, Taguchi Methods- Modeling & Simulation of Engineering Systems, Artificial Neural Networks, Fuzzy Logic, MATLAB - Graph Theory- Finite Element Methods, Computational Fluid Dynamics -R programming in Statistics- open source software

UNIT V **9**

Review of literature, Report writing – target audience – types of reports – contents of reports – styles and Conventions in reporting – steps in drafting a report. Basic concept of research paper writing for Journals and formats of publications in Journals, Report Structure - writing research abstract - introduction, review of literature, result, conclusions, Concepts of Bibliography and references

References:

1. C. R. Kothari, Research Methodology, New Age International Publishers. New Delhi, 2004.

2. Rajammal.P. Devadas, 1976, A hand book of methodology of research, RMM Vidyalaya Press.

3. R.A Day and A.L. Underwood, Quantitative analysis, Prentice Hall, 1999.

4. R. Gopalan, Thesis writing, Vijay Nicole Imprints Private Ltd., 2005.

5. W.J. DeCoursey, Statistics and Probability for Engineering Applications With Microsoft® Excel, Newnes, 2003.

6. Archibald Fripp, Jon Fripp, Michael Fripp; Just-in-Time Math for Engineers, Elsevier Science & Technology Books, 2003.

List of Electives - Elective V

22254E33A PRODUCT DESIGN AND DEVELOPMENT 3 0 0 3

UNIT I - INTRODUCTION 7

Significance of product design, product design and development process, sequential engineering design method, the challenges of product development.

UNIT II - PRODUCT PLANNING AND PROJECT SELECTION 8

Identifying opportunities evaluate and prioritize projects, allocation of resources Identifying Customer Needs, Interpret raw data in terms of customers need, organize needs in hierarchy and establish the relative importance of needs.

UNIT III - PRODUCT SPECIFICATIONS 8

Establish target specifications, setting final specifications, Concept Generation: Activities of concept generation, clarifying problem, search both internally and externally.

UNIT IV - INDUSTRIAL DESIGN AND CONCEPT SELECTION 10

Assessing need for industrial design, industrial design process, management, assessing quality of industrial design, Overview, concept screening and concept scoring, methods of selection.

UNIT V - THEORY OF INVENTIVE PROBLEM SOLVING (TRIZ) AND CONCEPT TESTING 12

Fundamentals, methods and techniques, General Theory of Innovation and TRIZ, Value engineering Applications in Product development and design, Model-based technology for generating innovative ideas Elements of testing: qualitative and quantitative methods including survey, measurement of customers' response, Intellectual Property: Elements and outline, patenting procedures.

BOOKS FOR REFERENCES:

1. Ulrich K. T, and Eppinger S.D, Product Design and Development, Tata McGraw Hill
2. Otto K, and Wood K, Product Design, Pearson
3. Engineering of creativity: introduction to TRIZ methodology of inventive Problem Solving, By Semyon D. Savransky, CRC Press.
4. Inventive thinking through TRIZ: a practical guide, By Michael A. Orloff, Springer.
5. Systematic innovation: an introduction to TRIZ ; (theory of inventive Problem Solving), By John Terninko, Alla Zusman, CRC Press.

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22254E33B FLUID POWER AUTOMATION 3 0 0 3

AIM:

To impart knowledge in the area of hydraulics, pneumatic and fluid power components and its functions.

OBJECTIVE:

• To make the students to learn the basic concepts of hydraulics and pneumatics and their controlling elements in the area of manufacturing process.

• To train the students in designing the hydraulics and pneumatic circuits using ladder diagram.

UNIT I INTRODUCTION 5

Need for Automation, Hydraulic & Pneumatic Comparison – ISO symbols for fluid power elements, Hydraulic, pneumatics – Selection criteria.

UNIT II FLUID POWER GENERATING/UTILIZING ELEMENTS 8

Hydraulic pumps and motor gears, vane, piston pumps-motors-selection and specification-Drive characteristics – Linear actuator – Types, mounting details, cushioning – power packs – construction. Reservoir capacity, heat dissipation, accumulators – standard circuit symbols, circuit (flow) analysis.

UNIT III CONTROL AND REGULATION ELEMENTS 8

Direction flow and pressure control valves-Methods of actuation, types, sizing of ports pressure and temperature compensation, overlapped and under lapped spool valves operating characteristics-electro hydraulic servo valves-Different types-characteristics and performance.

UNIT IV CIRCUIT DESIGN 10

Typical industrial hydraulic circuits-Design methodology – Ladder diagram-cascade, method-truth table-Karnaugh map method-sequencing circuits-combinational and logic circuit.

UNIT V ELECTRO PNEUMATICS & ELECTRONIC CONTROL OF HYDRAULIC AND PNEUMATIC CIRCUITS 7

Electrical control of pneumatic and hydraulic circuits-use of relays, timers, counters, Ladder diagram. Programmable logic control of Hydraulics Pneumatics circuits, PLC ladder diagram for various circuits, motion controllers, use of field busses in circuits. Electronic drive circuits for various Motors.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCES:

1. Antony Esposito, Fluid Power Systems and control Prentice-Hall, 1988.
2. Peter Rohner, Fluid Power logic circuit design. The Macmillan Press Ltd.,London, 1979
3. E.C.Fitch and J.B.Suryaatmadyn. Introduction to fluid logic, McGraw Hill, 1978.
4. W.Bolton, Mechatronics, Electronic control systems in Mechanical and Electrical Engineering Pearson Education, 2003.
5. Peter Rohner, Fluid Power Logic Circuit Design, Mcmelan Prem, 1994.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22254E33C INTERNET OF THINGS FOR MANUFACTURING 3 0 0 3

OBJECTIVES:

 To discover key IoT concepts including identification, sensors, localization, wireless protocols

 To explore IoT technologies, architectures, standards, and regulation

 To realize the value created by collecting, communicating, coordinating, and leveraging data

 To examine developments that will likely shape the industrial landscape in the future;

UNIT I INTRODUCTION 9

Technology of the IoT and applications,. IoT data management requirements, Architecture of IoT, Security issues Opportunities for IoT -Issues in implementing IoT. Technological challenges, RFID and the Electronic Product Code (EPC) network, the web of things.

UNIT II DESIGN OF IoT 9

Design challenges in IoT -Standardization, Security and privacy, Infrastructure, Analytics. Design steps for implementing IoT.

UNIT III PROTOTYPING OF IoT 9

Design principles for connected devices -Embedded devices, physical design, online components, embedded coding system. Informed Manufacturing plant – Elements, IoT implementation in Transportation and logistics, Energy and utilities, Automotive Connected supply chain, Plant floor control automation, remote monitoring, Management of critical assets, Energy management and resource optimization, proactive maintenance.

UNIT IV PREREQUISITES FOR IoT 9

IOT Technologies Wireless protocols low-power design (Bluetooth Low Energy), range extension techniques (data mining and mesh networking), and data-intensive IoT for continuous recognition applications Data storage and analysis Localization algorithms Localization for mobile systems

UNIT V APPLICATION IN MANUFACTURING 9

Applications HCI and IoT world -Multilingual interactions Robotics and Autonomous Vehicles Sensing and data processing-Simultaneous mapping and localization-Levels of autonomy, Smart factories, Future research challenges

TOTAL : 45 PERIODS

OUTCOMES:

 At the end of this course the students are expected to

 Utilizing sensors to gain greater visibility and real-time situational awareness

 Vertical applications that provide a clear business case and a pressing opportunity

 Emerging technologies to address IoT challenges

REFERENCES:

1. Adrian McEwan and Hakim Cassimally, "Designing the internet of things", Wiley, 2013

2. Code Halos: How the Digital Lives of People, Things, and Organizations are Changing the Rules of Business, by Malcolm Frank, Paul Roehrig and Ben Pring, published by John Wiley & Sons.

3. Internet of Things: A Hands-On Approach by Vijay Madisetti, Arshdeep Bahga, VPT; 1st edition 2014.

SKILL DEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

4. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle, “From Machine-to-Machine to the Internet of Things -Introduction to a New Age of Intelligence” Elsevier

5. Meta Products -Building the Internet of Things by Wimer Hazenberg, Menno Huisman, BIS Publishers 2014.

List of Electives - Elective VI

22254E34A ADVANCED MATERIAL TECHNOLOGY 3 0 0 3

AIM:

To impart knowledge on advance concepts of material technology

OBJECTIVE:

- To enlight the PG students on elastic, plastic and fractured behaviour of engineering Materials.
- To train the PG students in selection of metallic and non-metallic materials for the various engineering applications.

UNIT I ELASTIC AND PLASTIC BEHAVIOR 10

Elasticity in metals and polymers Anelastic and visco-elastic behaviour – Mechanism of plastic deformation and non metallic shear strength of perfect and real crystals – Strengthening mechanisms, work hardening, solid solutioning, grain boundary strengthening, poly phase mixture, precipitation, particle, fibre and dispersion strengthening. Effect of temperature, strain and strain rate on plastic behaviour – Super plasticity – Deformation of non crystalline materials.

UNIT II FRACTURE BEHAVIOUR 10

Griffith's theory, stress intensity factor and fracture toughness – Toughening mechanisms – Ductile, brittle transition in steel – High temperature fracture, creep – Larson Miller parameter – Deformation and fracture mechanism maps – Fatigue, low and high cycle fatigue test, crack initiation and propagation mechanisms and Paris law. Effect of surface and metallurgical parameters on fatigue – Fracture of non metallic materials – Failure analysis, sources of failure, procedure of failure analysis.

UNIT III SELECTION OF MATERIALS 10

Motivation for selection, cost basis and service requirements – Selection for mechanical properties, strength, toughness, fatigue and creep – Selection for surface durability corrosion and wear resistance – Relationship between materials selection and processing – Case studies in materials selection with relevance to aero, auto, marine, machinery and nuclear applications – Computer aided materials selection.

UNIT IV MODERN METALLIC MATERIALS 8

Dual phase steels, High strength low alloy (HSLA) steel, Transformation induced plasticity (TRIP) Steel, Maraging steel, Nitrogen steel – Intermetallics, Ni and Ti aluminides – smart materials, shape memory alloys – Metallic glass and nano crystalline materials.

UNIT V NON METALLIC MATERIALS 7

Polymeric materials – Formation of polymer structure – Production techniques of fibers, foams, adhesives and coating – structure, properties and applications of engineering polymers – Advanced structural ceramics, WC, TIC, TaC, Al_2O_3, SiC, Si_3N_4 CBN and diamond – properties, processing and applications.

TOTAL: 45 PERIODS

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

BOOKS FOR REFERENCES:

1. George E.Dieter, Mechanical Metallurgy, McGraw Hill, 1988.
2. Thomas H. Courtney, Mechanical Behaviour of Materials, (2nd edition), McGraw Hill, 2000.
3. Flinn, R.A., and Trojan, P.K., Engineering Materials and their Applications, (4^{th} Edition) Jaico, 1999.
4. ASM Hand book, Vol.11, Failure Analysis and Prevention, (10th Edition), ASM, 2002.
5. Ashby M.F., Material Selection in Mechanical Design, 3rd Edition, Butter Worth 2005.

22254E34B INDUSTRIAL SAFETY 3 0 0 3

OBJECTIVE:

To develop and strengthen the safety ideas and motivate the students to impart basic safety skills and understandings to run an industry efficiently and effectively

UNIT I OPERATIONAL SAFETY 9

Hot metal operation, boiler, pressure vessels – heat treatment shop – gas furnace operation – electroplating – hot bending pipes – safety in welding and cutting, Cold – metal operation – safety in machine shop – cold bending and chamfering of pipesmetal cutting – shot blasting, grinding, painting – power press and other machines. Management of toxic gases and chemicals – industrial fires and prevention – road safety – highway and urban safety – safety of sewage disposal and cleaning – control of environmental pollution – managing emergencies in industries – planning security and risk assessments, on – site and off site. Control of major industrial hazards.

UNIT II SAFETY APPRAISA L AND ANALYSIS 9

Human side of safety – personal protective equipment – causes and cost of accidents. Accidents prevention program – specific hazard control strategies – HAZOP training and development of employees – first aid – fire fight devices – accident reporting, investigation. Measurement of safety performance, accident reporting and investigation – plant safety inspection, job safety analysis – safety permit procedures. Product safety – plant safety rules and procedures – safety sampling – safety inventory systems. Determining the cost effectiveness of safety measurement.

UNIT **III OCCUPATIONAL HEALTH 9**

Concept and spectrum of health functional units and activities of operational health service – occupational and related disease – levels of prevention of diseases – notifiable occupational diseases Toxicology Lead – Nickel, chromium and manganese toxicity – gas poisoning (such as CO, Ammonia Chlorise, So2, H2s.) their effects and prevention – effects of ultra violet radiation and infrared radiation on human system.

UNIT IV SAFETY AND HEALTH REGULATIONS 9

Safety and health standards – industrial hygiene – occupational diseases prevention welfare facilities. The object of factories act 1948 with special reference to safety provisions, model rules 123a, history of legislations related to safety – pressure vessel act – Indian boiler act – the environmental protection act – electricity act – explosive act.

UNIT V SAFETY MANAGEMENT 9

Evaluation of modern safety concepts – safety management functions – safety organization, safety department- safety committee, safety audit – performance measurements and motivation – employee participation in safety - safety and productivity.

TOTAL: 45 PERIODS

OUTCOME:

At the end of this course the students are expected to gain knowledge and skills needed to run an industry with utmost safety precautions.

REFERENCES:

1. John V Grimaldi, Safety Management. AITB publishers, 2003.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

2. John.V .Grimaldi and Rollin. H Simonds, “Safety Managenent”, All India traveler book seller, New Delhi – 1989.

3. Krishnan N.V, “Safety in Industry”, Jaico Publisher House, 1996.

4. Singh, U.K and Dewan, J.M., “Sagety, Security And Risk Management”, APH publishing company, New Delhi, 1996.

22254E34C ADDITIVE MANUFACTURING

OBJECTIVE:

 To educate students with fundamental and advanced knowledge in the field of Additive manufacturing technology and the associated Aerospace, Architecture, Art, Medical and industrial applications.

UNIT I INTRODUCTION: 8

Need - Development of AM systems – AM process chain - Impact of AM on Product Development - Virtual Prototyping- Rapid Tooling – RP to AM -Classification of AM processes-Benefits- Applications.

UNIT II REVERSE ENGINEERING AND CAD MODELING: 10

Basic concept- Digitization techniques – Model reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data requirements – Geometric modeling techniques: Wire frame, surface and solid modeling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing, Tool path generation-Software for AM- Case studies.

UNIT III LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING SYSTEMS 10

Stereolithography Apparatus (SLA): Principle, pre-build process, part-building and post-build processes, photo polymerization of SL resins, part quality and process planning, recoating issues, materials, advantages, limitations and applications.

Solid Ground Curing (SGC): working principle, process, strengths, weaknesses and applications. Fused deposition Modeling (FDM): Principle, details of processes, process variables, types, products, materials and applications. Laminated Object Manufacturing (LOM): Working Principles, details of processes, products, materials, advantages, limitations and applications - Case studies.

UNIT IV POWDER BASED ADDITIVE MANUFACTURING SYSTEMS: 10

Selective Laser Sintering (SLS): Principle, process, Indirect and direct SLS- powder structures, materials, post processing, surface deviation and accuracy, Applications. Laser Engineered Net Shaping (LENS): Processes, materials, products, advantages, limitations and applications– Case Studies.

UNIT V OTHER ADDITIVE MANUFACTURING SYSTEMS: 7

Three dimensional Printing (3DP): Principle, basic process, Physics of 3DP, types of printing, process capabilities, material system. Solid based, Liquid based and powder based 3DP systems, strength and weakness, Applications and case studies. Shape Deposition Manufacturing (SDM), Ballastic Particle Manufacturing (BPM), Selective Laser Melting, Electron Beam Melting.

TOTAL: 45 PERIODS

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

OUTCOMES:

On completion of this course the students are expected to learn about a variety of Additive Manufacturing (AM) technologies, their potential to support design and manufacturing, case studies relevant to mass customized manufacturing, and some of the important research challenges associated with AM and its data processing tools

REFERENCES:

1. Chua, C.K., Leong K.F. and Lim C.S., "Rapid prototyping: Principles and applications", second edition, World Scientific Publishers, 2010.

2. Gebhardt, A., "Rapid prototyping", Hanser Gardener Publications, 2003.

3. Gibson, I., Rosen, D.W. and Stucker, B., "Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010.

4. Hilton, P.D. and Jacobs, P.F., Rapid Tooling: Technologies and Industrial Applications, CRC press, 2005.

5. Kamrani, A.K. and Nasr, E.A., "Rapid Prototyping: Theory and practice", Springer, 2006.

6. Liou, L.W. and Liou, F.W., "Rapid Prototyping and Engineering applications : A tool box for prototype development", CRC Press, 2011.

Research Integrated Curriculum

The relationship between teacher and learner is completely different in higher education from what it is in school. At the higher level, the teacher is not there for the sake of the student, both have their justification in the service of scholarship. For the students who are the professionals of the future, developing the ability to investigate problems, make judgments on the basis of sound evidences, take decisions on a rational basis and understand what they are doing and why is vital. Research and inquiry is not just for those who choose to pursue an academic career. It is central to professional life in the twenty-first century.

It is observed that the modern world is characterized by heightened levels of complexity and uncertainty. Fluidity, fuzziness, instability, fragility, unpredictability, indeterminacy, turbulence, changeability, contestability: these are some of the terms that mark out the world of the twenty-first century. Teaching and research is correlated when they are co-related. Growing out of the research on teaching- research relations, the following framework has been developed and widely adopted to help individual staff, course teams and whole institutions analyse their curricula and consider ways of strengthening students understanding of and through research. Curricula can be:

Research – Led: Learning about current research in the discipline

Here the curriculum focus is to ensure that what students learn clearly reflects current and ongoing research in their discipline. This may include research done by staff teaching them.

Research – Oriented: Developing research skills and techniques

Here the focus is on developing student's knowledge of and ability to carry out the research methodologies and methods appropriate to their discipline(s)

Research – Based: Undertaking research and inquiry

Here the curriculum focus is on ensuring that as much as possible the student learns in research and or inquiry mode (i.e. the students become producers of knowledge not just consumers). The strongest curricula form of this is in those special undergraduate programmes for selected students, but such research and inquiry may also be mainstreamed for all or many students.

Research- Tutored: engaging in research discussions

Here the focus is on students and staff critically discussing ongoing research in the discipline.

All four ways of engaging students with research and inquiry are valid and valuable and curricula can and should contain elements of them.

Moreover, the student participation in research may be classified as,

Level 1: Prescribed Research
Level 2: Bounded Research
Level 3: Scaffolded Research
Level 4: Self actuated Research
Level 5: Open Research

Taking into consideration the above mentioned facts in respect of integrating research into the M.Tech - Manufacturing Technology curriculum, the following Research Skill Based Courses are introduced in the curriculum.

Semester	RSB Courses	Credits
I	Research Led Seminar	1
II	Research Methodology	3
II	Participation in Bounded Research	2
III	Design Project/ Socio Technical Project	6
III	Project Work Phase I	10
IV	Project Work	15

Blueprint for assessment of student's performance in Research Led Seminar Course

- **Internal Assessment: 40 Marks**
  - Seminar Report (UG)/Concept Note(PG) : 5 X 4= 20 Marks
  - Seminar Review Presentation : 10 Marks
  - Literature Survey : 10 Marks
- **Semester Examination : 60 Marks**

(Essay type Questions set by the concerned resource persons)

Blueprint for assessment of student's performance in Design/Socio Technical Project

- **Continuous Internal Assessment through Reviews: 40 Marks**
  - Review I : 10 Marks
  - Review II : 10 Marks
  - Review III : 20 Marks
- **Evaluation of Socio Technical Practicum Final Report: 40 Marks**
- **Viva- Voce Examination: 20 Marks**
- **Total: 100 Marks**

Blueprint for assessment of student's performance in Research Methodology Courses

Continuous Internal Assessment: 20 Marks

- Research Tools(Lab) : 10 Marks
- Tutorial: 10 Marks

Model Paper Writing:	**40 Marks**
• Abstract:	5 Marks
• Introduction:	10 Marks
• Discussion:	10 Marks
• Review of Literature:	5 Marks
• Presentation:	10 Marks
Semester Examination:	**40 Marks**
Total:	**100 Marks**

PRIST Deemed to be University

VALLAM, THANJAVUR.

DEPARTMENT OF
MECHANICAL ENGINEERING

PROGRAMME HANDBOOK

M.Tech. – Manufacturing Technology

PART TIME PROGRAMME

Regulation 2022

(for candidates admitted to M.Tech Mechanical Engineering programme from June 2022onwards)

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

COURSE STRUCTURE

SEMESTER-I

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
22248S11EP	Advanced Engineering Mathematics	3	1	-	4
22254C12P	Theory of Metal Cutting	3	1	-	4
22254C13P	Advanced Manufacturing Processes	3	1	-	4
22254L14P	CAD/CAM Laboratory	-	-	3	3
TOTAL NO. OF CREDITS					15

SEMESTER-II

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
22254C21P	Tooling for Manufacturing	3	1	-	4
22254C22P	MEMS and Nano Technology	4	-	-	4
22254E23_P	Elective - I	4	-	-	3
22254L24P	Automation Lab	-	-	3	3
222TECWRP	Technical Writing/Seminar	-	-	3	3
TOTAL NO. OF CREDITS					17

SEMESTER-III

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
22254C31P	Advances in Casting and Welding	3	1	-	4
22254C32P	Automated Computer Integrated Manufacturing Systems	3	1	-	4
22254E33P	Elective II	4	-	-	3
TOTAL NO. OF CREDITS					11

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

SEMESTER-IV

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
22254C41P	Manufacturing Metrology and Quality Control	4	-	-	4
22254C42P	Metal Forming Process	4	-	-	4
22254E43_p	Elective III	4	-	-	3
22254P44P	Project Work Phase - I	-	-	10	10
TOTAL NO. OF CREDITS					**21**

SEMESTER-V

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
22254E51_P	Elective IV	4	-	-	3
22254E52_P	Elective V	4	-	-	3
22254E53_P	Elective VI	4	-	-	3
TOTAL NO. OF CREDITS					**9**

SEMESTER-VI

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
22254P61P	Project Work Phase - II	-	-	15	15
TOTAL NO. OF CREDITS					**15**

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

ELECTIVE-I

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
22254E23AP	Finite Element Application in Manufacturing	4	-	-	3
22254E23BP	Lean Manufacturing	4	-	-	3
22254E23CP	Design and Analysis of Experiments	4	-	-	3

ELECTIVE-II

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
22254E33AP	Materials Management And Logistics	4	-	-	3
22254E33BP	Quality And Reliability Engineering	4	-	-	3
22254E33CP	Manufacturing Information Systems	4	-	-	3

ELECTIVE-III

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
22254E43AP	Non-Destructive Testing And Evaluation	4	-	-	3
22254E43BP	Maintenance Management	4	-	-	3
22254E43CP	Optimization Techniques	3	1	-	3

ELECTIVE-IV

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
22254E51AP	Process Planning And Cost Estimation	4	-	-	3
22254E51BP	Instrumentation and Control Engineering	4	-	-	3
22254E51CP	Research Methodology	3	-	-	3

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

ELECTIVE-V

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
22254E52AP	Product Design and Development	4	-	-	3
22254E52BP	Fluid Power Automation	4	-	-	3
22254E52CP	Internet Of Things For Manufacturing	4	-	-	4

ELECTIVE-VI

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
22254E53AP	Advanced Material Technology	4	-	-	3
22254E53BP	Industrial Safety	4	-	-	3
22254E53CP	Additive Manufacturing	4	-	-	4

Total No of Credits - 88

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

DEPARTMENT OF MECHANICAL ENGINEERING

M.TECH., MANUFACTURING TECHNOLOGY - PART TIME PROGRAMME SYLLABUS-REGULATIONS- 2022

I - SEMESTER

22248S11EP ADVANCED ENGINEERING MATHEMATICS 3 1 0 4

LAPLACE TRANSFORM:

Laplace transform methods for one-dimensional wave equation – Displacement in a long string – longitudinal vibration of an elastic bar – Laplace equation – properties of harmonic functions.

FOURIER TRANSFORM

Fourier transforms methods for one – dimensional heat conduction problems in infinite and semi infinite rod – Fourier transform methods for Laplace equation.

PROBABILITY OF DISTRIBUTION

Probability – definition and introduction – random variable – probability density functions – study of standard distributions: Binomial, poisson, normal exponential and weibull distributions – Applications – Baye's theorem.

TESTING OF HYPOTHESIS

Testing of Hypothesis – Parametric test – Small samples – Test related proportion, Means, Standard deviation – Test based on chi-square, Goodness of fit and test of independence.

THEORY OF ESTIMATION

Principles of least squares – Multiple and partial correlation and regression – Estimation of parameters – Method of moments.

BOOKS FOR REFERENCE:

1. Sankar Rao.K., Introduction to partial differential equations, Pnentile Hall of India, New Delhi – 1995.
2. Sneddon.I.N., Elements of partial differential equations, MC Graw Hill, 1996
3. Engineering Statistics, Bowher and LIberman
4. Gupta.S.C. & Kappor, V.K. Fundamentals of Mathematical Statistics, Sultan Chand & Sons, Reprint 1999

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22254C12P THEORY OF METAL CUTTING 3 1 0 4

OBJECTIVE:

To know about the mechanics of chip formation, to analyse the tool failure, and thermodynamics involved in metal cutting and evaluation of tool materials.

UNIT- I: Orthogonal Cutting:

Orthogonal Cutting – Theories of merchant – Lee and Shaffer – Merchant's circle diagram – shear angle relationship – chip velocity – force – velocity relationships

UNIT-II: Chip Formation:

Mechanism of chip formation – Types of Chips – discontinuous,continuous continuous with BUE – Chip Formation in drilling and Milling – effect of cutting variables of chip reduction coefficient.

UNIT-III : Tool Life and Machinability:

Tool Failure:Mode of Plastic failure – Measurement of tool wear – tool life tests – tool life equation for variable theories – variables affecting tool life – machinability – machinability index – problems.

UNIT-IV: Thermal Analysis in Metal Cutting:

Thermodynamics of orthogonal cutting – analysis of temperature at shear plane and tool face – experimental methods for temperature measurement.

UNIT-V: Chatter:

Chatter - Importance of Chatter in machining – types of chatter – avoidance of chatter.Tools materials – requirements – alloy tools - HSS – carbides –PCD and CBN- properties and application.

BOOKS FOR REFERENCE:

1. Juneja .B.L, "Fundamentals of Metal cutting and Machine tools", New Age International,1995.

2. Bhattacharya.A, "Metal Cutting Theory and Practice", Central book publications
3. Kuppusamy .G, "Principle of Metal Cutting", University Press,1996.
4. Shaw .M.C, "Metal Cutting Principles",I BH Publications,1992.

Armarego E.J.A and Brown R.H, "The Machining of Metals", Prentice Hall,1969

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22254C13P ADVANCED MANUFACTURING PROCESSES 4 0 0 4

OBJECTIVE:

• To inform the students about the various alternative manufacturing processes available.
• To develop an altitude to look for the unconventional manufacturing process to machine
• To make them to understand and appreciate the latest manufacturing process for micro fabrication and devices.

UNIT I NEWER MACHINING PROCESSES - I 9

(Non thermal energy) – Abrasive machining – water jet machining - ultrasonic machining – chemical machining – electro chemical machining – construction working principle – steps - types – process parameters – derivations – problems, merits, demerits and applications .

UNIT II NEWER MACHINING PROCESS – II 9

Wire cut EDM - Electro chemical machining – ECG - Electric discharge machining – construction – principle – types – control - circuits – tool design – merits, demerits & applications.

UNIT III NEWER MACHINING PROCESS – III 9

Laser beam machining – Electron beam machining – Plasma arc machining – Ion beam machining – construction working principle types – process parameter – derivations – problems, merits, demerits and applications.

UNIT IV FABRICATION OF MICRO DEVICES 9

Semiconductors – films and film depurification – Oxidation - diffusion – ion implantation – etching – metallization – bonding – surface and bulk machining – LIGA Process – Solid free form fabrication.

UNIT V MICROFABRICATION TECHNOLOGY 9

Wafer preparation – monolithic processing – moulding – PCB board hybrid & mcm technology – programmable devices & ASIC – electronic material and processing.–
steriolithography SAW devices, Surface Mount Technology,

TOTAL: 45 PERIODS

BOOKS FOR REFERENCE:

1. Serope kelpekijian & stevan r. schmid- manufacturing process engg material – 2003
2. Micro senors Mems & smart devices- Julian W.Hardner – 2002
3. Brahem T. Smith, Advanced machining I.F.S. UK 1989.
4. Jaeger R.C., Introduction to microelectronic fabrication Addison Wesley, 1988.
5. Nario Taniguchi – Nano technology – Oxford University Press 1996.
6. Pandey P.C. & Shan HS Modern Machining Processes, Standard Publishing Co., 1980
7. More Madon, Fundamentals of Microfabrication, CRC Press, 1997.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22254L19 CAD / CAM LABORATORY 0 0 3 3

OBJECTIVES:

 To teach the students about the drafting of 3D components and analyzing the same using various CAD packages and programming of CNC machines

 To train them to use the various sensors

CAM LABORATORY

1. Exercise on CNC Lathe: Plain Turning, Step turning, Taper turning, Threading,

Grooving canned cycle

2. Exercise on CNC Milling Machine: Profile Milling, Mirroring, Scaling & canned cycle. Study of Sensors, Transducers & PLC: Hall-effect sensor, Pressure sensors, Strain gauge, PLC, LVDT, Load cell, Angular potentiometer, Torque, Temperature & Optical Transducers.

CAD LABORATORY

2D modeling and 3D modeling of components such as

1. Bearing
2. Couplings
3. Gears
4. Sheet metal components
5. Jigs, Fixtures and Die assemblies.

TOTAL: 60 PERIODS

OUTCOMES :

At the end of this course the students are expected

 To impart the knowledge on training the students in the area of CAD/CAM

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

LIST OF EQUIPMENTS S.NO	EQUIPMENT	QUANTITY
1.	Computer Server	1
2.	Computer nodes or systems (High end CPU with atleast 1 GB main memory) networked to the server	30
3.	A3 size plotter	1
4.	Laser Printer	1
5.	CNC Lathe	1
6.	CNC milling machine	1
SOFTWARE		
7.	Any High end integrated modeling and manufacturing CAD / CAM software	15 licenses
8.	CAM Software for machining centre and turning centre (CNC Programming and tool path simulation for FANUC / Sinumeric and Heidenhain controller)	15 licenses
9.	Licensed operating system	adequate
10.	Support for CAPP	adequate

AIM:

To impart the knowledge on training the students in the area of CAD/CAM.

OBJECTIVES:

To teach the students about the drafting of 3D components and analyzing the same using various CAD/CAM software's.

CAM LABORATORY

1. Exercise on CNC Lathe: Plain Turning, Step turning, Taper turning, Threading, Grooving & canned cycle
2. Exercise on CNC Milling Machine: Profile Milling, Mirroring, Scaling & canned cycle.
3. Study of Sensors, Transducers & PLC: Hall-effect sensor, Pressure sensors, Strain gauge, PLC, LVDT, Load cell, Angular potentiometer, Torque, Temperature & Optical Transducers.
4. Mini project on any one of the CIM elements is to be done. This can be either a software or hardware simulating a CIM element. At the end of the semester, the students has to submit a mini report and present his work before a Committee.

CAD LABORATORY

2D modeling and 3D modeling of components such as

1. Bearing
2. Couplings
3. Gears
4. Sheet metal components
5. Jigs, Fixtures and Die assemblies.

TOTAL: 30 PERIODS.

22254C21 TOOLING FOR MANUFACTURING 4 0 0 4

OBJECTIVES:

 To study the various design considerations for tooling.

 Develop knowledge in tooling and work holding devices

UNIT I INTRODUCTION 12

Manufacturing Processes-objectives of manufacturing processes-classification of manufacturing process-Objectives of Tool design-tool design process-Nature and scope of Tool engineering-principles of economy for tooling-problems of economy in tooling-planning and tooling for economy-Manufacturing principles applicable to process and tool planning-tool control-tool maintenance-tool materials and its selection

UNIT II TOOLING FOR METAL REMOVAL PROCESSES 12

Traditional machining processes -work and tool holding devices-tool nomenclatures-Mechanism of machining-force temperature and tool life of single point tool-multipoint tools -tool design-tool wear-special processes-capstan and turret lathe-tooling layout of automats-tooling in NC and CNC machines-tooling for machining centres-CAD in tool design-Jigs and fixtures-design-Non-traditional material removal processes-mechanical, electrical thermal and chemical energy processes-principles-operation-equipment-tooling parameters and limitations

UNIT III TOOLING FOR METAL FORMING PROCESSES 12

Classification of Forming processes-Types of presses-design of -blanking and piercing dies-simple, compound, combination and progressive dies-Drawing dies-Bending dies-forging dies-plastic moulding dies

UNIT IV TOOLING FOR METAL CASTING AND METAL JOINING PROCESSES 12

Tools and Equipment for moulding-patterns –pattern allowances – pattern construction-die casting tools-mechanization of foundries. Tooling for Physical joining processes Design of welding fixtures – Arc welding, Gas welding, Resistance welding, laser welding fixtures-Tooling for Soldering and Brazing Tooling for Mechanical joining processes

UNIT V TOOLING FOR INSPECTION AND GAUGING 12

Survey of linear and angular measurements-standards of measurement-design and manufacturing of gauges- measurement of form-Inspection bench centre-co-ordinate measuring machine-tooling in CMM.

TOTAL: 60 PERIODS

OUTCOMES:

At the end of this course the students are well versed in

1. State of Art in Tooling in Manufacturing and Inspection
2. Design and Develop tooling for Flexible Manufacturing

REFERENCES:

1. Cyril Donaldson Tool Design, Tata McGraw Hill, 1976
2. Hoffman E.G Fundamentals of tool design SME 1984.
3. Kalpak Jian S., Manufacturing Engineering and Technology Addison Wesley 1995.
4. L E Doyle Tool Engineering Prentice Hall 1950
5. Wellar, J Non-Traditional Machining Processes, SME, 1984

22254C22P MEMS AND NANO TECHNOLOGY 4 0 0 4

AIM:

To inspire the students to expect to the trends in manufacturing micro components and measuring systems to nano scale.

OBJECTIVES:

• To expose the students to the evolution of micro electromechanical systems, to the various fabrication techniques and to make students to be award of micro actuators.

• Also to impart knowledge to the students about nano materials and various nano measurements techniques.

UNIT I OVER VIEW OF MEMS AND MICROSYSTEMS 6

Definition – historical development – fundamentals – properties, micro fluidics, design and fabrication micro-system, microelectronics, working principle and applications of micro system.

UNIT II MATERIALS, FABRICATION PROCESSES AND MICRO SYSTEM PACKAGING 10

Substrates and wafers, silicon as substrate material, mechanical properties of Si, Silicon Compounds silicon piezo resistors, Galium arsenide, quartz, polymers for MEMS, conductive polymers. Photolithography, photo resist applications, light sources, in implantation, diffusion process exudation – thermal oxidation, silicon diode, chemical vapour deposition, sputtering - deposition by epitoxy – etching – bulk and surface machining – LIGA process Micro system packaging – considerations packaging – levels of micro system packaging die level, device level and system level.

UNIT III MICRO DEVICES AND MATERIALS 8

Sensors – classification – signal conversion ideal characterization of sensors micro actuators, mechanical sensors – measurands displacement sensors, pressure and flow sensors, micro actuators – smart materials – applications.

UNIT IV SCIENCE OF NANO MATERIALS 10

Classification of nano structures – effect of the nanometer length scale effects of nano scale dimensions on various properties – structural, thermal, chemical, mechanical, magnetic, optical and electronic properties – effect of nanoscale dimensions on biological systems. Fabrication methods – Top down processes – bottom up process.

UNIT V CHARACTERIZATION OF NANO MATERIALS 11

Nano-processing systems – Nano measuring systems – characterization – analytical imaging techniques – microscopy techniques, electron microscopy scanning electron microscopy, transmission electron microscopy, transmission electron microscopy, scanning tunneling microscopy, atomic force microscopy, diffraction techniques – spectroscopy techniques – Raman spectroscopy, 3D surface analysis – Mechanical, Magnetic and thermal properties – Nano positioning systems.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCE:

1. Tai – Ran Hsu, MEMS and Microsystems Design and Manufacture, Tata-McGraw Hill, New Delhi, 2002.
2. Mark Madou Fundamentals of Microfabrication, CRC Press, New York, 1997.
3. Norio Taniguchi, Nano Technology, Oxford University Press, New York, 2003
4. The MEMS Hand book, Mohamed Gad-el-Hak, CRC Press, New York, London.
5. Charles P Poole, Frank J Owens, Introduction to Nano technology, John Wiley and Sons, 2003
6. Julian W. Hardner Micro Sensors, Principles and Applications, CRC Press 1993.

22254L24P AUTOMATION LAB 0 0 3 3

AIM:

To impart knowledge in the area of hydraulic and pneumatic components and its functions.

OBJECTIVE:

• To make the students to learn the basic concepts of hydraulics and pneumatics and its applications in the area of manufacturing process.

• To simulate the various hydraulics and pneumatics circuits.

EXPERIMENTS:

1. Simulation of single and double acting cylinder circuits
2. Simulation of Hydraulic circuits
3. Simulation of electro pneumatic circuits
4. Simulation of electro hydraulic circuits
5. Simulation of PLC circuits
6. Exercises on linear and angular measurements
7. Exercises on speed measurements
8. Exercises on Vibration measurements
9. Exercises on Motion controller using servo motors, encoders, etc.
10. Exercises on fiber optics transducers.
11. Exercises on stepper motor.
12. Exercises on microprocessor based data acquisition system.
13. Software simulation of fluid power circuits using Automation studio.

TOTAL : 30 PERIODS

222TECWRP Technical Writing/Seminar: 0 0 3 3

Seminar should be based on the literature survey on any topic relevant to CAD/CAM/CAE. It may be leading to selection of a suitable topic of dissertation. The report shall contain some contribution by the candidate in the form of experimental results, deductions, compilation and inferences etc.

• Each student has to prepare a write-up of about 25 pages. The report typed on A4 sized sheets and bound in the necessary format should be submitted after approved by the guide and endorsement of the Head of Department.

• The student has to deliver a seminar talk in front of the teachers of the department and his classmates. The Guide based on the quality of work and preparation and understanding of the candidate shall do an assessment of the seminar.

RESEARCH METHODOLOGY

AIM:

To give an exposure to development of research questions and the various statistical methods suitable to address them through available literature, with basic computational operators.

OBJECTIVES:

- To understand the approaches towards and constraints in good research.
- To identify various statistical tools used in research methodology
- To appreciate and compose the manuscript for publication
- To train in basic computational and excel- skills for research in engineering.

OUTCOME:

Ability to develop research questions and the various research strategies, and compile research results in terms of journal manuscripts.

PREREQUISITES:

Research Methodology course in UG level or equivalent knowledge.

UNIT I

Introduction to Research — Criteria of Good Research, Research Problem: Definition of research problem, selecting the problem - Necessity of defining the problem - Techniques involved in defining the problem-Basic principles of experimental designs-Descriptive and experimental design – different types of experimental design – Validity of findings – internal and external validity – Variables in Research – Measurement and Scaling – Different scales. Ethics & Misconduct in research, Plagiarism,

UNIT II

Formulation of Hypothesis – Sampling techniques –Sampling error and sample size-Methods of data collection – Primary and secondary data – observation – Collection of literature, manual collection from library, usage of library, collection of literature from Scopus, Science Direct etc., compiling literature, software utilization in literature collection- Processing and analysis of data – editing – coding – transcription – tabulation –outline of statistical analysis.

UNIT III

Data Analysis using Excel- Tabulation of Data in excel (Creating Master Table and Sub Table), Formulas and Functions, Filters and Sort and Validation Lists, Data from External Sources. Data Analysis Using Charts and Graphs(Pivot Table & Charts), Time Value of Money, Measure of central tendency: mean, median, mode, Measure of dispersion: variance, standard deviation, Coefficient of variation. Correlation, regression lines. Z-test, t- test F-test, ANOVA one way classification, Chi square test, independence of attributes. Time series: forecasting Method of least squares, Moving average method, Introduction to presentation tool, features and functions, Creating Presentation, Customizing presentation.

UNIT IV

Various research methods-Design of Experiments, Response Surface Methodology, Taguchi Methods- Modeling & Simulation of Engineering Systems, Artificial Neural Networks, Fuzzy Logic, MATLAB - Graph Theory- Finite Element Methods, Computational Fluid Dynamics -R programming in Statistics- open source software

UNIT V

Review of literature, Report writing – target audience – types of reports – contents of reports – styles and Conventions in reporting – steps in drafting a report. Basic concept of research paper writing for Journals and formats of publications in Journals, Report Structure - writing research abstract - introduction, review of literature, result, conclusions, Concepts of Bibliography and references

References:

1. C. R. Kothari, Research Methodology, New Age International Publishers. New Delhi, 2004.

2. Rajammal.P. Devadas, 1976, A hand book of methodology of research, RMM Vidyalaya Press.

3. R.A Day and A.L. Underwood, Quantitative analysis, Prentice Hall, 1999.

4. R. Gopalan, Thesis writing, Vijay Nicole Imprints Private Ltd., 2005.

5. W.J. DeCoursey, Statistics and Probability for Engineering Applications With Microsoft® Excel, Newnes, 2003.

6. Archibald Fripp, Jon Fripp, Michael Fripp; Just-in-Time Math for Engineers, Elsevier Science & Technology Books, 2003.

22254C31P ADVANCES IN CASTING AND WELDING L T P C 3 0 0 3

OBJECTIVES:

 To study the metallurgical concepts and applications of casting and welding process.
 To acquire knowledge in CAD of casting and automation of welding process.

UNIT I CASTING DESIGN 8

Heat transfer between metal and mould –– Design considerations in casting – Designing for directional solidification and minimum stresses - principles and design of gating and risering

UNIT II CASTING METALLURGY 8

Solidification of pure metal and alloys – shrinkage in cast metals – progressive and directional solidification –– Degasification of the melt-casting defects – Castability of steel , Cast Iron, Al alloys, Babbit alloy and Cu alloy.

UNIT III RECENT TRENDS IN CASTING AND FOUNDRY LAYOUT 8

Shell moulding, precision investment casting, CO2 moulding, centrifugal casting, Die casting, Continuous casting, Counter gravity low pressure casting, Squeeze casting and semisolid processes. Layout of mechanized foundry – sand reclamation – material handling in foundry pollution control in foundry –– Computer aided design of casting.

UNIT IV WELDING METALLURGY AND DESIGN 10

Heat affected Zone and its characteristics – W eldability of steels, cast iron, stainless steel, aluminum, Mg , Cu , Zirconium and titanium alloys – Carbon Equivalent of Plain and alloy steels Hydrogen embrittlement – Lamellar tearing – Residual stress – Distortion and its control . Heat transfer and solidification - Analysis of stresses in welded structures – pre and post welding heat treatments – weld joint design – welding defects – Testing of weldment.

UNIT V RECENT TRENDS IN WELDING 11

Friction welding, friction stir welding – explosive welding – diffusion bonding – high frequency induction welding – ultrasonic welding – electron beam welding – Laser beam welding –Plasma welding – Electroslag welding- narrow gap, hybrid twin wire active TIG – Tandem MIG- modern brazing and soldering techniques – induction, dip resistance, diffusion processes – Hot gas, wave and vapour phase soldering. Overview of automation of welding in aerospace, nuclear, surface transport vehicles and under water
welding.

OUTCOMES:

At the end of this course the students are expected to impart knowledge on basic concepts and advances in casting and welding processes.

TOTAL: 45 PERIODS

REFERENCES:

1. ASM Handbook vol.6, welding Brazing & Soldering, 2003
2. ASM Handbook, Vol 15, Casting, 2004
3. Carrry B., Modern Welding Technology, Prentice Hall Pvt Ltd., 2002
4. CORNU.J. Advanced welding systems – Volumes I, II and III, JAICO Publishers, 1994.
5. HEINELOPER & ROSENTHAL, Principles of Metal Casting, Tata McGraw Hill, 2000.
6. IOTROWSKI – Robotic welding – A guide to selection and application – Society of mechanical Engineers, 1987.
7. Jain P.L., Principles of Foundry Technology, Tata McGraw Hill Publishers, 2003
8. LANCASTER.J.F. – Metallurgy of welding – George Alien & Unwin Publishers, 1980
9. Parmer R.S., Welding Engineering and Technology, Khanna Publishers,2002
10. SCHWARIZ, M.M. – Source book on innovative welding processes – American Society for Metals (OHIO), 1981

22254C32P AUTOMATED COMPUTER INTEGRATED MANUFACTURING SYSTEMS 4 0 0 4

OBJECTIVE:

To teach the role of computers in processing the information knowing across the various Stages and various departments in a manufacturing concern.

UNIT I INTRODUCTION 6

Introduction to CAD, CAM, CAD/CAM and CIM - Evolution of CIM – CIM wheel and cycle – Production concepts and mathematical models – Simple problems in production models – CIM hardware and software – Major elements of CIM system – Three step process for implementation of CIM – Computers in CIM – Computer networks for manufacturing – The future automated factory – Management of CIM – Impact of CIM on personnel – CIM status.

UNIT II AUTOMATED MANUFACTURING SYSTEMS 10

Automated production line – system configurations, work part transfer mechanisms – Fundamentals of Automated assembly system – System configuration, Part delivery at workstations – Design for automated assembly – Overview of material handling equipments – Consideration in material handling system design – The 10 principles of Material handling. Conveyor systems – Types of conveyors – Operations and features. Automated Guided Vehicle system – Types of vehicles and AGVs applications – Vehicle guidance technology – Vehicle management and safety. Storage system performance – storage location strategies – Conventional storage methods and equipments – Automated storage/Retrieval system and Carousel storage system Deadlocks in Automated manufacturing systems – Petrinet models – Applications in Dead lock avoidance.

UNIT III GROUP TECHNOLOGY AND FMS 10

Part families – Visual – Parts classification and coding – Production flow analysis – Grouping of parts and Machines by rank order clustering method – Benefits of GT – Case studies. FMS – Components – workstations – FMS layout configurations – Computer control systems – FMS planning and implementation issues – Architecture of FMS – flow chart showing various operations in FMS – Machine cell design – Composite part concept, Holier method, Key machine concept – Quantitative analysis of FMS – Bottleneck model – Simple and complicated problems – Extended Bottleneck model - sizing the FMS, FMS applications, Benefits.

UNIT IV PROCESS PLANNING 10

Process planning – Activities in process planning, Information's required. From design to process planning – classification of manufacturing processes – Selection of primary manufacturing processes – selecting among casting process, forming process and machining process. Sequencing of operations according to Anteriorities – various examples – forming of Matrix of Anteriorities – case study. Typical process sheet – case studies in Manual process planning. Computer Aided Process Planning – Process planning module and data base – Variant process planning – Two stages in VPP – Generative process planning – Flow chart showing various activities in generative PP – Semi generative process planning.

UNIT V TYPES OF PROCESS CONTROL AND AUTOMATIC DATA CAPTURE 9

Introduction to process model formulation – linear feedback control systems – Optimal control – Adaptive control –Sequence control and PLC. Computer process control – Computer process interface – Interface hardware – Computer process monitoring – Direct digital control and Supervisory computer control. Overviews of Automatic identification methods – Bar code technology – Other Automatic data capture technologies.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCE:

1. Mikell P.Groover, “Automation, Production system and Computer integrated Manufacturing”, Prentice Hall of India Pvt. Ltd., 2008.
2. Radhakrishnan,P., Subramanian,S., and Raju,V., “CAD/CAM/CIM” New Age International Publishers, 2000.
3. James A.Retrg, Herry W.Kraebber, “Computer Integrated Manufacturing”, Pearson Education, Asia, 2001.
4. Viswanathan,N., and Narahari,Y., “Performance Modeling and Automated Manufacturing Systems”, Prentice Hall of India Pvt. Ltd., 2000.
5. Alavudeen and Venkateshwaran, “Computer Integrated Manufacturing”, PHI Learning Pvt. Ltd., New Delhi, 2008.

22254C41P MANUFACTURING METROLOGY AND QUALITY CONTROL 3 1 0 4

AIM:

To expose the students, the importance of measurement and the various latest measuring techniques using Laser, Coordinate measuring machines and Optoelectronics devices. Also to stress upon the Importance of quality in manufacturing.

OBJECTIVES:

To impart through knowledge in various latest measurement systems such as laser metrology, coordinate measuring machines and electro-optical devices. Also to make the students to understand quality

UNIT – I LASER METROLOGY 8

Introduction – types of lasers – laser in engineering metrology – metrological laser methods for applications in machine systems – Interferometry applications – speckle interferometry – laser interferometers in manufacturing and machine tool alignment testing – calibration systems for industrial robots laser Doppler technique – laser Doppler anemometry.

UNIT – II PRECISION INSTRUMENTS BASED ON LASER 9

Laser telemetric systems – detection of microscopic imperfections on high quality surface Pitter NPL gauge interferometer – classification of optical scanning systems – high inertia laser scan technique – rotating mirror technique – laser gauging – bar coding – laser dimensional measurement system.

UNIT – III CO-ORDINATE MEASURING MACHINE 10

Co-ordinate metrology – CMM configurations – hardware components – software – Probe sensors – displacement devices – Performance Evaluations – Software – Hardware – Dynamic errors – Thermal effects diagram – temperature variations environment control – applications.

UNIT – IV OPTO ELECTRONICS AND VISION SYSTEM 9

Opto electronic devices – CCD – On-line and in-process monitoring in production – applications image analysis and computer vision – Image analysis techniques – spatical feature – Image extraction – segmentation – digital image processing – Vision system for measurement – Comparison laser scanning with vision system.

UNIT – V QUALITY IN MANUFACTURING ENGINEERING 9

Importance of manufacturing planning for quality – concepts of controllability – need for quality management system and models – quality engineering tools and techniques – statistical process control – six sigma concepts – Poka Yoke – Computer controlled systems used in inspection.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCE:

1. John A. Bosch, Giddings and Lewis Dayton, Co-ordinate Measuring Machines and Systems, Marcel Dekker, Inc, 1999.
2. Juran J.M. and Gyna F.M., Quality Planning and Analysis, Tata-McGraw Hill, New Delhi
3. Zuech, Nello Understanding and Applying Machine Vision, Marcel Dekker, Inc, 2000
4. Elanchezhian.C, Vijaya Ramnath.B and Sunder Selwyn, T., Engineering Metrology, Eswar Press, Chennai, 2004.

22254C42P METAL FORMING PROCESS 4 0 0 4

OBJECTIVE: To study about the response of materials under plastic deformation and the various techniques for finding the stress for various metal working processes, and the recent developments in high speed forming.

UNIT-I: Stress and Strain:

Stress-State of stress in two dimensions – three dimensions – stress tensor-Mohr's circles – 2D and 3D state of stress – Description of strain at a point – Mohr's circle of strain- Hydrostatic and stress deviator component of stress- Plasticity- flow curve- true and true strain yield criteria for ductile loads combined stress test-plastic stress and strain relations- Levy Mises equations-Prandyl_Resus equations.

UNIT-II: Analysis of Metal Forming:

Work Load analysis – work formula for homogeneous deformation- rolling, rod drawing and extrusion processes -Determination of load by stress evaluation method-Determination of drawing load – strip drawing with wedge shaped dies and cylindrical rod drawing with a conical die.

UNIT-III: Stress Evaluation:

Stress evaluation method-Determination of forging load-plane strain forging of a thin strip and a flat circular disc- Determination of extrusion load for round band flat strip- upper bound analysis – plane strain indentation with frictionless interface

UNIT-IV: High velocity Forming:

Study of effect of high speed on stress strain relationships- High velocity forming equipment-Description of high speed forming machine – hot forging, pneumatic-mechanical, high velocity forging – Fuel combustion process- Electro magnetic forming –Introduction- Procedure - process variables- Applications

UNIT-V: Advanced Forming process:

Explosive Forming – Explosives – characteristics- stand off and contact operations- stress waves and their effects- process variables – properties of formed components- applications- Electro hydraulic forming – principles, requirements and characteristics – process variables- water hammer forming- principles and parameters- governing the process.

BOOKS FOR REFERENCE:

1. George E.Dieter, "Mechanical Metallurgy", Mc Graw Hill International Edition, New York,1988
2. Rowe G.W,Edward , "An Introduction to the Principles of Metal Working", Edward Arnold publications.
3. Davies.R and Austin.E.R, "Developments in High Metal Forming", The Machinery Publishing Co.Ltd
4. Robert H.Wagoner and Jean Loup Chenot, "Fundamentals of Metal Forming", John Wiley and Sons Inc, New York,1992

List of Electives - Elective I

22254E23AP - FINITE ELEMENT APPLICATIONS IN MANUFACTURING 3 10 4

AIM:

To impart knowledge in the area of finite element methods and its application in manufacturing.

OBJECTIVE:

To study the fundamentals of one dimensional and two dimensional problems using FEA in manufacturing.

UNIT I INTRODUCTION 6

Fundamentals – Initial, boundary and eigen value problems – weighted residual, Galerkin and Raleigh Ritz methods - Integration by parts – Basics of variational formulation – Polynomial and Nodal approximation.

UNIT II ONE DIMENSIONAL ANALYSIS 10

Steps in FEM – Discretization. Interpolation, derivation of elements characteristic matrix, shape function, assembly and imposition of boundary conditions-solution and post processing – One dimensional analysis in solid mechanics and heat transfer.

UNIT III SHAPE FUNCTIONS AND HIGHER ORDER FORMULATIONS 10

Shape functions for one and two dimensional elements- Three noded triangular and four nodded quadrilateral element Global and natural co-ordinates—Non linear analysis – Isoparametric elements – Jacobian matrices and transformations – Basics of two dimensional, plane stress, plane strain and axisymmetric analysis.

UNIT IV COMPUTER IMPLEMENTATION 9

Pre Processing, mesh generation, elements connecting, boundary conditions, input of material and processing characteristics – Solution and post processing – Overview of application packages – Development of code for one dimensional analysis and validation.

UNIT V ANALYSIS OF PRODUCTION PROCESSES 10

FE analysis of metal casting – special considerations, latent heat incorporation, gap element – Time stepping procedures – Crank – Nicholson algorithm – Prediction of grain structure – Basic concepts of plasticity and fracture – Solid and flow formulation – small incremental deformation formulation – Fracture criteria – FE analysis of metal cutting, chip separation criteria, incorporation of strain rate dependency – FE analysis of welding.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCE:

1. Reddy, J.N. An Introduction to the Finite Element Method, McGraw Hill,1985.
2. Rao, S.S., Finite Element method in engineering, Pergammon press, 1989.
3. Lewis R.W.Morgan, K, Thomas, H.R. and Seetharaman, K.N. The Finite Element Method in Heat Transfer Analysis, John Wiley, 1994.

22254E23BP LEAN MANUFACTURING 4 0 0 4

AIM:

To introduce the concepts of lean manufacturing system.

OBJECTIVES:

- To study the various tools for lean manufacturing (LM).
- To apply the above tools to implement LM system in an organization.

UNIT – I INTRODUCTION TO LEAN MANUFACTURING 7

Conventional Manufacturing versus Lean Manufacturing – Principles of Lean Manufacturing – Basic elements of lean manufacturing – Introduction to LM Tools.

UNIT – II CELLULAR MANUFACTURING, JIT, TPM 9

Cellular Manufacturing – Types of Layout, Principles of Cell layout, Implementation. JIT – Principles of JIT and Implementation of Kanban. TPM – Pillars of TPM, Principles and implementation of TPM.

UNIT – III SET UP TIME REDUCTION, TQM, 5S, VSM 10

Set up time reduction – Definition, philosophies and reduction approaches. TQM – Principles and implementation. 5S Principles and implementation - Value stream mapping - Procedure and principles.

UNIT – IV SIX SIGMA 9

Six Sigma – Definition, statistical considerations, variability reduction, design of experiments – Six Sigma implementation.

UNIT – V CASE STUDIES 10

Various case studies of implementation of lean manufacturing at industries.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCES:

1. Design and Analysis of Lean Production Systems, Ronald G. Askin & Jeffrey B. Goldberg, John Wiley & Sons, 2003
2. Rother M. and Shook J, 1999 ‘Learning to See: Value Stream Mapping to Add Value and Eliminate Muda’ , Lean Enterprise Institute, Brookline, MA.
1. Mikell P. Groover (2002) ‘Automation, Production Systems and CIM.

22254E16A MATERIALS MANAGEMENT AND LOGISTICS 3 0 0 3

AIM:

To introduce to the students the various functions of materials management and logistics

OBJECTIVE:

To make the students familiar with the various concepts and functions of material management, so that the students will be in a position to manage the materials management department independently.

UNIT I INTRODUCTION 6

Introduction to materials management – Objectives – Functions – Operating Cycle – Value analysis – Make or buy decisions.

UNIT II MANAGEMENT OF PURCHASE 7

Purchasing policies and procedures – Selection of sources of supply – Vendor development – Vendor evaluation and rating – Methods of purchasing – Imports – Buyer – Seller relationship – Negotiations.

UNIT III MANAGEMENT OF STORES AND LOGISTICS 12

Stores function – Location – Layout – Stock taking – Materials handling – Transportation – Insurance – Codification – Inventory pricing – stores management – safety – warehousing – Distribution linear programming – Traveling Salesman problems – Network analysis – Logistics Management.

UNIT IV MATERIALS PLANNING 10

Forecasting – Materials requirements planning – Quantity – Periodic – Deterministic models – Finite production.

UNIT V INVENTORY MANAGEMENT 10

ABC analysis – Aggregate planning – Lot size under constraints – Just in Time (JIT) system.

TOTAL: 45 periods

BOOKS FOR REFERENCES:

1. Lamer Lee and Donald W.Dobler, Purchasing and Material Management, Text and cases, Tata McGraw Hill, 1996.
2. Gopalakrishnan.P, Handbook of Materials Management, Prentice Hall of India, 1996.
3. Guptha P.K. and Manmohan, Problems in Operations Research, Suttan Chand & Sons, 2003.
4. Dr.R. Kesavan, C.Elanchezian and B.Vijaya Ramnath, Production Planning and Control, Anuratha Publications, Chennai, 2008.
5. G. Reghuram, N. Rangaraj, Logistics and supply chain management – cases and concepts, Macmillan India Ltd., 2006.

List of Electives - Elective II

22254E33BP **QUALITY AND RELIABILITY ENGINEERING 3 0 0 3**

OBJECTIVES:

To make the students to understand the various quality control techniques and to construct the various quality control charts for variables and attributes and also the design concepts for reliable system and maintenance aspects in industries.

UNIT I QUALITY & STATISTICAL PROCESS CONTROL 8

Quality – Definition – Quality Assurance – Variation in process – Factors – process capability – control charts – variables X, R and X, - Attributes P, C and U-Chart tolerance design. Establishing and interpreting control charts – charts for variables – Quality rating – Short run SPC.

UNIT II ACCEPTANCE SAMPLING 8

Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling plans – OC curves – Producer's risk and consumer's risk. AQL, LTPD, AOQL, Concepts – standard sampling plans for AQL and LTPD – use of standard sampling plans.

UNIT III EXPERIMENTAL DESIGN AND TAGUCHI METHOD 9

Fundamentals – factorial experiments – random design, Latin square design – Taguchi method – Loss function – experiments – S/N ratio and performance measure – Orthogonal array.

UNIT IV CONCEPT OF RELIABILITY 9

Definition – reliability vs quality, reliability function – MTBF, MTTR, availability, bathtub curve – time dependent failure models – distributions – normal, weibull, lognormal – Reliability of system and models – serial, parallel and combined configuration – Markove analysis, load sharing systems, standby systems, covarient models, static models, dynamic models.

UNIT V DESIGN FOR RELIABILITY AND MAINTAINABILITY 11

Reliability design process, system effectiveness, economic analysis and life cycle cost, reliability allocation, design methods, parts and material selection, derating, stress-strength and analysis, failure analysis, identification determination of causes, assessments of effects, computation of criticality index, corrective action, system safety – analysis of down-time – the repair time distribution, stochastic point processes system repair time, reliability under preventive maintenance state dependent system with repair. MTTR – mean system down time, repair vs replacement, replacement models, proactive, preventive, predictive maintenance maintainability and availability, optimization techniques for system reliability with redundancy heuristic methods applied to optimal system reliability.

TOTAL: 45 PERIODS

Text Books:

1. Statistical Process Control, by Eugene Grant, Richard Leavenworth, McGraw Hill.

2. Quality Engineering in Production Systems, by G Taguchi , McGraw Hill, 1989.

3. Optimization &Variation Reduction in Quality, byW.A. Taylor,Tata McGraw Hill, 1991.

Reference Books:

1. Jurans Quality Planning and Analysis, by Frank. M.Gryna Jr. McGrawHill

2. Taguchi Techniques for Quality Engineering, (2ndEdition) by Philipposs, McGraw Hill, 1996,.

3. Reliability Engineering, (3rdEdition), by LS Srinath, Affiliated East West Pvt Ltd, 1991.

4. Reliability Engineering, by E.Bala Guruswamy, Tata McGraw Hill, 1994

22254E32A ADVANCED METROLOGY AND COMPUTER AIDED INSPECTION 4 0 0 4

AIM:

To give a thorough knowledge of measurement and instrumentation of increasing importance in industry. The student will be knowledgeable in various standards and proliferation of computerized and automated inspecting techniques along with the classical metrology.

OBJECTIVES:

- To teach the students basic concepts in various methods of engineering measurement techniques and applications, understand the importance of measurement and inspection in manufacturing industries.
- Expose the students to various modern metrological instruments and the procedure used to operate these instruments.

UNIT I GENERAL CONCEPTS OF MEASUREMENT 8

Definition – Standards of measurement – Errors in measurement – Interchangeability and Selective assembly – Accuracy and Precision – Calibration of instruments.

UNITII MEASUREMENT OF SURFACE FINISH AND MEASURING MACHINES 9

Definitions – Types of Surface Texture: Surface Roughness Measurement Methods- Comparison, Profilometer, 3D Surface Roughness Measurement – Instruments.

UNIT III INTERFEROMETRY 8

Interferometry – Introduction, Principles of light interference – Interferometers – Measurement and Calibration – Laser Interferometry.

UNIT IV COMPUTER AIDED AND LASER METROLOGY 10

Tool Makers Microscope – Microhite – Co – Ordinate measuring machine – Applications – Laser Micrometer, Laser Scanning gauge, Non contact and in-process inspection, Vision system.

UNIT V IMAGE PROCESSING 10

Overview, Computer imaging systems, Image Analysis, Preprocessing, Human vision system, Image model, Image enhancement, gray scale models, histogram models, Image Transforms.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCE:

1. GUPTA, I.C, “A Text Book of engineering metrology”, Dhanpat Rai and Sons, 1996.
2. G.N.GALYER F.W. and C.R.SHOTBOLT, “Metrology for engineers”, ELBS, 1990.
3. GRAHAM T.SMITH, “Industrial Metrology”, Springer, 2002
4. “ASTE Handbook of Industries Metrology”, Prentice Hall of India Ltd., 1992.
5. R.K.RAJPUT, “Engineering Metrology and Instrumentations”, Kataria & Sons Publishers, 2001.

22254E33BP FINANCIAL MANAGEMENT 4 0 0 4

AIM:

To introduce the concepts of financial and various functions of financial management so that the students will be able to handle higher level financial decisions.

OBJECTIVES:

To train students in various functions of finance such as working capital management, current assets management so that students will be able to make high investment decisions when they take up senior managerial positions.

UNIT – I FINANCIAL ACCOUNTING 8

Accounting principles - Basic records - Preparation and interpretation of profit and loss statement - balance sheet - Fixed assets - Current assets.

UNIT – II COST ACCOUNTING 12

Elements of cost - cost classification - material cost - labour costs - overheads - cost of a product - costing systems - cost determination - process - costing - Allocation of overheads - Depreciation - methods.

UNIT – III MANAGEMENT OF WORKING CAPITAL 10

Current assets - Estimation of working capital requirements - Management of accounts receivable - Inventory - Cash - Inventory valuation methods.

UNIT – IV CAPITAL BUDGETING 8

Significance of capital budgeting - payback period - present value method – accounting rate of return method - Internal rate of return method.

UNIT – V PROFIT PLANNING AND ANALYSIS 7

Cost - Volume profit relationship relevant costs in decision making profit management analysis - Break even analysis.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCE:

1. Presanna Chandra, Financial Management, Tata McGraw Hill, 1998.
2. G.B.S. Narang, Production and Costing, Khanna Publishers, 1993.
3. R. Kesavan, C.Elanchezian, Sundar Selwyn, Engineering Economics and Financial Accounting, Laxmi Publications, New Delhi, 2005.
4. R Kesavan, C. Elanchezian, B.Vijaramnath, Engineering Economics and Cost Analysis Anuratha Publications, Chennai.

22254E33CP MANUFACTURING INFORMATION SYSTEMS 4 0 0 4

AIM:

To impart the knowledge in manufacturing information system.

OBJECTIVE:

On completion of this course, the students are expected to be conversant with order policies, data base terminologies, designing, manufacturing considerations and information system for manufacturing.

UNIT I INTRODUCTION 5

The Evolution of order policies, from MRP to MRP II, the role of Production organization, Operations control.

UNIT II DATABASE 7

Terminologies – Entities and attributes – Data models, schema and subschema - Data Independence – ER Diagram – Trends in database.

UNIT III DESIGNING DATABASE 13

Hierarchical model – Network approach- Relational Data model concepts, principles, keys, relational operations – functional dependence – Normalization types – Query.

UNIT IV MANUFACTURING CONSIDERATION 10

The product and its structure, inventory and process flow – Shop floor control Data structure and procedure – various model – the order scheduling module, Input/output analysis module the stock status database – the complete IOM database.

UNIT V INFORMATION SYSTEM FOR MANUFACTURING 10

Parts oriented production information system – concepts and structure – Computerized production scheduling, online production control systems; Computer based production management system, computerized manufacturing information system – case study.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCE:

1. Luca G.Sartori, "Manufacturing Information Systems", Addison-Wesley Publishing Company, 1988.
2. Date.C.J.,"An Introduction to Database Systems" Addison Wesley, 8th Edn,.2003
3. Orlicky.G., "Material Requirements Planning", McGraw-Hill, 1994.
4. Kerr.R, "Knowledge based Manufacturing Management", Addison-Wesley,1991.
5. Manufacturing Information & Data Systems Analysis, Design & Practice,CECELJA FRANJO, 2002.

List of Electives - Elective III

22254E43AP Non-Destructive Testing And Evaluation

OBJECTIVES :

To stress the importance of NDT in engineering.

UNIT I

NON-DESTRUCTIVE TESTING: AN INTRODUCTION, VISUAL INSPECTION & LIQUID PENETRANT TESTING 6

Introduction to various non-destructive methods, Comparison of Destructive and Non destructive Tests, Visual Inspection, Optical aids used for visual inspection, Applications.

Physical principles, procedure for penetrant testing, Penetrant testing materials, Penetrant testing methods-water washable, Post – Emulsification methods, Applications

UNIT II EDDY CURRENT TESTING & ACOUSTIC EMISSION 10

Principles, Instrumentation for ECT, Absolute, differential probes, Techniques – High sensitivity techniques, Multi frequency, Phased array ECT, Applications.

Principle of AET, Instrumentation, Applications - testing of metal pressure vessels, Fatigue crack detection in aerospace structures.

UNIT III MAGNETIC PARTICLE TESTING & THERMOGRAPHY 10

Principle of MPT, procedure used for testing a component, Equipment used for MPT, Magnetizing techniques, Applications.

Principle of Thermography, Infrared Radiometry, Active thermography measurements, Applications – Imaging entrapped water under an epoxy coating, Detection of carbon fiber contaminants.

UNIT IV ULTRASONIC TESTING 10

Principle, Ultrasonic transducers, Ultrasonic Flaw detection Equipment, Modes of display A- scan, B-Scan, C- Scan, Applications, Inspection Methods - Normal Incident Pulse-Echo Inspection, Normal Incident Through-transmission Testing, Angle Beam Pulse-Echo testing, TOFD Technique, Applications of Normal Beam Inspection in detecting fatigue cracks, Inclusions, Slag, Porosity and Intergranular cracks - Codes, standards, specification and procedures and case studies in ultrasonics test.

UNIT V RADIOGRAPHY 9

Principle of Radiography, x-ray and gamma ray sources- safety procedures and standards, Effect of radiation on Film, Radiographic imaging, Inspection Techniques – Single wall single image, Double wall Penetration, Multiwall Penetration technique, Real Time Radiography - Codes, standards, specification and procedures and case studies in Radiography test.

Case studies on defects in cast, rolled, extruded, welded and heat treated components - Comparison and selection of various NDT techniques

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course the students are expected to have hands on experience on all types of NDT and their applications in Engineering.

REFERENCES:

1. Baldev Raj, Jeyakumar,T., Thavasimuthu,M., “Practical Non Destructive Testing” Narosa publishing house, New Delhi, 2002

2. Krautkramer. J., “Ultra Sonic Testing of Materials”, 1st Edition, Springer – Verlag Publication, New York, 1996.

3. Peter J. Shull “Non Destructive Evaluation: Theory, Techniques and Application” Marcel Dekker, Inc., New York, 2002

4. www.ndt.net

22254E43BP MAINTENANCE MANAGEMENT 4 0 0 4

OBJECTIVE:

To understand the concepts of maintenance management and to have knowledge in developing a suitable maintenance system for any type of an organization.

UNIT I: Introduction to Maintenance Management: 7

Maintenance: Its role and scope in total Organizational contexts - role of Maintenance. Centralized and decentralized maintenance organization structures. Maintenance Economics – reliability and Availability – MTBF, MTTR.

UNIT II: Maintenance Categories: 10

Maintenance system– Categories - Design and its selection – Breakdown Maintenance –Routine Maintenance- Predictive Maintenance –Preventive Maintenance- Corrective Maintenance-Total Productive Maintenance –Maintenance Schedule – Repair Cycle.

UNIT III: Spare Parts Management: 8

Pareto's principles for repetitive breakdown analysis, spares management, planning considerations for each type of activities.

UNIT – IV: Condition Monitoring: 10

Condition Monitoring (CM) – Introduction- Economics of CM – On-load and off-load testing – Methods and instruments for CM – Temperature sensitive tapes – Pistol thermometers – wear-debris analysis.

UNIT V: Maintenance Manpower Cost, Performance Management: 10

Maintenance man power planning - Selection training - Scheduling maintenance costs - Budget preparation and budgetary control of maintenance expenditures Maintenance effectiveness various performance indices - evaluation, uses and limitations - Monitoring of Maintenance performance.

BOOKS FOR REFERENCE:

1. Gopalakrishnan P. and Sundarajan 1996. Maintenance Management. New Delhi, Prentice-Hall of India.
2. Srivastava S.K., "Industrial Maintenance Management", - S. Chand & Co.,1981.
3. Higgirs L.T and Morrow L.C., 1997, ``Maintenance Engineering Handbook``, McGraw Hill.
Armstrong, "Condition Monitoring", BSIRSA, 1988.

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22254E43CP OPTIMIZATION TECHNIQUES 3 1 0 4

UNIT I - INTRODUCTION TO OPTIMIZATION 7

Formulation of an optimization problem- Classification of optimization problem – optimization techniques-Classical optimization technique – Single variable optimization – Multi variable optimization algorithms

UNIT II - MINIMIZATION METHODS 8

One dimensional minimization methods: unimodal function – elimination methods: unrestricted search, exhaustive search, Dichotomous search, Fibonacci methods, Golden section methods, Interpolation methods: Quadratic and cubic interpolation methods.

UNIT III - CONSTRAINED OPTIMIZATION TECHNIQUES 10

Optimization with equality and inequality constraints - Direct methods – Indirect methods using penalty functions, Lagrange multipliers - separable programming and Geometric programming.

UNIT IV - UNCONSTRAINED OPTIMIZATION TECHNIQUES 10

Multi variable unconstrained optimization techniques: Direct search methods: Random search method, unvaried method, pattern search method, steepest descent method and Conjugate gradient method.

UNIT V - APPLICATIONS OF HEURISTICS IN OPTIMIZATION 10

Heuristics-Introduction-Multi objective optimization: Genetic algorithms and Simulated Annealing techniques; neural network & Fuzzy logic principles in optimization.

BOOKS FOR REFERENCE:

1. Rao, Singaresu, S., "Engineering Optimization – Theory & Practice", New Age International (P) Limited, New Delhi, 2000.
2. Johnson Ray, C., "Optimum design of mechanical elements", Wiley, John & Sons, 1990.
3. Kalyanamoy Deb, "Optimization for Engineering design algorithms and Examples", Prentice Hall of India Pvt. 1995.
4. Goldberg, D.E., "Genetic algorithms in search, optimization and machine", Barnen, Addison-Wesley, New York, 1989.

List of Electives - Elective IV

22254E51AP PROCESS PLANNING AND COST ESTIMATION 3 0 0 3

OBJECTIVES: To introduce the process planning concepts to make cost estimation for various products after process planning

UNIT I INTRODUCTION TO PROCESS PLANNING 10

Introduction- methods of process planning-Drawing interpretation-Material evaluation – steps in process selection-.Production equipment and tooling selection

UNIT II PROCESS PLANNING ACTIVITIES 10

Process parameters calculation for various production processes-Selection jigs and fixtures election of quality assurance methods – Set of documents for process planning-Economics of process planning- case studies

UNIT III INTRODUCTION TO COST ESTIMATION 8

Importance of costing and estimation –methods of costing-elements of cost estimation –Types of estimates – Estimating procedure- Estimation labor cost, material cost- allocation of over head charges- Calculation of depreciation cost

UNIT IV PRODUCTION COST ESTIMATION 8

Estimation of Different Types of Jobs – Estimation of Forging Shop, Estimation of Welding Shop, Estimation of Foundry Shop

UNIT V MACHINING TIME CALCULATION 9

Estimation of Machining Time – Importance of Machine Time Calculation- Calculation of Machining Time for Different Lathe Operations ,Drilling and Boring – Machining Time Calculation for Milling, Shaping and Planning -Machining Time Calculation for Grinding

TOTAL: 45 PERIODS

OUTCOMES: At the end of this course the students are expected to use the concepts of process planning and cost estimation for various products.

REFERENCES:

1. Chitale A.V. and Gupta R.C., “Product Design and Manufacturing”, 2nd Edition, PHI, 2002.
2. Ostwalal P.F. and Munez J., “Manufacturing Processes and systems”, 9th Edition, John Wiley, 1998.
3. Peter scalon, “Process planning, Design/Manufacture Interface”, Elsevier science technology Books, Dec 2002.
4. Russell R.S and Tailor B.W, “Operations Management”, 4th Edition, PHI, 2003.

22254E51BP INSTRUMENTATION AND CONTROL ENGINEERING 4 0 0 4

UNIT–I: Introduction to Instrumentation: 8
Mechanical Instrumentation- General concepts, General measurement system. Classification of Instruments - indicators, recorders and integrators- working principles, Precision and Accuracy: Measurement Error and calibration.

UNIT–II: Measuring Devices 10
Measurement of speed, frequency, acceleration - Vibrometer, Accelerometer etc. Pressure measurement: Gravitational, Bourdon, elastic transducers, strain gauge, pressure cells, and measurement of high and low pressure. Temperature measurement: Bi-Metallic, Resistance Thermometer, Thermocouples, Pyrometer, thermostats, Magnetic flow meter , Ultrasonic flow meter.

UNIT – III: Transducers: 8
Transducers – Introduction – Types -Variable resistance Transducers-Variable reactive transducers- Piezo Electric transducers- Fibre optic transducers- Laser instrumentation-analogue and digital type -incremental and absolute measurement.

UNIT – IV: Machine Diagnostic and Condition Monitoring: 10
Machine Diagnostics – Basic Concepts - Analysis of failure in machines-Distribution of fault occurrences-Objectives of monitoring-Monitoring techniques applied to Machineries.

UNIT – V: Computer Control System: 9
Data acquisition system-Introduction-Direct Digital control-Programmable Logic Controls (PLC) -Ladder diagrams-Communication used in PLC.

BOOKS FOR REFERENCE:
1. Thomas Beckwith, Lewis Buck N.Ray, D. Maragoni, “Mechabical Measurements”, Narosia Publishing House, NewDelhi.
2. M.P.Groover - " Automation, Production Systems and computer Intergrated Manufacturing ", Prentice Hall.
3. A.K. Sawhney, “Elecrical and Electronics Measurements & Instrumentation”, Dhanpat Rai & Sons, 1993
4. C.S.Rangan,V.S.V.Mani and G.R.Sarma - " Instrumentation Devices and systems", Tata McGraw Hill,1983

22254E51CP ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS 3 1 0 4

UNIT – I - Neural Networks 8

Introduction to soft Computing-Neural Networks-Supervised Learning Neural Networks – Perceptrons – Adaline – Back propagation Multilayer perceptrons – Radial Basic Function Networks – Unsupervised Learning and Other Neural Networks – Competitive Learning Networks – Kohonen Self – Organizing Networks – Learning Vector Quantization – Habbian Learning.

UNIT – II - Fuzzy Logic: 10

Fuzzy Sets – Basic Definition and Terminology – Set –theoretic operations – Member Function Formulation and parameterization – Fuzzy Rules and Fuzzy Reasoning. Fuzzy Logic: Extension principle and Fuzzy Relations – Fuzzy If – Then Rules – Fuzzy Reasoning – Fuzzy Inference Systems – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models – Input Space Partitioning and Fuzzy Modeling.

UNIT – III Genetic Algorithm: 9

Derivative – based Optimization – Descent Methods – The Method of steepest Descent – Classical Newton's Method – Step Size Determination – Derivative – free Optimization – Genetic Algorithms – Simulated Annealing – Random Search – Downhill Simplex Search.

UNIT – IV Neuro Fuzzy Modeling: 10

Adaptive Neuro – Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm – learning Methods that Cross – Fertilize ANFIS and RBFN – Coactive Neuro – Fuzzy Modeling – Framework – Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum.

UNIT – V Applications: 8

Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency prediction – Soft Computing for Color Recipe Prediction – Single MLP approaches –CANFIS modeling for color recipe prediction

BOOKS FOR REFERENCE:

1. Jang, J.S.R., C.T. Sun and E. Mizutani., "Neuro – Fuzzy and Soft Computing", PHI, Person Education, 2004.
2. Eberhart, R., simpson, P. and Dobbins, R., " Computatuonal Intelligence PC Tools", AP Professional, Boston 1996.
3. Goldberg, Davis E., "Optimization and Machine Learning" Addison Wesley, New York, 1989.
4. S. Rajasekaran and Pai, G.A.V., "Neural Networks, Fuzzy Logic and Genetic Algorithms",Prentice Hall of India, New Delhi, 2003.

List of Electives - Elective V

22254E52AP INTERNET OF THINGS FOR MANUFACTURING 3 0 0 3

OBJECTIVES:

- To discover key IoT concepts including identification, sensors, localization, wireless protocols
- To explore IoT technologies, architectures, standards, and regulation
- To realize the value created by collecting, communicating, coordinating, and leveraging data
- To examine developments that will likely shape the industrial landscape in the future;

UNIT I INTRODUCTION 9

Technology of the IoT and applications,. IoT data management requirements, Architecture of IoT, Security issues Opportunities for IoT -Issues in implementing IoT. Technological challenges, RFID and the Electronic Product Code (EPC) network, the web of things.

UNIT II DESIGN OF IoT 9

Design challenges in IoT -Standardization, Security and privacy, Infrastructure, Analytics. Design steps for implementing IoT.

UNIT III PROTOTYPING OF IoT 9

Design principles for connected devices -Embedded devices, physical design, online components, embedded coding system. Informed Manufacturing plant – Elements, IoT implementation in Transportation and logistics, Energy and utilities, Automotive Connected supply chain, Plant floor control automation, remote monitoring, Management of critical assets, Energy management and resource optimization, proactive maintenance.

UNIT IV PREREQUISITES FOR IoT 9

IOT Technologies Wireless protocols low-power design (Bluetooth Low Energy), range extension techniques (data mining and mesh networking), and data-intensive IoT for continuous recognition applications Data storage and analysis Localization algorithms Localization for mobile systems

UNIT V APPLICATION IN MANUFACTURING 9

Applications HCI and IoT world -Multilingual interactions Robotics and Autonomous Vehicles Sensing and data processing-Simultaneous mapping and localization-Levels of autonomy, Smart factories, Future research challenges

TOTAL : 45 PERIODS

OUTCOMES:

- At the end of this course the students are expected to
- Utilizing sensors to gain greater visibility and real-time situational awareness
- Vertical applications that provide a clear business case and a pressing opportunity
- Emerging technologies to address IoT challenges

REFERENCES:

1. Adrian McEwan and Hakim Cassimally, “Designing the internet of things”, Wiley, 2013
2. Code Halos: How the Digital Lives of People, Things, and Organizations are Changing the Rules of Business, by Malcolm Frank, Paul Roehrig and Ben Pring, published by John Wiley & Sons.
3. Internet of Things: A Hands-On Approach by Vijay Madisetti, Arshdeep Bahga, VPT; 1st edition 2014.
4. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle, “From Machine-to-Machine to the Internet of Things -Introduction to a New Age of Intelligence” Elsevier
5. Meta Products -Building the Internet of Things by Wimer Hazenberg, Menno Huisman, BIS Publishers 2014.

22254E52BP FLUID POWER AUTOMATION 4 0 0 4

AIM:

To impart knowledge in the area of hydraulics, pneumatic and fluid power components and its functions.

OBJECTIVE:

• To make the students to learn the basic concepts of hydraulics and pneumatics and their controlling elements in the area of manufacturing process.

• To train the students in designing the hydraulics and pneumatic circuits using ladder diagram.

UNIT I INTRODUCTION 5

Need for Automation, Hydraulic & Pneumatic Comparison – ISO symbols for fluid power elements, Hydraulic, pneumatics – Selection criteria.

UNIT II FLUID POWER GENERATING/UTILIZING ELEMENTS 8

Hydraulic pumps and motor gears, vane, piston pumps-motors-selection and specification-Drive characteristics – Linear actuator – Types, mounting details, cushioning – power packs – construction. Reservoir capacity, heat dissipation, accumulators – standard circuit symbols, circuit (flow) analysis.

UNIT III CONTROL AND REGULATION ELEMENTS 8

Direction flow and pressure control valves-Methods of actuation, types, sizing of ports pressure and temperature compensation, overlapped and under lapped spool valves operating characteristics-electro hydraulic servo valves-Different types-characteristics and performance.

UNIT IV CIRCUIT DESIGN 10

Typical industrial hydraulic circuits-Design methodology – Ladder diagram-cascade, method-truth table-Karnaugh map method-sequencing circuits-combinational and logic circuit.

UNIT V ELECTRO PNEUMATICS & ELECTRONIC CONTROL OF HYDRAULIC AND PNEUMATIC CIRCUITS 7

Electrical control of pneumatic and hydraulic circuits-use of relays, timers, counters, Ladder diagram. Programmable logic control of Hydraulics Pneumatics circuits, PLC ladder diagram for various circuits, motion controllers, use of field busses in circuits. Electronic drive circuits for various Motors.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCE:

1. Antony Esposito, Fluid Power Systems and control Prentice-Hall, 1988.
2. Peter Rohner, Fluid Power logic circuit design. The Macmillan Press Ltd.,London, 1979
3. E.C.Fitch and J.B.Suryaatmadyn. Introduction to fluid logic, McGraw Hill, 1978.
4. W.Bolton, Mechatronics, Electronic control systems in Mechanical and Electrical Engineering Pearson Education, 2003.
5. Peter Rohner, Fluid Power Logic Circuit Design, Mcmelan Prem, 1994.

List of Electives - Elective VI

22254E53AP ADVANCED MATERIAL TECHNOLOGY 4 0 0 4

AIM:

To impart knowledge on advance concepts of material technology

OBJECTIVE:

- To enlight the PG students on elastic, plastic and fractured behaviour of engineering Materials.
- To train the PG students in selection of metallic and non-metallic materials for the various engineering applications.

UNIT I ELASTIC AND PLASTIC BEHAVIOR 10

Elasticity in metals and polymers Anelastic and visco-elastic behaviour – Mechanism of plastic deformation and non metallic shear strength of perfect and real crystals – Strengthening mechanisms, work hardening, solid solutioning, grain boundary strengthening, poly phase mixture, precipitation, particle, fibre and dispersion strengthening. Effect of temperature, strain and strain rate on plastic behaviour – Super plasticity – Deformation of non crystalline materials.

UNIT II FRACTURE BEHAVIOUR 10

Griffith's theory, stress intensity factor and fracture toughness – Toughening mechanisms – Ductile, brittle transition in steel – High temperature fracture, creep – Larson Miller parameter – Deformation and fracture mechanism maps – Fatigue, low and high cycle fatigue test, crack initiation and propagation mechanisms and Paris law. Effect of surface and metallurgical parameters on fatigue – Fracture of non metallic materials – Failure analysis, sources of failure, procedure of failure analysis.

UNIT III SELECTION OF MATERIALS 10

Motivation for selection, cost basis and service requirements – Selection for mechanical properties, strength, toughness, fatigue and creep – Selection for surface durability corrosion and wear resistance – Relationship between materials selection and processing – Case studies in materials selection with relevance to aero, auto, marine, machinery and nuclear applications – Computer aided materials selection.

UNIT IV MODERN METALLIC MATERIALS 8

Dual phase steels, High strength low alloy (HSLA) steel, Transformation induced plasticity (TRIP) Steel, Maraging steel, Nitrogen steel – Intermetallics, Ni and Ti aluminides – smart materials, shape memory alloys – Metallic glass and nano crystalline materials.

UNIT V NON METALLIC MATERIALS 7

Polymeric materials – Formation of polymer structure – Production techniques of fibers, foams, adhesives and coating – structure, properties and applications of engineering polymers – Advanced structural ceramics, WC, TIC, TaC, Al2O3, SiC, Si3N4 CBN and diamond – properties, processing and applications.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCE:

1. George E.Dieter, Mechanical Metallurgy, McGraw Hill, 1988.
2. Thomas H. Courtney, Mechanical Behaviour of Materials, (2nd edition), McGraw Hill, 2000.
3. Flinn, R.A., and Trojan, P.K., Engineering Materials and their Applications, (4^{th} Edition) Jaico, 1999.
4. ASM Hand book, Vol.11, Failure Analysis and Prevention, (10th Edition), ASM, 2002.
5. Ashby M.F., Material Selection in Mechanical Design, 3rd Edition, Butter Worth 2005.

22254E53BP INDUSTRIAL SAFETY 3 0 0 3

OBJECTIVE:
To develop and strengthen the safety ideas and motivate the students to impart basic safety skills and understandings to run an industry efficiently and effectively

UNIT I OPERATIONAL SAFETY 9

Hot metal operation, boiler, pressure vessels – heat treatment shop – gas furnace operation – electroplating – hot bending pipes – safety in welding and cutting, Cold – metal operation – safety in machine shop – cold bending and chamfering of pipesmetal cutting – shot blasting, grinding, painting – power press and other machines. Management of toxic gases and chemicals – industrial fires and prevention – road safety – highway and urban safety – safety of sewage disposal and cleaning – control of environmental pollution – managing emergencies in industries – planning security and risk assessments, on – site and off site. Control of major industrial hazards.

UNIT II SAFETY APPRAISA L AND ANALYSIS 9

Human side of safety – personal protective equipment – causes and cost of accidents. Accidents prevention program – specific hazard control strategies – HAZOP training and development of employees – first aid – fire fight devices – accident reporting, investigation. Measurement of safety performance, accident reporting and investigation – plant safety inspection, job safety analysis – safety permit procedures. Product safety – plant safety rules and procedures – safety sampling – safety inventory systems. Determining the cost effectiveness of safety measurement.

UNIT III OCCUPATIONAL HEALTH 9

Concept and spectrum of health functional units and activities of operational health service – occupational and related disease – levels of prevention of diseases – notifiable occupational diseases Toxicology Lead – Nickel, chromium and manganese toxicity – gas poisoning (such as CO, Ammonia Chlorise, So2, H2s.) their effects and prevention – effects of ultra violet radiation and infrared radiation on human system.

UNIT IV SAFETY AND HEALTH REGULATIONS 9

Safety and health standards – industrial hygiene – occupational diseases prevention welfare facilities. The object of factories act 1948 with special reference to safety provisions, model rules 123a, history of legislations related to safety – pressure vessel act – Indian boiler act – the environmental protection act – electricity act – explosive act.

UNIT V SAFETY MANAGEMENT 9

Evaluation of modern safety concepts – safety management functions – safety organization, safety department- safety committee, safety audit – performance measurements and motivation – employee participation in safety - safety and productivity.

TOTAL: 45 PERIODS

OUTCOME:
At the end of this course the students are expected to gain knowledge and skills needed to run an industry with utmost safety precautions.

REFERENCES:
1. John V Grimaldi, Safety Management. AITB publishers, 2003.
2. John.V .Grimaldi and Rollin. H Simonds, “Safety Managenent”, All India traveler book seller, New Delhi – 1989.
3. Krishnan N.V, “Safety in Industry”, Jaico Publisher House, 1996.
4. Singh, U.K and Dewan, J.M., “Sagety, Security And Risk Management”, APH publishing company, New Delhi, 1996.

22254E53CP ADDITIVE MANUFACTURING 3 0 0 3

OBJECTIVE:

 To educate students with fundamental and advanced knowledge in the field of Additive manufacturing technology and the associated Aerospace, Architecture, Art, Medical and industrial applications.

UNIT I INTRODUCTION: 8

Need - Development of AM systems – AM process chain - Impact of AM on Product Development - Virtual Prototyping- Rapid Tooling – RP to AM -Classification of AM processes-Benefits- Applications.

UNIT II REVERSE ENGINEERING AND CAD MODELING: 10

Basic concept- Digitization techniques – Model reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data requirements – Geometric modeling techniques: Wire frame, surface and solid modeling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing, Tool path generation-Software for AM- Case studies.

UNIT III LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING SYSTEMS 10

Stereolithography Apparatus (SLA): Principle, pre-build process, part-building and post-build processes, photo polymerization of SL resins, part quality and process planning, recoating issues, materials, advantages, limitations and applications.

Solid Ground Curing (SGC): working principle, process, strengths, weaknesses and applications. Fused deposition Modeling (FDM): Principle, details of processes, process variables, types, products, materials and applications. Laminated Object Manufacturing (LOM): Working Principles, details of processes, products, materials, advantages, limitations and applications - Case studies.

UNIT IV POWDER BASED ADDITIVE MANUFACTURING SYSTEMS: 10

Selective Laser Sintering (SLS): Principle, process, Indirect and direct SLS- powder structures, materials, post processing, surface deviation and accuracy, Applications. Laser Engineered Net Shaping (LENS): Processes, materials, products, advantages, limitations and applications– Case Studies.

UNIT V OTHER ADDITIVE MANUFACTURING SYSTEMS: 7

Three dimensional Printing (3DP): Principle, basic process, Physics of 3DP, types of printing, process capabilities, material system. Solid based, Liquid based and powder based 3DP systems, strength and weakness, Applications and case studies. Shape Deposition Manufacturing (SDM), Ballastic Particle Manufacturing (BPM), Selective Laser Melting, Electron Beam Melting.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course the students are expected to learn about a variety of Additive Manufacturing (AM) technologies, their potential to support design and manufacturing, case studies relevant to mass customized manufacturing, and some of the important research challenges associated with AM and its data processing tools

REFERENCES:

1. Chua, C.K., Leong K.F. and Lim C.S., "Rapid prototyping: Principles and applications", second edition, World Scientific Publishers, 2010.
2. Gebhardt, A., "Rapid prototyping", Hanser Gardener Publications, 2003.
3. Gibson, I., Rosen, D.W. and Stucker, B., "Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010.
4. Hilton, P.D. and Jacobs, P.F., Rapid Tooling: Technologies and Industrial Applications, CRC press, 2005.
5. Kamrani, A.K. and Nasr, E.A., "Rapid Prototyping: Theory and practice", Springer, 2006.
6. Liou, L.W. and Liou, F.W., "Rapid Prototyping and Engineering applications : A tool box for prototype development", CRC Press, 2011.

PRIST Deemed to be University
Vallam, Thanjavur.

DEPARTMENT OF
MECHANICAL ENGINEERING

PROGRAM HANDBOOK

B.Tech
MECHANICAL ENGINEERING
Part time
[Regulation 2022]

Semester – I

Sl. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22148S11P	Transforms & Partial Differential Equations	3	1	0	4
2	22154C12P	Electrical drives and controls	3	0	0	3
3	22154C13P	Engineering Thermodynamics	3	1	0	4
4	22154C14P	Fluid Mechanics and Machinery	3	1	0	4
5	22154C15P	Manufacturing Technology - I	4	0	0	4
					Total No of Credits	19

Semester – II

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22148S21P	Numerical Methods	3	1	0	4
2	22154C22P	Manufacturing Technology - II	3	0	0	3
3	22154C23P	Thermal Engineering	3	1	0	4
4	22154C24P	Strength of Materials	3	1	0	4
5	22154C25P	Engineering Materials and Metallurgy	4	0	0	4
					Total No of Credits	19

Semester – III

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22148S31CP	Probability and Statistics	3	1	0	4
2	22154C32P	Kinematics of Machinery	3	1	0	4
3	22154C33P	Computer Aided Design and Manufacturing	4	0	0	4
4	22154C34P	Engineering Metrology and Measurements	4	0	0	4
5	22154L35P	Computer Aided Simulation and Analysis Laboratory	0	0	3	2
					Total No of Credits	18

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

Semester –IV

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22154C41P	Professional Ethics	4	0	0	4
2	22154C42P	Dynamics of Machinery	3	1	0	4
3	22154C43P	Design of Machine Elements	3	1	0	4
4	22154E44-P	Elective -I	4	0	0	4
5	22154L45P	Dynamics Laboratory	0	0	3	2
					Total No of Credits	18

Semester – V

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22154C51P	Heat and Mass Transfer	3	1	0	4
2	22154C52P	Design of Transmission Systems	3	1	0	4
3	22154C53P	Safety in Process Industries	4	0	0	4
4	22154E54-P	Elective-II	4	0	0	4
5	22154L55P	Heat Transfer Laboratory	0	0	3	2
					Total No of Credits	18

Semester –VI

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22154C61P	Finite Elements Analysis	3	1	0	4
2	22154C62P	Mechatronics	4	0	0	4
3	22154C63P	Maintenance Engineering	4	0	0	4
4	22154E64-P	Elective-III	4	0	0	4
5	22154L65P	Mechatronics Laboratory	0	0	3	2
					Total No of Credits	18

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

Semester –VII

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22160S71P	Total Quality Management	3	0	0	3
2	22154C72P	Process Planning and Cost Estimation	3	1	0	4
3	22154C73P	Advanced I.C. Engines	3	0	0	4
4	22154E74-P	Elective-IV	3	0	0	3
5	22154P75P	Project Work	0	0	12	6
					Total No of Credits	19

Total No of Credits from Semester I to VII – 130

LIST OF ELECTIVES

Elective I

Semester – IV

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22154E44AP	Gas Dynamics and Jet Propulsion	4	0	0	4
2	22154E44BP	Welding Technology	4	0	0	4
3	22154E44CP	Fundamentals of Nanoscience	4	0	0	4
4	22154E44DP	Renewable Sources of Energy	4	0	0	4

Elective II

Semester – V

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22154E54AP	Environmental Science and Engineering	4	0	0	4
2	22154E54BP	Human Rights	3	0	0	4
3	22154E54CP	Robotics	4	0	0	4
4	22154E54DP	Marketing Management	4	0	0	4

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

Elective III

Semester – VI

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22154E64AP	Principles of Management	4	0	0	4
2	22154E64BP	Energy Conservation and Management	4	0	0	4
3	22154E64CP	Engineering Economics	4	0	0	4
4	22148E64DP	Mathematics for Industrial Operations	4	0	0	4

Elective IV

Semester – VII

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22154E74AP	Additive Manufacturing	3	0	0	3
2	22154E74BP	Computational Fluid Dynamics	3	0	0	3
3	22154E74CP	Unconventional Machining Process	3	0	0	3
4	22154E74DP	Disaster Management	3	0	0	3

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22148S11P TRANSFORMS & PARTIAL DIFFERENTIAL EQUATIONS

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9 + 3

Charpits method- Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients.

UNIT II FOURIER SERIES 9 + 3

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval's identify – Harmonic Analysis.

UNIT III BOUNDARY VALUE PROBLEMS 9 + 3

Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two-dimensional heat equation (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

UNIT IV FOURIER TRANSFORM 9 + 3

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V Z -TRANSFORM AND DIFFERENCE EQUATIONS 9 + 3

Z-transform - Elementary properties – Inverse Z – transform – Convolution theorem -Formation of difference equations – Solution of difference equations using Z - transform.

TUTORIAL 15

TOTAL : 60

TEXT BOOKS

1. Grewal, B.S., "Higher Engineering Mathematics", Thirty Sixth Edition, Khanna Publishers, Delhi, 2001.
2. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Engineering Mathematics Volume III", S. Chand & Company ltd., New Delhi, 1996.

REFERENCES

1. Narayanan, S., Manicavachagom Pillay, T.K. and Ramaniah, G., "Advanced Mathematics for Engineering Students", Volumes II and III, S. Viswanathan (Printers and Publishers) Pvt. Ltd. Chennai, 2002.
2. Churchill, R.V. and Brown, J.W., "Fourier Series and Boundary Value Problems", Fourth Edition, McGraw-Hill Book Co., Singapore, 1987.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22153C12P ELECTRICAL DRIVES AND CONTROLS

UNIT-I D.C. MACHINES (9)

Principle of operation, Construction, Method of Excitation, Characteristics of d.c shunt, series ,compound generator, emf equation, application. Characteristics of d.c shunt, series, compound motor, torque equation, application, Types of d.c motor starters.

UNIT-II A.C. MACHINES (9)

Principle of operation, Construction of Induction and Synchronous machines- Characteristics and its applications. Starters for induction machines.

UNIT-III (9)

Basic elements-types of drives-factors influencing the choice of electrical drives-heating and cooling curves-loading conditions and classes of duty-selection of power rating for drive motors with regard to thermal overloading and load variation factors.

UNIT-IV CONVENTIONAL AND SOLID STATE SPEED CONTROL OF D.C. DRIVES (9)

Speed control of DC series and shunt motors – Armature and field control, Ward-Leonard control system - Using controlled rectifiers and DC choppers –applications.

UNIT-V CONVENTIONAL AND SOLID STATE SPEED CONTROL OF A.C. DRIVES (9)

Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Using inverters and AC voltage regulators – applications.

Total Hours : 45

TEXT BOOKS

1. VEDAM SUBRAHMANIAM, “Electric Drives (concepts and applications)”, Tata McGraw-Hill, 2001
2. NAGRATH.I.J. & KOTHARI.D.P, “Electrical Machines”, Tata McGraw-Hill, 1998

REFERENCES

1. PILLAI.S.K “A first course on Electric drives”, Wiley Eastern Limited, 1998
2. M.D.SINGH, K.B.KHANCHANDANI, “Power Electronics”, Tata McGraw-Hill, 1998

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22154C13P ENGINEERING THERMODYNAMICS

UNIT- I: BASIC CONCEPTS 9

Basic concepts - macroscopic approach, thermodynamic systems - closed, open and isolated. Property, state, path and process, quasi-static process, work, modes of work, Zeroth law of thermodynamics – concept of temperature and heat.. First law of thermodynamics – application to closed and open systems, internal energy, specific heat capacities, enthalpy, steady flow process with reference to various thermal equipments.

UNIT – II: SECOND LAW, ENTROPY AND AVAILABILITY 9

Second law of thermodynamics – Kelvin's and Clausius statements of second law. Reversibility and irreversibility. Carnot cycle, reversed carnot cycle, efficiency, COP. Clausius inequality, concept of entropy, entropy of ideal gas, principle of increase of entropy – Carnot theorem

UNIT – III: STEAM POWER CYCLE 9

Properties of pure substances – Thermodynamic properties of pure substances in solid, liquid and vapour phases, phase rule, P-V, P-T, T-V, T-S, H-S diagrams, PVT surfaces, thermodynamic properties of steam. Calculations of work done and heat transfer in non-flow and flow processes. Standard Rankine cycle, Reheat and regenerative cycle**.**

UNIT – IV : THERMODYNAMIC RELATIONS 9

Gas mixtures – Properties of ideal and real gases, equation of state, Vander Waal's equation of states, compressibility, compressibility chart. Exact differentials, Maxwell relations, Clausius Clapeyron equations, Joule Thomson Coefficient.

UNIT – V: PSYCHROMETRY 9

Psychrometry and psychrometric charts, property calculations of air vapour mixtures. Psychrometric process – Sensible heat exchange processes. Latent heat exchange processes. Adiabatic mixing, evaporative cooling, problems.

TUTORIALS 15

TOTAL HOURS: 60

(Use of standard thermodynamic tables, Mollier diagram, Psychometric chart and Refrigerant property tables are permitted)

TEXT BOOKS

1. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi, 1998.
2. Cengel, "Thermodynamics" An Engineering Approach, Third Edition – 2003, Tata Mc Graw Hill, New Delhi.

REFERENCES

1. Holman.J.P., "Thermodynamics", 3rd Ed. McGraw-Hill, 1995.
2. Arora C.P, " Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.
3. Sri Vastava R.C, Saha S. K, Jan A. K, " Thermodynamics" Prentice Hall of India, New Delhi, 2004.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22154C14P FLUID MECHANICS AND MACHINERY

1. BASIC CONCEPTS AND PROPERTIES 6

Fluid – definition - Properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension - Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers and pressure gauges.

2. KINEMATICS OF FLUID AND FLUID DYNAMICS 12

Fluid Kinematics - Flow visualization - lines of flow - types of flow - velocity field and acceleration - continuity equation (one and three dimensional differential forms)- stream line, streak line and path line (definitions only)-stream function and velocity potential function (definitions only)- Euler's equation along a streamline - Bernoulli's equation – applications - Venturi meter, Orifice meter, Pitot tube - dimensional analysis - Buckingham's π theorem- applications - similarity laws and models.

3. INCOMPRESSIBLE FLUID FLOW 12

Viscous flow - Navier-Stoke's equation (Statement only) - Shear stress, pressure gradient relationship - laminar flow between parallel plates - Laminar flow through circular tubes (Hagen poiseulle's) - Hydraulic and energy gradient (descriptive treatment only) - flow through pipes - Darcy -weisback's equation - pipe roughness -friction factor- Moody's diagram-minor losses - flow through pipes in series and in parallel - Boundary layer (definition only)

4. HYDRAULIC TURBINES 8

Fluid machines: definition and classification - exchange of energy - Euler's equation for turbo machines - Construction of velocity vector diagrams - head and specific work - components of energy transfer - degree of reaction.

Hydro turbines: definition and classifications - Pelton turbine - Francis turbine - propeller turbine - Kaplan turbine - working principles - velocity triangles - work done - specific speed - efficiencies -performance curve for turbines.

5. HYDRAULIC PUMPS 7

Pumps: definition and classifications - Centrifugal pump: classifications, working principle, velocity triangles, specific speed, efficiency and performance curves - Reciprocating pump: classification, working principle, indicator diagram, performance curves - cavitations in pumps - rotary pumps: working principles of gear and vane pumps

TUTORIALS 15 TOTAL : 60

TEXT BOOKS

Streeter, V.L., and Wylie, E.B., “Fluid Mechanics”, McGraw-Hill, 1983.

Kumar, K.L., “Engineering Fluid Mechanics”, Eurasia Publishing House (P) Ltd, New Delhi (7^{th} edition), 1995.

Vasandani, V.P., “Hydraulic Machines - Theory and Design”, Khanna Publishers.1992

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

REFERENCES

1. Bansal, R.K., “Fluid Mechanics and Hydraulics Machines”, (5th edition), Laxmi publications (P) Ltd, New Delhi, 1995
2. White, F.M., “Fluid Mechanics”, Tata McGraw-Hill, 5th Edition, New Delhi, 2003.
3. Ramamirtham, S., "Fluid Mechanics and Hydraulics and Fluid Machines", Dhanpat Rai and Sons, Delhi, 1998.
4. Som, S.K., and Biswas, G., “Introduction to Fluid Mechanics and Fluid Machines”, Tata McGraw-Hill, 2nd Edition, 2004.

22154C15P Manufacturing Technology - I

UNIT-I: INTRODUCTION **9**

Introduction to moulding and casting Processes – Steps involved – advantages, limitations and application of casting process. Patterns – Types _ their applications – Pattern allowances – Pattern materials – Colour coding as per BIS. Pattern making cores – Core prints –Core boxes – core making.

UNIT – II: MOULDING PROCESSES **9**

Manual moulding processes – equipments and tools – Moulding sand ingredients – Moulding sand properties, influence of ingredients on properties – sand preparation and control – sand testing – machine moulding – types of machines,

UNIT – III: CASTING PROCESSES **9**

Sand casting processes –permanent mould casting processes-pressure die casting, centrifugal casting – precision/investment casting-shell moulding,– continuous casting –– electro slag casting processes, Vacuum process, magnetic moulding process.

UNIT – IV: SPECIAL WELDING PROCESSES **9**

Gas tungsten arc (TIG) welding, Gas metal arc (MIG) welding, submerged arc welding, power sources and other characteristics for these individual processes, equipments and accessories, application and limitation of each process. Resistance welding processes-their principle-Types (spot, seam, projection).

UNIT – V: MODERN WELDING PROCESSES **9**

Electron beam welding, laser beam welding, Plasma arc welding, friction welding, explosive welding, ultrasonic welding, stud welding, diffusion bonding, welding of dissimilar metals.

TUTORIALS: 15 **TOTAL HOURS: 60**

TEXT BOOK

1. Lal,Mand Khanna O.P “A Text Book of Foundry Technology” Dhanpat Rai and Sons, New Delhi 1986.
2. Workshop Technology Volume I &II,Hajra Choudry & Bhattacharya.

REFERENCES

1. Production Technology ,R.K.Jain & S.C.Gupta
2. Radhakrishnan.V.M. “Welding Technology and Design” New age International Pub. Ltd., New Delhi 2002

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22148C21P NUMERICAL METHODS

1. SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 9

Linear interpolation methods (method of false position) - Newton's method - Statement of Fixed Point Theorem - Fixed pointer iteration x=g(x) method - Solution of linear system of Gaussian elimination and Gauss-Jordan methods - Iterative methods: Gauss Jacobi and Gauss – Seidel methods- Inverse of a matrix by Gauss-Jordan method. Eigen value of a matrix by power methods.

2. INTERPOLATION AND APPROXIMATION 9

Lagrangian Polynomials - Divided difference - Interpolation with a cubic spline - Newton forward and backward difference formulae.

3. NUMERICAL DIFFERENTIATION AND INTEGRATION 9

Derivatives from difference table - Divided difference and finite difference - Numerical integration by Trapezoidal and Simpson's 1/3 and 3/8 rules - Romberg's method - Two and three point Gaussian quadrature formulas - Double integrals using trapezoidal and Simpson's rules.

4. INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9

Single step Methods : Taylor Series and methods - Euler and Modified Euler methods - Fourth order Runge-Kutta method for solving first and second order equations - Multistep methods – Milne's and Adam's predictor and corrector methods.

5. BOUNDARY VALUE PROBLEMS 9

Finite difference solution for the second order ordinary differential equations. Finite difference solution for one dimensional heat equation by implict and explict methods - one dimensional wave equation and two dimensional Laplace and Poisson equations.

TUTORIAL: 15
TOTAL : 60

TEXT BOOKS

1. Gerald, C.F, and Wheatley, P.O, "Applied Numerical Analysis", Sixth Edition, Pearson Education Asia, New Delhi.2002.
2. Balagurusamy, E., "Numerical Methods", Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 1999.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

REFERENCES

1. Kandasamy, P.Thilakavthy, K and Gunavathy, K. “Numerical Methods”, S.Chand and Co. New Delhi.1999
2. Burden, R.L and Faries, T.D., “Numerical Analysis”, Seventh Edition, Thomson Asia Pvt. Ltd., Singapore, 2002.
3. Venkatraman M.K, “Numerical Methods” National Pub. Company, Chennai, 1991
4. Sankara Rao K., “Numerical Methods for Scientists and Engineers”, 2nd Ed. Prentice Hall India. 2004

22154C22P MANUFACTURING TECHNOLOGY – II

UNIT – I: METAL CUTTING THEORY 8

Introduction: material removal processes, types of machine tools – theory of metal cutting: chip formation, Types of metal cutting, cutting tool materials, Types of tool wear, Simple problems on Tool life.

UNIT –II: CENTRE LATHE AND SPECIAL PURPOSE LATHES 10

Centre lathe, constructional features, cutting tools, various operations, taper turning methods, thread cutting methods, special attachments, machining time and power estimation.

Capstan and turret lathes – automatic lathes : semi automatic, automats – single spindle : cutting off, multi spindle; cutting off machines.

UNIT – III: SHAPING, PLANING, SLOTTING & MILLING MACHINES 10

Reciprocating machine tools: shaper, planer, slotter ; milling : types, milling cutters, operations.

UNIT – IV: GRINDING, BROACHING AND GEAR CUTTING 10

Grinding: Introduction- Grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, surface grinding, centreless grinding – honing, lapping, super finishing, polishing and buffing.

Broaching Machines: broach Specification – push, pull, surface and continuous broaching machines, Gear cutting: forming, generation, shaping, Hobbing.

UNIT – V: CNC MACHINES AND APT PROGRAMMING 7

Numerical Control (NC) machine tools – CNC – Introduction, Types, constructional details, special features, Advantages and applications.

Part programming fundamentals – manual programming – computer assisted part programming – APT language.

TOTAL : 45

TEXT BOOKS :

1. Hajra Choudry, "Elements of Work Shop Technology – Vol. II", Media Promoters. 2002
2. P.C. Sharma, "A Text Book of Production Engineering", S. Chand and Co. Ltd, IV edition, 1993.

REFERENCES:

1. Rao, P.N. "Manufacturing Technology", Metal Cutting and Machine Tools, Tata McGraw–Hill, New Delhi, 2003.
2. Richerd R. Kibbe, John E. Neely, Roland O. Merges and Warren J. White, "Machine Tool Practices", Prentice Hall of India, 2003.
3. HMT – "Production Technology", Tata McGraw-Hill, 1998.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22154C23P THERMAL ENGINEERING

UNIT-I: GAS POWER CYCLES 9

Otto, Diesel, Dual, Brayton cycles, Calculation of mean effective pressure and air standard efficiency, Actual and theoretical PV diagram of Four stroke engines, Actual and theoretical PV diagram of two stroke engines.

UNIT – II: INTERNAL COMBUSTION ENGINES 9

Classification of IC engine, IC engine components and functions. Comparison of two stroke and four stroke engines. Fuel supply systems, Ignition Systems, Performance calculation. Comparison of petrol & diesel engine. Fuels, Knocking and Detonation. Lubrication system and cooling system. Exhaust gas analysis, pollution control nor

UNIT – III: STEAM NOZZLES AND TURBINES 9

Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ratio, supersaturated flow. Impulse and reaction principles, compounding, velocity diagrams for simple and multistage turbines,

UNIT – IV: AIR COMPRESSORS 9

Classification and working principle, work of compression with and without clearance. Volumetric efficiency, Isothermal efficiency and isentropic efficiency of reciprocating air compressors. Multistage air compressor and inter cooling – work of multistage air compressor, various types of compressors (Thoeretical treatment only).

UNIT – V: REFRIGERATION AND AIR-CONDITIONING 9

Vapour compression Refrigeration cycle – super heat, sub cooling, performance calculations. Working principle of vapour absorption system. Ammonia – water, Lithium bromide – water systems (Theory only), Comparison between vapour compression and absorption systems. Psychrometry, Psychometric chart, Cooling load calculations. Concept of RSHF, GSHF, ESHF, Air conditioning systems.

TUTORIALS : 15
TOTAL HOURS : 60

(Use of standard thermodynamic tables, Mollier diagram, Psychometric chart and Refrigerant property tables are permitted in the examination)

TEXT BOOKS

1. Rajput, "Thermal Engineering", S. Chand publishers, 2000.

REFERENCES

1. Kothandaraman.C.P., Domkundwar.S. and A.V.Domkundwar., "A course in Thermal Engineering", Dhanpat Rai & Sons, Fifth edition, 2002
2. Holman. J.P., "Thermodynamics", McGraw-Hill, 1985.
3. Rogers, Meyhew, "Engineering Thermodynamics", ELBS, 1992.
4. Arora.C.P., "Refrigeration and Air conditioning", TMH, 1994.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22154C24P STRENGTH OF MATERIALS

1. STRESS AND STRAIN 9

Bodies - Rigid and Deformable bodies- Stresses; Tensile, Compressive and Shear – Deformation of simple and compound bars under axial load – Thermal stress – Elastic constants – Strain energy and unit strain energy

2. BEAMS - SFD & BMD 9

Beams -Types: Supports and Loads – Shear force and Bending Moment Diagrams in beams – Cantilever and Simply supported– Stresses in beams – Theory of simple bending – Stress variation along the length and in the beam section – Effect of shape of beam section on stress induced.

3. TORSION IN SHAFTS 9

Analysis of torsion in shafts – Shear stress distribution – Solid, Stepped and Hollow shafts – Twist and torsion stiffness – Replacement of Shafts - Compound shafts – Fixed and simply supported shafts.

4. DEFLECTION IN SPRINGS 9

Springs- Introduction, Types- Close coiled helical springs – Maximum shear stress in spring section– Deflection of helical coil springs under axial loads – Design of helical coil springs – stresses in helical coil springs under torsion loads

5. ANALYSIS OF STRESSES IN TWO DIMENSIONS 9

Thin cylindrical and spherical shells – Deformation in thin cylindrical and spherical shells – Biaxial stresses at a point –Principal planes and stresses – Analytical Method- Graphical Method: Mohr’s circle – Only for two stresses applied mutually perpendicular to each other on a body– Maximum shear stress.

TUTORIALS 15
TOTAL: 60

TEXT BOOKS

1. Popov E.P, “Engineering Mechanics of Solids”, Prentice-Hall of India, New Delhi, 1997.
2. Kazimi S.M.A, “Solid Mechanics”, Tata McGraw-Hill Publishing Co, New Delhi, 1981

REFERENCE BOOKS

1. Nash W.A, “Theory and problems in Strength of Materials”, Schaum Outline Series, McGraw-Hill Book Co, New York, 1995
2. Ryder G.H, “Strength of Materials”, Macmillan India Ltd., Third Edition, 2002
3. Singh D.K “Mechanics of Solids” Pearson Education 2002.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22154C25P ENGINEERING MATERIALS AND METALLURGY

1. CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 10

Solid solutions, substitutional and interstitial – phase diagrams, invariant reactions, Iron – Iron carbide equilibrium diagram

2. HEAT TREATMENT 11

Definition – Full annealing, stress relief, recrystallisation and spheroidizing –normalising, hardening and Tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram CCR - Hardenability, Jominy end quench test

3. FERROUS AND NON FERROUS METALS 9

Effect of alloying additions on steel (Mn, Si, Cr, Mo, V Ti & W) - stainless and tool steels – HSLA - maraging steels –types of CI

Copper and Copper alloys – Brass, Bronze and Cupronickel – Aluminum and Al-Cu – precipitation strengthening treatment.

4. NON-METALLIC MATERIALS 9

Polymers – types of polymer– Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE Polymers — Engineering Ceramics – Properties and applications of Al_2O_3, SiC, SiC, Si_3, N_4, PSZ and Sialon – Fibre and particulate reinforced composites.

5. **MECHANICAL PROPERTIES AND TESTING 6**

Mechanism of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell) Impact test Izod and charpy, fatigue and creep test.

Total Hours : 45

TEXT BOOK:

1. Kenneth G.Budinski and Michael K.Budinski "Engineering Materials" Prentice-Hall of India Private Limited, 4th Indian Reprint 2002.

REFERENCES:

1. William D Callsber "Material Science and Engineering", John Wiley and Sons 1997.
2. Raghavan.V "Materials Science and Engineering", Prentice Hall of India Pvt., Ltd., 1999. Sydney H.Avner "Introduction to Physical Metallurgy" McGraw Hill Book Company, 1994

SKILL DEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

22148C31CP PROBABILITY AND STATISTICS

1. PROBABILITY AND RANDOM VARIABLE 9

Axioms of probability - Conditional probability - Total probability - Bayes theorem - Random variable - Probability mass function - Probability density functions - Properties- Moments - Moment generating functions and their properties.

2. TWO DIMENSIONAL RANDOM VARIABLES 9

Joint distributions - Marginal and conditional distributions – Covariance - Correlation and Regression - Transformation of random variables - Central limit theorem.

3. STANDARD DISTRIBUTIONS 9

Binomial, Poisson, Geometric, Negative Binomial, Uniform, Exponential, Gamma, Weibull and Normal distributions and their properties - Functions of a random variable.

4. TESTING OF HYPOTHESIS 9

Sampling distributions – Testing of hypothesis for mean, variance, proportions and differences using Normal, t, Chi-square and F distributions - Tests for independence of attributes and Goodness of fit.

5. DESIGN OF EXPERIMENTS 9

Analysis of variance – One way classification – CRD - Two – way classification – RBD - Latin square.

Note : Use of approved statistical table permitted in the examination.

TUTORIALS 15

TOTAL : 60

TEXT BOOKS

1. Ross. S., "A first Course in Probability", Fifth Edition, Pearson Education, Delhi 2002. (Chapters 2 to 8)
2. Johnson. R. A., "Miller & Freund's Probability and Statistics for Engineers", Sixth Edition, Pearson Education, Delhi, 2000. (Chapters 7, 8, 9, 12)

REFERENCES

1. Walpole, R. E., Myers, R. H. Myers R. S. L. and Ye. K, "Probability and Statistics for Engineers and Scientists", Seventh Edition, Pearsons Education, Delhi, 2002.
2. Lipschutz. S and Schiller. J, "Schaum's outlines - Introduction to Probability and Statistics", McGraw-Hill, New Delhi, 1998.
3.

SKILL DEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

22154C32P KINEMATICS OF MACHINERY

UNIT – I: BASICS OF MECHANISMS 7

Terminology and Definitions-Degree of Freedom Mobility-Kutzbach criterion-Grashoff's law-Kinematic Inversions of 4-bar chain and slider crank chains-Mechanical Advantage-Transmission angle-Description of reciprocating Mechanisms-Single slider crank, double slider crank mechanisms, Quick return mechanisms, Offset slider crank mechanism.

UNIT – II: KINEMATICS 12

Displacement, velocity and acceleration - analysis in simple mechanisms - Graphical Method velocity and acceleration polygons -Vector Approach, - Coriolis Acceleration.

UNIT – III: CAM PROFILE 8

Introduction-Classification cam and followers- cam nomenclature- Displacement diagrams-uniform velocity motion, uniform acceleration and retardation motion -Simple harmonic and Cycloidal motions – construction of displacement, velocity and acceleration diagrams-construction of cam profile with knife edge follower, roller follower, oscillating follower, flat faced mushroom follower

UNIT – IV: GEARS 10

Spur gear Terminology and definitions-Fundamental Law of toothed gearing-Inter changeable gears-gear tooth action – Terminology - Interference and undercutting-Non standard gear teeth-Helical, Bevel, Worm, Rack and Pinion gears (Basics only)-Gear trains-Parallel axis gear trains-Epicyclic gear trains

UNIT – V: FRICTION 8

Friction-Concepts, Types - Friction drives: Clutches - Introduction, Single & Multiplate Clutches – Friction in screw threads - Belt and rope drives.

Brakes: Types – Block Brake, Band: Simple Band & Differential, Band and Block Brakes.

TUTORIALS 15

TOTAL HOURS : 60

TEXT BOOKS

1. Rattan S.S, "Theory of Machines", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1998.
2. Ghosh A and A.K.Mallick, "Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., New Delhi, 1988.

REFERENCES:

1. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 1984.
2. Rao J.S and Dukkipati R.V, "Mechanism and Machine Theory", Wiley-Eastern Ltd., New Delhi, 1992.
3. John Hannah and Stephens R.C, "Mechanics of Machines", Viva Low-Prices Student Edition, 1999

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22154C33P COMPUTER AIDED DESIGN AND MANUFACTURING

OBJECTIVES:

• To provide an overview of how computers are being used in mechanical component design

UNIT I FUNDAMENTALS OF COMPUTER GRAPHICS 9

Product cycle- Design process- sequential and concurrent engineering- Computer aided design – CAD system architecture- Computer graphics – co-ordinate systems- 2D and 3D transformations homogeneous coordinates - Line drawing -Clipping- viewing transformation

UNIT II GEOMETRIC MODELING 9

Representation of curves- Hermite curve- Bezier curve- B-spline curves-rational curves-Techniques for surface modeling – surface patch- Coons and bicubic patches- Bezier and B-spline surfaces. Solid modeling techniques- CSG and B-rep

UNIT III VISUAL REALISM 9

Hidden – Line-Surface-Solid removal algorithms – shading – colouring – computer animation.

UNIT IV ASSEMBLY OF PARTS 9

Assembly modelling – interferences of positions and orientation – tolerance analysis-mass property calculations – mechanism simulation and interference checking.

UNIT V CAD STANDARDS 9

Standards for computer graphics- **Graphical Kernel System** (GKS) - standards for exchange images- **Open G**raphics Library **(OpenGL)** - Data exchange standards - IGES, STEP, CALSetc. - communication standards.

TOTAL : 45 PERIODS

OUTCOMES:

• Upon completion of this course, the students can able to use computer and CAD software's for modeling of mechanical components

TEXT BOOKS:

1. Ibrahim Zeid “Mastering CAD CAM” Tata McGraw-Hill Publishing Co.2007

REFERENCES:

1. Chris McMahon and Jimmie Browne “CAD/CAM Principles", "Practice and Manufacturing management “ Second Edition, Pearson Education, 1999.
2. William M Neumann and Robert F.Sproul “Principles of Computer Graphics”, McGraw Hill Book Co. Singapore, 1989.
3. Donald Hearn and M. Pauline Baker “Computer Graphics”’. Prentice Hall, Inc, 1992.
4. Foley, Wan Dam, Feiner and Hughes - "Computer graphics principles & practice" Pearson Education - 2003.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22154C34P ENGINEERING METROLOGY AND MEASUREMENTS

UNIT – I: INTRODUCTION 9

Measurement -Introduction – Generalised measurement system-Units and standards-measuring instruments- range of accuracy, precision- repeatability-systematic and random errors-correction, calibration, interchangeability.

UNIT – II: LINEAR AND ANGULAR MEASURING DEVICES 9

Definition of Metrology-Linear measuring instruments: Vernier, micrometer, interval measurement, Slip gauges and classification, limit gauges- Comparators: Mechanical, pneumatic and electrical types, applications.

Angular measurements: -Sine bar, optical bevel protractor, angle Decker – Taper measurements.

UNIT – III: SCREW THREAD & GEAR FORM MEASUREMENT 9

Measurement of screw threads-Thread gauges, floating carriage micrometer-measurement of gears-tooth thickness-constant chord and base tangent method-.

UNIT – IV: LASER METROLOGY AND CMM 9

Precision instruments based on laser-Principles- laser interferometer-application in linear, angular measurements

Coordinate measuring machine (CMM)- Constructional features – types, applications –computer aided inspection.

UNIT – V: POWER, FLOW AND TEMPERATURE MEASUREMENT 9

Force, torque, power:-mechanical and pneumatic type-Flow measurement: Venturi, orifice, rotameter,–Temperature: bimetallic strip, pressure thermometers, thermocouples,

TEXT BOOKS:

1. Jain R.K., “Engineering Metrology”, Khanna Publishers, 1994
2. Alan S. Morris, “The Essence of Measurement”, Prentice Hall of India, 1997

REFERENCES:

1. Gupta S.C, “Engineering Metrology”, Dhanpat rai Publications, 1984
2. Jayal A.K, “Instrumentation and Mechanical Measurements”, Galgotia Publications 2000
3. Alan S. Morris, “The Essence of Measurement”, Prentice Hall of India, 1997

4. Donald D Eckman, “Industrial Instrumentation”, Wiley Eastern, 1985.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22154L35P COMPUTER AIDED SIMULATION AND ANALYSIS LABORATORY

LIST OF EXPERIMENTS

A. Simulation ***15***

1. Simulation of cam and follower mechanism using C / MAT Lab.
2. Analysis (Simple Treatment only) 30
3. Stress analysis of a plate with a circular hole.
4. Stress analysis of rectangular L bracket
5. Stress analysis of an axi-symmetric component
6. Stress analysis of beams (Cantilever, Simply supported, Fixed ends)
7. Mode frequency analysis of a 2 D component
8. Mode frequency analysis of beams (Cantilever, Simply supported, Fixed ends)
9. Harmonic analysis of a 2D component
10. Thermal stress analysis of a 2D component
11. Conductive heat transfer analysis of a 2D component
12. Convective heat transfer analysis of a 2D component

TOTAL : 45

22154C41P PROFESSIONAL ETHICS

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

OBJECTIVES:

□□To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I HUMAN VALUES 10

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and imeditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

UNIT V GLOBAL ISSUES 8

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility

TOTAL: 45 PERIODS

OUTCOMES :

□□Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society

TEXTBOOKS:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.

2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.

2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009

3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003

4. Edmund G Seebauer and Robert L Barry, "Fundametals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001

5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd.,New Delhi 2013.

6. World Community Service Centre, " Value Education", Vethathiri publications, Erode, 2011

22154C42P DYNAMICS OF MACHINERY

UNIT – I: FORCE ANALYSIS IN MOVING PARTS 10

Rigid Body dynamics in general plane motion – Equations of motion - Dynamic force analysis - Inertia force and Inertia torque – D'Alemberts principle - - Dynamic Analysis in Reciprocating Engines – Gas Forces - Equivalent masses - Bearing loads - Crank shaft Torque - Turning moment diagrams - Fly wheels

UNIT – II: BALANCING OF MOVING PARTS 9

Static and dynamic balancing - Balancing of rotating masses – Balancing-single cylinder Multi-cylinder - Partial balancing in locomotive Engines - Balancing linkages - balancing machines

UNIT – III: FREE VIBRATIONS 10

Basic features of vibratory systems - idealized models - Basic elements and lumping of parameters - Degrees of freedom - Single degree of freedom - Free vibration - Equations of motion - natural frequency - Types of Damping - Damped vibration critical speeds of simple shaft - Torsional systems

UNIT – IV: FORCED VIBRATIONS 6

Response to periodic forcing - Harmonic Forcing - Forcing caused by unbalance - Support motion – Force transmissibility and amplitude transmissibility – Vibration

isolation.

UNIT – V: MECHANISMS FOR CONTROL 10

Governors - Types - Centrifugal governors - Gravity controlled and spring controlled centrifugal governors –Characteristics - Effect of friction - Controlling Force -
Gyroscopes - Gyroscopic forces and Torques - Gyroscopic stabilization - Gyroscopic effects in Automobiles, ships and airplanes

TUTORIAL 15 TOTAL HOURS : 60

TEXT BOOKS:

1. Rattan S.S., "Theory of Machines", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1994.
2. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 1984.

REFERENCES:

1 Ghosh A. and Mallick A.K., "Theory of Mechanisms and Machines", Affiliated East-West Press Pvt. Ltd., New Delhi, 1988.

2 Shigley J.E. and Uicker J.J., "Theory of Machines and Mechanisms", McGraw-Hill, Inc., 1995.

3. Rao J.S. and Dukkipati R.V., "Mechanism and Machine Theory ", Wiley-Eastern Limited, New Delhi, 1992.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

4 John Hannah and Stephens R.C., "Mechanics of Machines", Viva low-Priced Student Edition, 1999.

5 Sadhu Singh “Theory of Machines” Pearson Education, 2002

22154C43P DESIGN OF MACHINE ELEMENTS

UNIT – I : STRESSES IN MACHINE MEMBERS 9

Introduction to the design process - factor influencing machine design, selection of materials based on mechanical properties – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, Factor of safety - theories of failure – stress concentration – design for variable loading – Soderberg, Goodman and Gerber relations

UNIT – II: DESIGN OF SHAFTS AND COUPLINGS 9

Design of solid and hollow shafts based on strength, rigidity and critical speed – Design of keys and key ways - Design of rigid and flexible couplings – Introduction to gear and shock absorbing couplings

UNIT – III: DESIGN OF FASTNERS AND WELDED JOINTS 9

Threaded fastners - Design of bolted joints including eccentric loading – Design of welded joints for pressure vessels and structures -.

UNIT – IV: DESIGN OF SPRINGS AND LEVERS 9

Design of helical, leaf, disc and torsional springs under constant loads and varying loads – Concentric torsion springs - Belleville springs

UNIT – V: DESIGN OF BEARINGS AND FLYWHEELS 9

Design of bearings – sliding contact and rolling contact types. – Cubic mean load – Design of journal bearings – Mckees equation – Lubrication in journal bearings – calculation of bearing dimensions

TUTORIAL 15

TOTAL HOURS : 60

Note: (Use of P S G Design Data Book is permitted in the University examination)

TEXT BOOKS:

1. Juvinall R.C, and Marshek K.M, “Fundamentals of Machine Component Design”, John Wiley & Sons, Third Edition, 2002.

2. Bhandari V.B, “Design of Machine Elements”, Tata McGraw-Hill Book Co, 2003.

REFERENCES:

1. Norton R.L, “Design of Machinery”, Tata McGraw-Hill Book Co, 2004.
2. Orthwein W, “Machine Component Design”, Jaico Publishing Co, 2003.
3. Ugural A.C, “Mechanical Design – An Integral Approach, McGraw-Hill Book Co, 2004.
4. Spotts M.F., Shoup T.E “Design and Machine Elements” Pearson Education, 2004.

STANDARDS:

IS 10260 : Part 1 : 1982 Terms, definitions and classification of Plain bearings Part 1 : Construction.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

IS 10260 : Part 1 : 1982 Terms, definitions and classification of Plain bearings Part 2 : Friction and Wear.

IS 10260 : Part 1 : 1982 Terms, definitions and classification of Plain bearings Part 3 : Lubrication**.**

22154L45P DYNAMICS LABORATORY

LIST OF EXPERIMENTS

1. Governors - Determination of sensitivity, effort, etc. for Watt, Porter
2. Cam - Study of jump phenomenon and drawing profile of the cam.
3. Motorised Gyroscope-Verification of laws -Determination of gyroscopic couple.
4. Whirling of shaft-Determination of critical speed of shaft with concentrated loads.
5. Balancing of rotating masses.
6. Determination of moment of inertia by oscillation method for connecting rod and flywheel.
7. Vibrating system - Spring mass system-Determination of damping co-efficient of single degree of freedom system.
8. Determination of torsional frequencies for compound pendulum and flywheel system with lumped Moment of inertia.
9. Transverse vibration –free- Beam. Determination of natural frequency and deflection of beam.

Total Hours: 45

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22154C51P HEAT AND MASS TRANSFER

UNIT – I: CONDUCTION **11**

Basic Concepts – Mechanism of Heat Transfer – Conduction, Convection and Radiation – General Differential equation of Heat Conduction – Fourier Law of Conduction – Cartesian and Cylindrical Coordinates – One Dimensional Steady State Heat Conduction – Conduction through Plane Wall, Composite walls– Conduction with Internal Heat Generation –

UNIT – II: CONVECTION **10**

Basic Concepts – Convective Heat Transfer Coefficients – Boundary Layer Concept – Types of Convection – Forced Convection – Dimensional Analysis – External Flow – Flow over Plates,– Internal Flow – Laminar and Turbulent Flow – – Free Convection –Flow over Vertical Plate, Horizontal Plate, Inclined Plate

UNIT – III: HEAT EXCHANGERS **9**

Nusselts theory of condensation-pool boiling, flow boiling, correlations in boiling and condensation. Types of Heat Exchangers – LMTD Method of heat Exchanger Analysis – Effectiveness – NTU method of Heat Exchanger Analysis – Overall Heat Transfer Coefficient – Fouling Factors**.**

UNIT – IV: RADIATION **8**

Basic Concepts, Laws of Radiation – Stefan Boltzman Law, Kirchoff Law –Black Body Radiation –Grey body radiation Shape Factor Algebra – Radiation Shields .

UNIT – V: MASS TRANSFER **7**

Basic Concepts – Diffusion Mass Transfer – Fick's Law of Diffusion – Steady state Molecular Diffusion – Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy

TUTORIAL:15

TOTAL HOURS : 60

Note: (Use of standard heat and mass transfer data book is permitted in the University examination)

TEXT BOOKS:

1. Sachdeva R C, "Fundamentals of Engineering Heat and Mass Transfer" New Age International, 1995.
2. Kothandaraman C.P "Fundamentals of Heat and Mass Transfer" New Age International, New Delhi, 1998

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

REFERENCES:

3. Ozisik M.N, “Heat Transfer”, McGraw-Hill Book Co., 1994.
4. Holman J.P “Heat and Mass Transfer” Tata McGraw-Hill, 2000.
5. Frank P. Incropera and David P. DeWitt, “Fundamentals of Heat and Mass Transfer”, John Wiley and Sons, 1998.

22154C52P DESIGN OF TRANSMISSION SYSTEMS

UNIT – I: DESIGN OF TRANSMISSION SYSTEMS 9

Selection of V belts and pulleys – selection of Flat belts and pulleys -– Selection of Transmission chains and Sprockets. Design of pulleys and sprockets.

UNIT – II: SPUR GEARS AND PARALLEL AXIS HELICAL GEARS 9

Gear Terminology-Speed ratios and number of teeth-Force analysis - Dynamic effects - Fatigue strength - Factor of safety - Gear materials – Module and Face width-power rating calculations based on strength and wear considerations -– Pressure angle in the normal and transverse plane-Equivalent number of teeth-forces and stresses.

UNIT – III: BEVEL AND CROSS HELICAL GEARS 9

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears.
Cross helical: Terminology-helix angles-Estimating the size of the pair of cross helical gears.

UNIT – IV: GEAR BOXES DESIGN 9

Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box -Constant mesh gear box. – Design of multi speed gear box.

UNIT – V: DESIGN OF CAM, CLUTCHES AND BRAKES 9

Cam Design: Types-pressure angle and under cutting base circle determination-forces and surface stresses.
Design of plate clutches –axial clutches-cone clutches-internal expanding rim clutches-

TUTORIALS 30

TOTAL HOURS: 75

Note: (Usage of P.S.G Design Data Book is permitted in the University examination)

TEXT BOOKS

1. Prabhu. T.J., “Design of Transmission Elements”, Mani Offset, Chennai, 2000,
2. Bhandari, V.B., “Design of Machine Elements”, Tata McGraw-Hill Publishing Company Ltd., 1994.

REFERENCES

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

1. Maitra G.M., Prasad L.V., “Hand book of Mechanical Design”, II Edition, Tata McGraw-Hill, 1985.
2. Shigley J.E and Mischke C. R., “Mechanical Engineering Design”, McGraw-Hill International Editions, 1989.

22154C53P SAFETY IN PROCESS INDUSTRIES

OBJECTIVES:

- ❖ To give the procedures in safe handling of chemicals.
- ❖ To give a knowledge about the safety equipment used in process industry.
- ❖ To give knowledge about fire safety and Emergency preparedness.

UNIT – I INTRODUCTION TO SAFETY 12

Accident – Causes and Cost – Prevention of accident – Laws and regulations – Indian Factories Act governing health and safety of workers.

UNIT – II SAFE HANDLING OF CHEMICALS 12

Organizational Control – Identifications, labeling, safe handling, storing and transfer of chemicals – medical examination of workers – Material safety data sheet

UNIT – III SAFETY EQUIPMENT 12

Personal protective equipment – Principle, role and types – Safe work permit system

UNIT – IV FIRE SAFETY 12

Fire – Causes of fire – Extinguishing and classification of fire – Type of extinguisher applications – Fire hydrants.

UNIT – V EMERGENCY PREPAREDNESS 12

Emergency – preparation of on site and off site emergency plan – data required Mock drill – Constitution and role of emergency organization.

TOTAL HOURS:60

REFERENCE:

1) Accident prevention manual, NSC, Chicago
2) Factories Act 1948
3) Safe handling of Chemicals in Industry by P.A Carson, C.J. Mamford (Vol.3)

22154L55P HEAT TRANSFER LABORATORY

LIST OF EXPERIMENTS

HEAT TRANSFER **30**

1. Thermal conductivity measurement by guarded plate method
2. Thermal conductivity of pipe insulation using lagged pipe apparatus
3. Natural convection heat transfer from a vertical cylinder
4. Forced convection Inside tube
5. Heat transfer from Pin-fin (natural & forced convection modes)
6. Determination of Stefan-Boltzmann constant
7. Determination of Emissivity of a grey surface
8. Effectiveness of Parallel/counter flow heat exchanger

REFRIGERATION AND AIR CONDITIONING **15**

1. Determination of COP of a refrigeration system
2. Experiments on air-conditioning system
3. Performance test on single/two stage reciprocating air compressor.

Total Hours : 45

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22154C61P FINITE ELEMENT ANALYSIS

UNIT – I: INTRODUCTION TO FEA: 9

Historical background – Matrix approach – Application to the continuum – Discretisation – Matrix algebra – Gaussian elimination – Governing equations for continuum – Classical Techniques in FEM – Weighted residual method – Ritz method

UNIT – II: ONE DIMENSIONAL PROBLEMS 9

Finite element modeling – Coordinates and shape functions- Potential energy approach – Galarkin approach – Assembly of stiffness matrix and load vector – Finite element equations – Quadratic shape functions – Applications to plane trusses

UNIT – III: TWO DIMENSIONAL PROBLEMS 9

Introduction – Finite element modelling – Scalar valued problem – Poisson equation –Laplace equation – Triangular elements – Element stiffness matrix – Force vector – Galarkin approach - Stress calculation.

UNIT – IV: AXISYMMETRIC PROBLEMS 9

Axisymmetric formulation – Element stiffness matrix and force vector – Galarkin approach – Body forces– Stress calculations – Boundary conditions.

UNIT – V: ISOPARAMETRIC ELEMENTS 9

The four node quadrilateral – Shape functions – Element stiffness matrix and force vector – Numerical integration - Stiffness integration – Stress calculations – Four node quadrilateral for axisymmetric problems.

TUTORIAL 15
TOTAL HOURS :60

TEXT BOOKS*:*

1. Chandrupatla T.R., and Belegundu A.D., "Introduction to Finite Elements in Engineering", Pearson Education 2002, 3rd Edition.
2. Reddy J.N., "An Introduction to Finite Element Method", McGraw-Hill International Student Edition, 1985

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

REFERENCES:

1. Rao S.S., “The Finite Element Method in Engineering”, Pergammon Press, 1989
2. Logan D.L., “A First course in the Finite Element Method”, Third Edition, Thomson Learning, 2002.
3. Robert D.Cook., David.S, Malkucs Michael E Plesha, “Concepts and Applications of Finite Element Analysis” 4 Ed. Wiley, 2003.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

22154C62P MECHATRONICS

UNIT – I: INTRODUCTION 9

Introduction to Mechatronics – Measurement Systems – Control Systems – Microprocessor based Controllers.

Sensors and Transducers – Performance Terminology – Sensors for Displacement, Position and Proximity; Velocity, Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature, Light Sensors – Selection of Sensors

UNIT – II: POWER DRIVE SYSTEM 9

Pneumatic and Hydraulic Systems – Directional Control Valves – Rotary Actuators.

Mechanical Actuation Systems – Cams – Gear Trains – Ratchet and pawl – Belt and Chain Drives – Bearings.

Electrical Actuation Systems – Mechanical Switches – Solid State Switches – Solenoids – D.C Motors – A.C Motors – Stepper Motors.

UNIT – III: SYSTEM MODELS AND CONTROLLERS 9

Building blocks of Mechanical, Electrical, Fluid and Thermal Systems, Rotational – Transnational Systems, Electromechanical Systems – Hydraulic – Mechanical Systems.

Continuous and discrete process Controllers – Control Mode – Two – Step mode – Proportional Mode – Derivative Mode – Integral Mode – PID Controllers.

UNIT – IV: PROGRAMMING LOGIC CONTROLLERS(PLC) 9

Programmable Logic Controllers – Basic Structure – Input / Output Processing – Programming – Mnemonics – Timers, Internal relays and counters – Shift Registers – Master and Jump Controls – Data Handling – Analogs Input / Output .

UNIT – V: DESIGN OF MECHATRONICS SYSTEM 9

Stages in designing Mechatronics Systems – Traditional and Mechatronic Design - Possible Design Solutions

Case Studies of Mechatronics Systems, Pick and place robot – Automatic Car Park Systems

Total Hours : 45

TEXT BOOKS:

1. W. Bolton, "Mechatronics", Pearson Education, Second Edition, 1999.

REFERENCES

1. Michael B. Histand and David G. Alciatore, " Introduction to Mechatronics and Measurement Systems", McGraw-Hill International Editions, 2000.
2. Bradley D. A., Dawson D., Buru N.C. and. Loader A.J, "Mechatronics", Chapman and Hall, 1993.
3. Dan Necsulesu, "Mechatronics", Pearson Education Asia, 2002 (Indian Reprint).

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22154C63P MAINTENANCE ENGINEERING

OBJECTIVES:

- To enable the student to understand the principles, functions and practices adapted in industry for the successful management of maintenance activities.
- To explain the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements.
- To illustrate some of the simple instruments used for condition monitoring in industry.

UNIT I PRINCIPLES AND PRACTICES OF MAINTENANCE PLANNING 9

Basic Principles of maintenance planning – Objectives and principles of planned maintenance activity

– Importance and benefits of sound Maintenance systems – Reliability and machine availability – MTBF, MTTR and MWT – Factors of availability – Maintenance organization – Maintenance economics.

UNIT II MAINTENANCE POLICIES – PREVENTIVE MAINTENANCE 9

Maintenance categories – Comparative merits of each category – Preventive maintenance, maintenance schedules, repair cycle - Principles and methods of lubrication – TPM.

UNIT III CONDITION MONITORING 9

Condition Monitoring – Cost comparison with and without CM – On-load testing and offload testing – Methods and instruments for CM – Temperature sensitive tapes – Pistol thermometers – wear-debris analysis

UNIT IV REPAIR METHODS FOR BASIC MACHINE ELEMENTS 10

Repair methods for beds, slide ways, spindles, gears, lead screws and bearings – Failure analysis – Failures and their development – Logical fault location methods – Sequential fault location.

UNIT V REPAIR METHODS FOR MATERIAL HANDLING EQUIPMENT 8

Repair methods for Material handling equipment - Equipment records –Job order systems - Use of computers in maintenance.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of the programme, the students can able to implement the maintenance function and different practices in industries for the successful management of maintenance activities

- To identify the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements.

TEXT BOOKS:

1. Srivastava S.K., “Industrial Maintenance Management”, S. Chand and Co., 1981
2. Venkataraman .K “Maintancence Engineering and Management”, PHI Learning, Pvt. Ltd., 2007

REFERENCES:

1. Bhattacharya S.N., “Installation, Servicing and Maintenance”, S. Chand and Co., 1995
2. White E.N., “Maintenance Planning”, I Documentation, Gower Press, 1979.
2. Garg M.R., “Industrial Maintenance”, S. Chand & Co., 1986.
3. Higgins L.R., “Maintenance Engineering Hand book”, 5th Edition, McGraw Hill, 1988.
4. Armstrong, “Condition Monitoring”, BSIRSA, 1988.
5. Davies, “Handbook of Condition Monitoring”, Chapman & Hall, 1996.
6. “Advances in Plant Engineering and Management”, Seminar Proceedings - IIPE, 1996.

22154L65P MECHATRONICS LABORATORY

<u>LIST OF EXPERIMENTS</u>

1. Fluid power circuits to control
   (i) single and double acting cylinder
2. Design of circuits with logic sequence using Electro pneumatic trainer kits.
3. Circuits with multiple cylinder sequences in Electro pneumatic using PLC.
4. Servo controller interfacing for open loop
5. Servo controller interfacing for closed loop
6. Stepper motor interfacing with 8051 Micro controller
   (i) full step resolution (ii) half step resolution
7. Computerized data logging system with control for process variables like pressure flow and temperature.

TOTAL : 45

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22160C71P TOTAL QUALITY MANAGEMENT

UNIT – I: BASICS OF TQM **9**

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT – II: PRINCIPLES OF TQM **9**

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Performance Measures – Basic Concepts, Strategy, Performance Measure.

UNIT – III: QUALITY CONCEPTS **9**

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Concept of six sigma,

UNIT – IV: TQM TOOLS **9**

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits,   FMEA – Stages of FMEA.

UNIT – V: ISO STANDARDS **9**

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, ISO 14000 – Concept, Requirements and Benefits.

TOTAL : 45

TEXT BOOKS:

1. Dale H. Besterfiled, et al., “Total Quality Management”, Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6.
2. Basker, “ TOTAL QUALITY MANAGEMENT”, Anuradha Agencies.

REFERENCES:

1. Feigenbaum.A.V. “Total Quality Management”, McGraw Hill, 1991.

SKILL DEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

2. Oakland.J.S. "Total Quality Management", Butterworth – Hcinemann Ltd., Oxford. 1989.
3. Narayana V. and Sreenivasan, N.S. "Quality Management – Concepts and Tasks", New Age International 1996

22154C72P PROCESS PLANNING AND COST ESTIMATION

UNIT-I: WORK STUDY AND TIME STUDY 10

Method study – Definition – Objectives-Motion economy- Principles – Tools and Techniques- Applications – Work measurements- purpose – use – procedure – tools and techniques- Standard time –Time study– principles – applications.

UNIT-II: PROCESS PLANNING 10

Definition – Objective –approaches to process planning- Process planning activities – Finished part requirements- manufacturing sequences- machine selection – material selection parameters- Set of documents for process planning-process chart - production time calculation – selection of cost optimal processes.

UNIT-III: INTRODUCTION TO COST ESTIMATION 7

Objective of cost estimation- costing – cost accounting- classification of cost- Elements of cost.

UNIT-IV: COST ESTIMATION 8

Types of estimates – methods of estimates – data requirements and sources- collection of cost

UNIT-V: PRODUCTION COST ESTIMATION 10

Estimation of material cost, labour cost and over heads, allocation of overheads – Estimation for different types of jobs.

Total Hours : 45

TEXT BOOKS:

1 Sinha.B.P., "Mechanical Estimating and Costing", Tata McGraw-Hill, Publishing Co., 1995

2 Russell.R.S and Tailor, B.W, "Operations Management", PHI, 4th Edition, 2003.

REFERENCES:

1. Phillip.F Ostwalal and Jairo Munez, "Manufacturing Processes and systems", John Wiley, 9th Edition, 1998.
2. Chitale.A.V. and Gupta.R.C., "Product Design and Manufacturing", PHI, 2nd Edition, 2002.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22154C73P ADVANCED I.C. ENGINES

OBJECTIVES:

- To update the knowledge in engine exhaust emission control and alternate fuels
- To enable the students to understand the recent developments in IC Engines

UNIT I SPARK IGNITION ENGINES 9

Air-fuel ratio requirements, Design of carburetor –fuel jet size and venture size, Stages of combustion-normal and abnormal combustion, Factors affecting knock, Combustion chambers, Introduction to thermodynamic analysis of SI Engine combustion process.

UNIT II COMPRESSION IGNITION ENGINES 9

Stages of combustion-normal and abnormal combustion – Factors affecting knock, Direct and Indirect injection systems, Combustion chambers, Turbo charging, Introduction to Thermodynamic Analysis of CI Engine Combustion process.

UNIT III ENGINE EXHAUST EMISSION CONTROL 9

Formation of NO_X , HC/CO mechanism , Smoke and Particulate emissions, Green House Effect , Methods of controlling emissions , Three way catalytic converter and Particulate Trap, Emission (HC,CO, NO and NO_X ,) measuring equipments, Smoke and Particulate measurement, Indian Driving Cycles and emission norms

UNIT IV ALTERNATE FUELS 9

Alcohols , Vegetable oils and bio-diesel, Bio-gas, Natural Gas , Liquefied Petroleum Gas ,Hydrogen , Properties , Suitability, Engine Modifications, Performance , Combustion and Emission Characteristics of SI and CI Engines using these alternate fuels.

UNIT V RECENT TRENDS 9

Homogeneous Charge Compression Ignition Engine, Lean Burn Engine, Stratified Charge Engine, Surface Ignition Engine, Four Valve and Overhead cam Engines, Electronic Engine Management, Common Rail Direct Injection Diesel Engine, Gasoline Direct Injection Engine, Data Acquisition System –pressure pick up, charge amplifier PC for Combustion and Heat release analysis in Engines.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Heinz Heisler, 'Advanced Engine Technology," SAE International Publications, USA,1998
2. Ganesan V.." Internal Combustion Engines" , Third Edition, Tata McGraw-Hill ,2007

REFERENCES:

1. John B Heywood," Internal Combustion Engine Fundamentals", Tata McGraw-Hill 1988
2. Patterson D.J. and Henein N.A,"Emissions from combustion engines and their control," Ann Arbor Science publishers Inc, USA, 1978
3. Gupta H.N, "Fundamentals of Internal Combustion Engines" ,Prentice Hall of India,

2006
4. Ultrich Adler ," Automotive Electric / Electronic Systems, Published by Robert Bosh GmbH,1995

LIST OF ELECTIVES

22154E44AP GAS DYNAMICS AND JET PROPULSION

UNIT – I: FUNDAMENTALS OF COMPRESSIBLE FLOW 8

Energy and momentum equations for compressible fluid flows, various regions of flows, reference velocities, stagnation state, velocity of sound, critical states, Mach number, critical Mach number, Mach cone, Mach angle, effect of Mach number on compressibility.

UNIT – II: FLOW THROUGH VARIABLE AREA DUCTS 9

Isentropic flow through variable area ducts, T-s and h-s diagrams for nozzle and diffuser flows, area ratio as a function of Mach number, mass flow rate through nozzles and diffusers, effect of friction in flow through nozzles.

UNIT – III : Flow through Constant Area Ducts 10

Flow in constant area ducts with friction (Fanno flow) – Fanno curves and Fanno flow equation, variation of flow propertiesFlow in constant area ducts with heat transfer (Rayleigh flow), Rayleigh line and Rayleigh flow equation, variation of flow properties,

UNIT – IV: NORMAL SHOCK 8

Governing equations, variation of flow parameters like static pressure, static temperature, density, stagnation pressure and entropy across the normal shock, Prandtl - Meyer equation, flow in convergent and divergent nozzle with shock, normal shock in Fanno and Rayleigh flows,

UNIT – V: PROPULSION 10

Aircraft propulsion – types of jet engines – energy flow through jet engines, study of turbojet engine components – diffuser, compressor, combustion chamber, turbine and exhaust systems, performance of turbo jet engines – thrust, thrust power, propulsive and overall efficiencies, ram jet and pulse jet engines

TUTORIAL 15
TOTAL HOURS : 60

Note: (Use of approved gas tables is permitted in the University examination)

TEXT BOOKS

1. Yahya. S.M., "Fundamental of compressible flow", New Age International (p) Ltd., New Delhi, 1996.
2. Patrich.H. Oosthvizen, William E.Carscallen, "Compressible fluid flow", McGraw-Hill, 1997

REFERENCES:

1. Cohen. H., Rogers R.E.C and Sravanamutoo, "Gas turbine theory", Addison Wesley Ltd., 1987.
2. Ganesan. V., "Gas Turbines", Tata McGraw-Hill, New Delhi, 1999
3. Rathakrishnan.E, "Gas Dynamics", Prentice Hall of India, New Delhi, 2001

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

22154E44BP WELDING TECHNOLOGY

OBJECTIVES

- To understand the basics of welding and to know about the various types of welding processes

UNIT I GAS AND ARC WELDING PROCESSES: 9

Fundamental principles – Air Acetylene welding, Oxyacetylene welding, Carbon arc welding, Shielded metal arc welding, Submerged arc welding, TIG & MIG welding, Plasma arc welding and Electroslag welding processes - advantages, limitations and applications.

UNIT II RESISTANCE WELDING PROCESSES: 9

Spot welding, Seam welding, Projection welding, Resistance Butt welding, Flash Butt welding, Percussion welding and High frequency resistance welding processes - advantages, limitations and applications.

UNIT III SOLID STATE WELDING PROCESSES: 9

Cold welding, Diffusion bonding, Explosive welding, Ultrasonic welding, Friction welding, Forge welding, Roll welding and Hot pressure welding processes - advantages, limitations and applications.

UNIT IV OTHER WELDING PROCESSES: 9

Thermit welding, Atomic hydrogen welding, Electron beam welding, Laser Beam welding, Friction stir welding, Under Water welding, Welding automation in aerospace, nuclear and surface transport vehicles.

UNIT V DESIGN OF WELD JOINTS, WELDABILITY AND TESTING OF WELDMENTS 9

Various weld joint designs – Weldability of Aluminium, Copper, and Stainless steels. Destructive and non destructive testing of weldments.

TOTAL : 45 HOURS

OUTCOMES:

- Upon completion of this course, the students can able to compare different types of Welding process for effective Welding of Structural components.

TEXT BOOKS:

1. Parmer R.S., “Welding Engineering and Technology”, 1st edition, Khanna Publishers, New Delhi, 2008.
2. Parmer R.S., “Welding Processes and Technology”, Khanna Publishers, New Delhi, 1992.
3. Little R.L., “Welding and welding Technology”, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 34th reprint, 2008.

REFERENCES:

1. Schwartz M.M. “Metals Joining Manual”. McGraw Hill Books, 1979.
2. Tylecote R.F. “The Solid Phase Welding of Metals”. Edward Arnold Publishers Ltd. London, 1968.
3. AWS- Welding Hand Book. 8th Edition. Vol- 2. “Welding Process”
4. Nadkarni S.V. “Modern Arc Welding Technology”, 1st edition, Oxford IBH Publishers, 2005.
5. Christopher Davis. “Laser Welding- Practical Guide”. Jaico Publishing House, 1994.
6. Davis A.C., “The Science and Practice of Welding”, Cambridge University Press, Cambridge,

REFERENCES:

1. ASM Metals Handbook, ”Non-Destructive Evaluation and Quality Control”, American Society of Metals, Metals Park, Ohio, USA, 200, Volume-17.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

2. ASNT, American Society for Non Destructive Testing, Columbus, Ohio, NDT Handbook,Vol. 1, Leak Testing, Vol. 2, Liquid Penetrant Testing, Vol. 3, Infrared and Thermal Testing Vol. 4, Radiographic Testing, Vol. 5, Electromagnetic Testing, Vol. 6, Acoustic Emission Testing, Vol. 7, Ultrasonic Testing
3. Charles, J. Hellier,“ Handbook of Nondestructive evaluation”, McGraw Hill, New York 2001.
1. 4. Paul E Mix, “Introduction to Non-destructive testing: a training guide”, Wiley, 2nd Edition New Jersey, 2005

22154E44CP FUNDAMENTALS OF NANOSCIENCE

OBJECTIVES

 To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION 8

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilmsmultilayered
materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION 9

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS 12

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO_2,MgO, ZrO_2, NiO, nanoalumina, CaO, $AgTiO_2$, Ferrites, Nanoclaysfunctionalization and applications-Quantum wires, Quantum dots-preparation, properties and
applications

UNIT IV CHARACTERIZATION TECHNIQUES 9

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

UNIT V APPLICATIONS 7

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery

TOTAL : 45 PERIODS

OUTCOMES

 Will familiarize about the science of nanomaterials
 Will demonstrate the preparation of nanomaterials
 Will develop knowledge in characteristic nanomaterial

TEXT BOOKS

1. Edelstein. A.S. and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. John Dinardo. N, “Nanoscale charecterisation of surfaces & Interfaces”, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000

REFERENCES

1. Timp .G, “Nanotechnology”, AIP press/Springer, 1999.
2. Akhlesh Lakhtakia (Editor),“The Hand Book of Nano Technology, Nanometer Structure,

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22154E44DP RENEWABLE SOURCES OF ENERGY

UNIT– I: FACTORS AFFECTING ENERGY SOURCES: 9

Primary energy sources - world energy resources- energy cycle of the earth –environmental aspects of energy utilisation, CO_2 emissions and Global warming–renewable energy resources and their importance. Potential impacts of harnessing the different renewable energy resources.

UNIT – II: SOLAR ENERGY : 9

Principles of Solar energy collection -Solar radiation - measurements - instruments - data and estimation- types of collectors - characteristics and design principles of different type of collectors - performance of collectors - testing of collectors. Solar thermal applications - water heaters and air heaters - performance and applications - simple calculations - solar cooling - solar drying - solar ponds - solar tower concept - solar furnace.

UNIT – III: WIND, TIDAL AND GEO THERMAL ENERGY 9

Energy from the wind - general theory of windmills - types of windmills - design aspects of horizontal axis windmills - applications. Energy from tides and waves – working principles of tidal plants and ocean thermal energy conversion plants - power from geothermal energy - principle of working of geothermal power plants.

UNIT – IV: BIO ENERGY 9

Energy from bio mass & bio gas plants -various types - design principles of biogas plants - applications. Energy from wastes - waste burning power plants - utilization of industrial and municipal wastes - energy from the agricultural wastes.

UNIT – V: RECENT ADVANCEMENTS 9

Direct energy conversion (Description, principle of working and basic design aspects only) – Magneto hydrodynamic systems (MHD) - thermoelectric generators – thermionic generators - fuel cells - solar cells - types,

Total Hours : 45

TEXT BOOKS

1. Rai G.D, “Non conventional Energy sources” (1999) Khanna Publishers, New Delhi
2. Ashok V Desai, “Non-conventional Energy”, Wiley Eastern Ltd, New Delhi, 1990

REFERENCES

1. Sukhatme, S.P., Solar Energy, 2nd edition, TMH, 2003
2. Sulton, “Direct Energy Conversion”, McGraw-Hill, 1966.
3. Duffie and Beckmann, “Solar Energy Thermal Processes, John Wiley, 1974.

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22158E54AP ENVIRONMENTAL SCIENCE AND ENGINEERING

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 10

Definition, scope and importance – need for public awareness – forest resources: use and over-exploitation, deforestation,. Timber extraction, mining, dams-benefits and problems – mineral resources: use and effects on forests and tribal people – water resources: use and over-utilization of surface and exploitation, environmental effects of extracting and using mineral resources, case studies – food resources: world food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – energy resources: growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies – land resources: land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources.

UNIT II ECOSYSTEMS AND BIODIVERSITY 14

Concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem. Introduction to biodiversity – definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity –endangered and endemic species of India – conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

UNIT III ENVIRONMENTAL POLLUTION 8

Definition – causes, effects and control measures of: (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards — role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management

environmental ethics: issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents. environment production act – air (prevention and control of pollution) act – water (prevention and control of pollution) act – wildlife protection act – forest conservation act – issues involved in enforcement of environmental legislation – public awareness

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – hiv / aids – women and

SKILL DEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

child welfare – role of information technology in environment and human health – case studies.

TOTAL : 45

TEXT BOOKS

1. Gilbert M .Masters, “Introduction to Environmental Engineering and Science”, Pearson Education Pvt., Ltd., Second Edition, ISBN 81-297-0277-0, 2004.
2. Miller T.G. Jr., “Environmental Science”, Wadsworth Publishing Co.

REFERENCES

1. Bharucha Erach, “The Biodiversity of India”, Mapin Publishing Pvt. Ltd., Ahmedabad India.
2. Trivedi R.K., “Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards”, Vol. I and II, Enviro Media.
3. Cunningham, W.P.Cooper, T.H.Gorhani, “Environmental Encyclopedia”, Jaico Publ., House, Mumbai, 2001.
4. Wager K.D. “Environmental Management”, W.B. Saunders Co., Philadelphia, USA, 1998.
5. Townsend C., Harper J and Michael Begon, “Essentials of Ecology, Blackwell Science.
6. Trivedi R.K. and P.K. Goel, Introduction to Air Pollution, Techno-Science Publications

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22154E54BP HUMAN RIGHTS

OBJECTIVES :

 To sensitize the Engineering students to various aspects of Human Rights.

UNIT I 9

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II 9

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III 9

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV 9

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V 9

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

TOTAL : 45 PERIODS

OUTCOME :

 Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.

3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22154E54CP ROBOTICS

UNIT-I: INTRODUCTION OF ROBOT BASICS 7

Robot – Definition – Robot Anatomy – Co-ordinate Systems, Work Envelope, types and classification – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and Their Functions – Need for Robots – Different Applications

UNIT-II: ROBOT ACTUATORS AND END EFFECTORS 10

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of all these Drives

End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered Internal Grippers and External Grippers;

UNIT-III: SENSORS AND MACHINE VISION SYSTEM 10

Requirements of a sensor, Principles and Applications of the following types of sensors – Position of sensors - Piezo Electric Sensor, LVDT, Optical Encoders, Range Sensors, Proximity Sensors - nductive, Hall Effect, Capacitive, Ultrasonic Touch Sensors, Sensing and Digitizing Image Data – Signal Conversion, Image Storage, Lighting Techniques. Image Processing and Analysis – Data Reduction, Segmentation, Feature Extraction, Object Recognition.

UNIT-IV: ROBOT KINEMATICS AND ROBOT PROGRAMMING 10

Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional),
Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effecter commands, and Simple programs

UNIT – V: IMPLEMENTATION AND ROBOT ECONOMICS 8

RGV, AGV; Implementation of Robots in Industries – Various Steps; Safety Considerations for Robot Operations; Economic Analysis of Robots – Pay back Method, Rate of Return Method.

Total Hours : 45

TEXT BOOKS:

1. M.P.Groover, "Industrial Robotics – Technology, Programming and Applications", McGraw-Hill, 2001

REFERENCES

1. Fu.K.S. Gonzalz.R.C., and Lee C.S.G., "Robotics Control, Sensing, Vision and Intelligence", McGraw-Hill Book Co., 1987

2. Yoram Koren, "Robotics for Engineers", McGraw-Hill Book Co., 1992
3. Janakiraman.P.A., "Robotics and Image Processing", Tata McGraw-Hill, 1995

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22154E54DP MARKETING MANAGEMENT

OBJECTIVES:

 To enable students to deal with newer concepts of marketing concepts like strategic marketing segmentation, pricing, advertisement and strategic formulation. The course will enable a student to take up marketing as a professional career.

UNIT I MARKETING PROCESS 9

Definition, Marketing process, dynamics, needs, wants and demands, marketing concepts, environment, mix, types. Philosophies, selling versus marketing, organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy.

UNIT II BUYING BEHAVIOUR AND MARKET SEGMENTATION 9

Cultural, demographic factors, motives, types, buying decisions, segmentation factors - demographic -
Psycho graphic and geographic segmentation, process, patterns.

UNIT III PRODUCT PRICING AND MARKETING RESEARCH 9

Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process
of marketing research.

UNIT IV MARKETING PLANNING AND STRATEGY FORMULATION 9

Components of marketing plan-strategy formulations and the marketing process, implementations,
portfolio analysis, BCG, GEC grids.

UNIT V ADVERTISING, SALES PROMOTION AND DISTRIBUTION 9

Characteristics, impact, goals, types, and sales promotions - point of purchase - unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in
retailing, Modern Trends, e-Marketing.

TOTAL: 45 PERIODS

OUTCOMES :

 The learning skills of Marketing will enhance the knowledge about Marketer's Practices and create insights on Advertising, Branding, Retailing and Marketing Research.

TEXT BOOKS:

1. Philip Kolter & Keller, "Marketing Management", Prentice Hall of India, 14th edition, 2012.
2. Chandrasekar. K.S., "Marketing Management Text and Cases", 1st Edition, Tata McGraw Hill –
Vijaynicole, 2010.

REFERENCES:

1. Ramasamy and Nama kumari, "Marketing Environment: Planning, implementation and control
the Indian context", 1990.
2. Czinkota&Kotabe, "Marketing management", Thomson learning, Indian edition 2007
3. Adrain palmer, " Introduction to marketing theory and practice", Oxford university press IE 2004.
4. Donald S. Tull and Hawkins, "Marketing Reasearch", Prentice Hall of Inida-1997.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22154E64AP PRINCIPLES OF MANAGEMENT

OBJECTIVES:

 To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization .

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system andcontingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

UNIT II PLANNING 9

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques– Decision making steps and process.

UNIT III ORGANISING 9

Nature and purpose – Formal and informal organization – organization chart – organization structure– types – Line and staff authority – departmentalization – delegation of authority – centralization anddecentralization – Job Design - Human Resource Management – HR Planning, Recruitment,selection, Training and Development, Performance Management , Career planning and management.

UNIT IV DIRECTING 9

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication –communication and IT.

UNIT V CONTROLLING 9

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control andperformance – direct and preventive control – reporting.

TOTAL: 45 PERIODS

OUTCOMES:

 Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

TEXTBOOKS:

1. Stephen P. Robbins & Mary Coulter, “Management”, Prentice Hall (India)Pvt. Ltd., 10th Edition,
2009.

2. JAF Stoner, Freeman R.E and Daniel R Gilbert “Management”, 6th Edition, Pearson Education, 2004.

REFERENCES:

1. Stephen A. Robbins & David A. Decenzo & Mary Coulter, “Fundamentals of Management” 7th Edition, Pearson Education, 2011.

2. Robert Kreitner & Mamata Mohapatra, “ Management”, Biztantra, 2008.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22154E64BP ENERGY CONSERVATION AND MANAGEMENT

OBJECTIVES:

At the end of the course, the student is expected to

- understand and analyse the energy data of industries
- carryout energy accounting and balancing
- conduct energy audit and suggest methodologies for energy savings and
- utilise the available resources in optimal ways

UNIT I INTRODUCTION 8

Energy - Power – Past & Present scenario of World; National Energy consumption Data – Environmental aspects associated with energy utilization –Energy Auditing: Need, Types, Methodology and Barriers. Role of Energy Managers. Instruments for energy auditing.

UNIT II ELECTRICAL SYSTEMS 12

Components of EB billing – HT and LT supply, Transformers, Cable Sizing, Concept of Capacitors,Power Factor Improvement, Harmonics, Electric Motors - Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED Lighting andscope of Encon in Illumination.

UNIT III THERMAL SYSTEMS 12

Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency computation and encon measures. Steam: Distribution &U sage: Steam Traps, Condensate Recovery, Flash Steam Utilization, Insulators & Refractories

UNIT IV ENERGY CONSERVATION IN MAJOR UTILITIES 8

Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. sets

UNIT V ECONOMICS 5

Energy Economics – Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing –ESCO concept

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course, the students can able to analyse the energy data of industries.

- Can carryout energy accounting and balancing
- Can suggest methodologies for energy savings

TEXT BOOKS:

1. Energy Manager Training Manual (4 Volumes) available at www.energymanager training.com,
a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India, 2004.

REFERENCES:

1. Witte. L.C., P.S. Schmidt, D.R. Brown, "Industrial Energy Management and Utilisation" Hemisphere Publ, Washington, 1988.
2. Callaghn, P.W. "Design and Management for Energy Conservation", Pergamon Press, Oxford, 1981.
3. Dryden. I.G.C., "The Efficient Use of Energy" Butterworths, London, 1982
4. Turner. W.C., "Energy Management Hand book", Wiley, New York, 1982.
5. Murphy. W.R. and G. Mc KAY, "Energy Management", Butterworths, London 1987.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22154E64CP ENGINEERING ECONOMICS

OBJECTIVES:

 To enable students to understand the fundamental economic concepts applicable to engineering and to learn the techniques of incorporating inflation factor in economic decision making.

UNIT I INTRODUCTION TO ECONOMICS 8

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics – Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis - V ratio, Elementary economic Analysis – Material selection for product Design selection for a product, Process planning.

UNIT II VALUE ENGINEERING 10

Make or buy decision, Value engineering – Function, aims, Value engineering procedure. Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor - Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

UNIT III CASH FLOW 9

Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods.

UNIT IV REPLACEMENT AND MAINTENANCE ANALYSIS 9

Replacement and Maintenance analysis – Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.

UNIT V DEPRECIATION 9

Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions – procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset.

TOTAL: 45 PERIODS

OUTCOMES :

 Upon successful completion of this course, students will acquire the skills to apply the basics of economics and cost analysis to engineering and take economically sound decisions.

TEXT BOOKS:

1. Panneer Selvam, R, “Engineering Economics”, Prentice Hall of India Ltd, New Delhi, 2001.

REFERENCES:

1. Chan S.Park, “Contemporary Engineering Economics”, Prentice Hall of India, 2011.
2. Donald.G. Newman, Jerome.P.Lavelle, “Engineering Economics and analysis” Engg. Press, Texas, 2010.

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3. Degarmo, E.P., Sullivan, W.G and Canada, J.R, “Engineering Economy”, Macmillan, New York, 2011.
4. Zahid A khan: Engineering Economy, "Engineering Economy", Dorling Kindersley, 2012
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22148E64DP MATHEMATICS FOR INDUSTRIAL OPERATIONS

Unit I Introduction to Linear Programming (LP)

Introduction to applications of operations research in functional areas of management. Linear Programming – formulation, solution by graphical and simplex methods (Primal – Penalty, Two Phase), Special cases, Sensitivity Analysis.

Unit II Transportation and Assignment models

Transportation Models (Minimizing and Maximizing Cases) – Balanced and unbalanced cases – Initial Basic feasible solution by N-W Corner Rule, Least cost and Vogal's approximation methods. Check for optimality. Solution by MODI / Stepping Stone method. Cases of degeneracy. Transportation Models. Assignment Models (Minimizing and Maximizing Cases) – Balanced and Unbalanced Cases. Solution by Hungarian and Branch and Bound Algorithms. Travelling Salesman problem. Crew Assignment Models.

Unit III Integer Linear Programming and Game Theory

Solution to pure and mixed integer programming problem by Branch and Bound and cutting plane algorithms. Game Theory – Two person zero sum games – Saddle point, Dominance Rule, Convex Linear Combination (Averages), methods of matrices, graphical and L.P. Solutions.

Unit IV Dynamic Programming, Simulation and Decision Theory

Dynamic Programming (DP) – Deterministic Cases – Maximizing and Minimizing problems. DP techniques for L.P. problems, decision making under risk – decision trees – decision making under uncertainty. Application of simulation techniques for decision making.

Unit V Queuing Theory and Replacement Models

Basic elements of the Queuing Model, of the Poisson and Exponential Distributions, Queuing with combined arrivals and departures, Queues with priorities for service, P.E.R.T. & C.P.M. and replacement model: drawing networks – identifying critical path – probability of completing the project within given time – project crashing – optimum cost and optimum duration.

Total no. of hrs: 60 hrs.

TEXT BOOK

1. K. Kannan, Operation Research, Anuradha publication
2. Hamdy, A. Taha, Operation Research: An Introduction, Prentice-Hall of India; New Delhi 2007.
3. Premkumar Gupta, Hira, Operations Research, S. Chand, 2008

REFERENCES BOOKS

1. J. K Sharma, Operations Research: Theory and Applications, Macmillan India, 2007.
2. Barry Render, Ralph M. Stair. Jr. Michael E. Hanna, Quantitative Analysis for Management, 9/e PHI Pvt. Ltd New Delhi 2007.
3. N.D. Vohra, Quantitative Techniques in Management, TMH, New Delhi, 2007
4. Winston, Operations Research, Cengage, 2008.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22154E74AP ADDITIVE MANUFACTURING

OBJECTIVES:

 To know the principle methods, areas of usage, possibilities and limitations as well as environmental effects of the Additive Manufacturing technologies

 To be familiar with the characteristics of the different materials those are used in Additive Manufacturing.

UNIT I INTRODUCTION 10

Overview – History - Need-Classification -Additive Manufacturing Technology in product development-Materials for Additive Manufacturing Technology – Tooling - Applications.

UNIT II CAD & REVERSE ENGINEERING 10

Basic Concept – Digitization techniques – Model Reconstruction – Data Processing for Additive Manufacturing Technology: CAD model preparation – Part Orientation and support generation – Model Slicing –Tool path Generation – Softwares for Additive Manufacturing Technology: MIMICS, MAGICS.

UNIT III LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING SYSTEMS 10

Classification – Liquid based system – Stereolithography Apparatus (SLA)- Principle, process, advantages and applications - Solid based system –Fused Deposition Modeling - Principle, process, advantages and applications, Laminated Object Manufacturing

UNIT IV POWDER BASED ADDITIVE MANUFACTURING SYSTEMS 10

Selective Laser Sintering – Principles of SLS process - Process, advantages and applications, Three Dimensional Printing - Principle, process, advantages and applications- Laser Engineered Net Shaping (LENS), Electron Beam Melting.

UNIT V MEDICAL AND BIO-ADDITIVE MANUFACTURING 5

Customized implants and prosthesis: Design and production. Bio-Additive Manufacturing-Computer Aided Tissue Engineering (CATE) – Case studies

TOTAL : 45 PERIODS

OUTCOMES:

 Upon completion of this course, the students can able to compare different method and discuss the effects of the Additive Manufacturing technologies and analyse the characteristics of the different materials in Additive Manufacturing.

TEXT BOOKS:

1. Chua C.K., Leong K.F., and Lim C.S., “Rapid prototyping: Principles and applications”, Third Edition, World Scientific Publishers, 2010.

2. Gebhardt A., “Rapid prototyping”, Hanser Gardener Publications, 2003.

REFERENCES:

1. Liou L.W. and Liou F.W., “Rapid Prototyping and Engineering applications : A tool box for prototype development”, CRC Press, 2007.

2. Kamrani A.K. and Nasr E.A., “Rapid Prototyping: Theory and practice”, Springer, 2006.

3. Hilton P.D. and Jacobs P.F., “Rapid Tooling: Technologies and Industrial Applications”, CRC press, 2000.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22154E74BP COMPUTATIONAL FLUID DYNAMICS

OBJECTIVES:

 To introduce Governing Equations of viscous fluid flows
 To introduce numerical modeling and its role in the field of fluid flow and heat transfer
 To enable the students to understand the various discretization methods, solution procedures and turbulence modeling.
 To create confidence to solve complex problems in the field of fluid flow and heat transfer by using high speed computers.

UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 8

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations – Chemical species transport – Physical boundary conditions – Time-averaged equations for Turbulent Flow – Turbulent–Kinetic Energy Equations – Mathematical
behaviour of PDEs on CFD - Elliptic, Parabolic and Hyperbolic equations.

UNIT II FINITE DIFFERENCE AND FINITE VOLUME METHODS FOR DIFFUSION 9

Derivation of finite difference equations – Simple Methods – General Methods for first and second
order accuracy – Finite volume formulation for steady state One, Two and Three -dimensional diffusion problems –Parabolic equations – Explicit and Implicit schemes – Example problems on elliptic and parabolic equations – Use of Finite Difference and Finite Volume methods.

UNIT III FINITE VOLUME METHOD FOR CONVECTION DIFFUSION 10

Steady one-dimensional convection and diffusion – Central, upwind differencing schemes properties
of discretization schemes – Conservativeness, Boundedness, Transportiveness, Hybrid, Power-law,
QUICK Schemes.

UNIT IV FLOW FIELD ANALYSIS 9

Finite volume methods -Representation of the pressure gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and Velocity corrections – Pressure Correction equation, SIMPLE algorithm and its variants – PISO Algorithms.

UNIT V TURBULENCE MODELS AND MESH GENERATION 9

Turbulence models, mixing length model, Two equation (k-Є) models – High and low Reynolds number models – Structured Grid generation – Unstructured Grid generation – Mesh refinement –
Adaptive mesh – Software tools.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course, the students can able
 To create numerical modeling and its role in the field of fluid flow and heat transfer
 To use the various discretization methods, solution procedures and turbulence modeling to solve flow and heat transfer problems.

TEXT BOOKS:

1. Versteeg, H.K., and Malalasekera, W., "An Introduction to Computational Fluid Dynamics: The
finite volume Method", Pearson Education Ltd.Second Edition, 2007.
2. Ghoshdastidar, P.S., "Computer Simulation of flow and heat transfer", Tata McGraw Hill Publishing Company Ltd., 1998.

REFERENCES:

1. Patankar, S.V. "Numerical Heat Transfer and Fluid Flow", Hemisphere Publishing Corporation,
2004.
2. Chung, T.J. "Computational Fluid Dynamics", Cambridge University, Press, 2002.
3. Ghoshdastidar P.S., "Heat Transfer", Oxford University Press, 2005
4. Muralidhar, K., and Sundararajan, T., "Computational Fluid Flow and Heat Transfer", Narosa Publishing House, New Delhi, 1995.
5. ProdipNiyogi, Chakrabarty, S.K., Laha, M.K. "Introduction to Computational Fluid Dynamics",
Pearson Education, 2005.
6. Anil W. Date "Introduction to Computational Fluid Dynamics" Cambridge University Press, 2005.

22154E74CP UNCONVENTIONAL MACHINING PROCESSES

UNIT – I: INTRODUCTION: 5

Non traditional machining Process – Introductions-Need–types- Brief overview of all techniques.

UNIT – II: AJM, WJM & USM 10

Abrasive Jet Machining – Water Jet Machining – Ultrasonic Machining. (AJM, WJM and USM). Working Principles – equipment used – Process parameters – MRR-Variation in techniques used – Applications.

UNIT – III: EDM 8

Electric Discharge Machining (EDM)- working Principles-equipments-Process Parameters-MRR- electrode / Tool – Power Circuits-Tool Wear – Dielectric – Flushing – Wire cut EDM – Applications.

UNIT – IV: ECM & ECG 12

Chemical Machining and Electro-Chemical machining (CHM and ECM)-Etchants-maskant-techniques of applying maskants-Process Parameters – MRR-Applications.

Principles of ECM-equipments-MRR-Electrical circuit-Process Parameters-ECG and ECH Applications.

UNIT – V: LBM, PAM & EBM 10

Laser Beam machining (LBM), plasma Arc machining (PAM) and Electron Beam Machining (EBM). Principles-Equipment-Types-Beam control techniques – Applications**.**

Total Hours : 45

TEXT BOOKS:

1. Vijay.K. Jain "Advanced Machining Processes" Allied Publishers Pvt. Ltd., New Delhi (2002) ISBN 81-7764-294-4.
2. Benedict. G.F. "Nontraditional Manufacturing Processes" Marcel Dekker Inc., New York (1987).

REFERENCES:

1. Pandey P.C. and Shan H.S. "Modern Machining Processes" Tata McGraw-Hill, New Delhi (1980).
2. Mc Geough, "Advanced Methods of Machining" Chapman and Hall, London (1998).

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22154E74DP DISASTER MANAGEMENT

OBJECTIVES:

 To provide students an exposure to disasters, their significance and types.
 To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
 To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
 To enhance awareness of institutional processes in the country and
 To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

The students will be able to

 Differentiate the types of disasters, causes and their impact on environment and society

 Assess vulnerability and various methods of risk reduction measures as well as mitigation.

 Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.

TEXTBOOK:

1. Singhal J.P. “Disaster Management”, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423

2. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]

3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011

4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005

2. Government of India, National Disaster Management Policy,2009.

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SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING

PROGRAM HANDBOOK

B.Tech – FULL TIME

[Regulation 2021]

COURSE STRUCTURE

I - VIII SEMESTER CURRICULUM AND SYLLABI
B.TECH (FT) MECHANICAL [Regulation 2021]

SEMESTER I

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	21147IP	INDUCTION PROGRAM	2-WEEKS			
2.	21147S11	Professional English - I	3	0	0	3
3.	21148S12	Matrices and Calculus	3	1	0	4
4.	21149S13	Engineering Physics	3	0	0	3
5.	21149S14	Engineering Chemistry	3	0	0	3
6.	21150S15	Problem Solving and Python Programming	3	0	0	3
PRACTICAL						
7.	21150L16	Problem Solving and Python Programming Laboratory	0	0	4	2
8.	21149L17	Physics and Chemistry Laboratory	0	0	4	2
9	21147L18	Communication Laboratory- I	0	0	2	1
TOTAL			**15**	**1**	**10**	**21**

*SKILL DEVELOPMENT **EMPLOYABILITY *** ENTREPRENEURSHIP

SEMESTER II

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	21147S21	Professional English - II	3	0	0	3
2.	21148S22	Statistics and Numerical Methods	3	1	0	4
3	21149S23D	Materials Science	3	0	0	3
4.	21154S24	Engineering Graphics	2	0	4	4
5.	21153S25A	Basic Electrical and Electronics Engineering	3	0	0	3
PRACTICAL						
6.	21154L21	Engineering Practices Laboratory	0	0	4	2
7.	21153L22C	Basic Electrical and Electronics Engineering Laboratory	0	0	4	2
8.	21147L23	Communication Laboratory - II	0	0	4	2
TOTAL			**14**	**1**	**16**	**23**

*SKILL DEVELOPMENT

SEMESTER III

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	21148S31D	Transforms and Partial Differential Equations	3	1	0	4
2.	21154C32	Engineering Mechanics	3	0	0	3
3.	21154C33	Engineering Thermodynamics	3	0	0	3
4.	21154C34	Fluid Mechanics and Machinery	2	1	0	3
5.	21154C35	Engineering Materials and Metallurgy	3	0	0	3

6	21154C36	Manufacturing Processes	3	0	0	3
PRACTICAL						
7.	21154L37	Computer Aided Machine Drawing	0	0	4	2
8.	21154L38	Manufacturing Technology Laboratory	0	0	4	2
9.	21154L39	Professional Development **(only internal marks)**	0	0	2	1
TOTAL			**17**	**2**	**10**	**24**

*SKILL DEVELOPMENT **EMPLOYABILITY *** ENTREPRENEURSHIP

SEMESTER IV

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	21154C41	Theory of Machines	3	0	0	3
2.	21154C42	Thermal Engineering	3	1	0	4
3.	21154C43	Hydraulics and Pneumatics	3	0	0	3
4.	21154C44	Manufacturing Technology	3	0	0	3
5.	21154C45	Strength of Materials	3	0	0	3
6.	21149S46	Environmental Sciences and Sustainability	3	0	0	3
PRACTICAL						
7.	21154L47	Strength of Materials and Fluid Machinery Laboratory	0	0	4	2
8.	21154L48	Thermal Engineering Laboratory	0	0	4	2
TOTAL			**18**	**1**	**8**	**23**

SEMESTER V

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	21154C51	Design of Machine Elements	3	1	0	4
2.	21154C52	Metrology and Measurements	3	0	0	3
3.	21154E53--	Elective I	3	0	0	3
4.	21154E54--	Elective II	3	0	0	3
5.	21154E55	Elective III	3	0	0	3
6	21147MC51--	Mandatory Course-I **(Internal Assessment Only)**	3	0	0	0
PRACTICAL						
6.	21154L57	Summer Internship (Company Certificate)	0	0	4	1
7.	21154L58	Metrology and Dynamics Laboratory	0	0	4	2
TOTAL			**18**	**1**	**8**	**19**

*SKILL DEVELOPMENT **EMPLOYABILITY *** ENTREPRENEURSHIP

SEMESTER VI

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	21150OE61-	Open Elective – I	3	0	0	3
2.	21154C62	Heat and Mass Transfer	3	1	0	4
3.	21154E63--	Elective IV	3	0	0	3
4.	21154E64--	Elective V	3	0	0	3
5.	21154E65--	Elective VI	3	0	0	3
6.	21154E66--	Elective VII	3	0	0	3
7.	21147MC61--	Mandatory Course-II (Internal marks only)	3	0	0	0
PRACTICAL						
8.	21154L68	CAD / CAM Laboratory	0	0	4	2
9.	21154L69	Heat Transfer Laboratory	0	0	4	2
TOTAL			**21**	**1**	**8**	**23**

SEMESTER VII

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	21147S71	Human Values and Ethics	3	0	0	3
2.	21150OE72	Open Elective – II	3	0	0	3
3.	21150OE73	Open Elective – III	3	0	0	3
4.	21150OE74	Open Elective – IV	3	0	0	3
5.	21154C75	Mechatronics and IoT	3	0	0	3
6.	21154C76	Computer Integrated Manufacturing	3	0	0	3
7.	21154C77	Industrial Management	3	0	0	3
PRACTICAL						
8.	21154L79	Mechatronics and IoT Laboratory	0	0	4	2
9.	21154L80	Summer Internship (Company Certificate)	0	0	0	1
TOTAL			**21**	**0**	**4**	24

SEMESTER VIII

S.No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	21154PW	Project Work / Internship	0	0	20	10
TOTAL			**0**	**0**	**20**	**10**

TOTAL NO. OF CREDITS: 167

Mandatory courses I

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	21147MC51A	Introduction to Women and Gender Studies	3	0	0	0
2.	21147MC51B	Disaster Management	3	0	0	0

Mandatory courses II

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	21147MC61A	Well Being with traditional practices (Yoga, Ayurveda and Siddha)	3	0	0	0
2.	21147MC61B	Safety in Engineering Industry	3	0	0	0

.ELECTIVE – I (V SEMESTER)

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	21154E53A	CAD/CAM	3	0	0	3
2.	21154E53B	Value Engineering	3	0	0	3
3.	21154E53C	Product Life Cycle Management	3	0	0	3

ELECTIVE – II (V SEMESTER)

	COURSE CODE	COURSE TITLE	L	T	P	C
1.	21154E54A	Robotics	3	0	0	3
2.	21154E54B	Smart Mobility and Intelligent Vehicles	3	0	0	3
3.	21154E54C	Electrical Drives and Actuators	3	0	0	3

ELECTIVE – III (V SEMESTER)

SI. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	21154E55A	Automobile Engineering	3	0	0	3
2.	21154E55B	Design Concepts in Engineering	3	0	0	3
3.	21154E55C	Dynamics of Ground Vehicles	3	0	0	3

ELECTIVE – IV (VI SEMESTER)

SI. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	21154E63A	Design of Transmission System	3	0	0	3
2.	21154E63B	Thermal Power Engineering	3	0	0	3
3.	21154E63C	Turbo Machines	3	0	0	3

ELECTIVE – V (VI SEMESTER)

SI. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	21154E64A	Material Handling and solid processing Equipment	3	0	0	3
2.	21154E64B	Thermal and Fired Equipment design	3	0	0	3
3.	21154E64C	Design Codes and Standards	3	0	0	3

ELECTIVE – VI (VI SEMESTER)

SI. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	21154E65A	Power Plant Engineering	3	0	0	3
2.	21154E65B	Energy Conservation in Industries	3	0	0	3
3.	21154E65C	Bioenergy Conversion Technologies	3	0	0	3

ELECTIVE – VI (VII SEMESTER)

SI. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	21154E66A	Gas Dynamics and Jet Propulsion	3	0	0	3
2.	21154E66B	Operational Research	3	0	0	3
3.	21154E66C	Process Planning and Cost Estimation	3	0	0	3

OPEN ELECTIVE– I (SEMESTER VI)

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	21150OE61A	IoT Concepts and Applications	3	0	0	3
2.	21150OE61B	Augmented and Virtual Reality	3	0	0	3

OPEN ELECTIVE– II (SEMESTER VII)

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C

1.	21150OE72A	Artificial Intelligence and Machine Learning Fundamentals	3	0	0	3
2.	21150OE72B	Data Science Fundamentals	3	0	0	3

OPEN ELECTIVE– III

Sl. No	DEPT	COURSE CODE	COURSE TITLE	L	T	P	C
1.	ENGLISH	21152OE73A	English for Competitive Examinations	3	0	0	3
2.	ECE	21152OE73A	Biomedical Instrumentation	3	0	0	3
3.		21152OE73B	Space Engineering	3	0	0	3
4.	EEE	21152OE73A	Renewable Energy Technologies	3	0	0	3
5.		21152OE73B	Fundamentals of Electronic Devices and Circuits	3	0	0	3
6.	MECH **	21152OE73A	Introduction to NDT	3	0	0	3
7.		21152OE73B	Industrial Management	3	0	0	3
8.	CIVIL	21152OE73A	Remote Sensing Concepts	3	0	0	3
9.		21152OE73B	Drinking Water Supply and Treatment	3	0	0	3

** Offered for other department only

OPEN ELECTIVE– IV

Sl. No	DEPT	COURSE CODE	COURSE TITLE	L	T	P	C
1.	ECE	21152OE74A	Wearable devices	3	0	0	3
2.		21152OE74B	Medical Informatics	3	0	0	3
3.	EEE	21152OE74A	Electrical, Electronic and Magnetic materials	3	0	0	3
4.		21152OE74B	Energy Technology	3	0	0	3
5.	MECH **	21152OE74A	Industrial Safety	3	0	0	3
6.		21152OE74B	Additive Manufacturing	3	0	0	3
7.	CIVIL	21152OE74A	Basics of Integrated Water Resources Management	3	0	0	3
8.		21152OE74B	Geographical Information System	3	0	0	3

** Offered for other department only

CGPA CREDITS

Semester	Core	Elective	Open elective	Practical	INTERN SHIP	Project	Total
I	16	-	-	05	-	-	21
II	17	-	-	06	-	-	23

III	19	-	-	05	-	-	24
IV	19	-	-	04	-	-	23
V	07	09	-	02	01	-	19
VI	04	12	03	04	-	-	23
VII	12	-	09	03	-	-	24
VIII	-	-	-	-	-	10	10
TOTAL							167

TOTAL **CGPA CREDITS : 167**

21147S11 PROFESSIONAL ENGLISH – I L T P C 3 0 0 3

OBJECTIVES :

- To improve the communicative competence of learners
- To learn to use basic grammatic structures in suitable contexts
- To acquire lexical competence and use them appropriately in a sentence and understandtheir meaning in a text
- To help learners use language effectively in professional contexts
- To develop learners' ability to read and write complex texts, summaries, articles, blogs,definitions, essays and user manuals.

UNIT I INTRODUCTION TO EFFECTIVE COMMUNICATION 1

What is effective communication? (Explain using activities) Why is communication critical for excellence during study, research and work? What are the seven C's of effective communication? What are key language skills? What is effective listening? What does it involve? What is effective speaking? What does it mean to be an excellent reader? What should you be able to do? What is effective writing? How does one develop language and communication skills? What does the coursefocus on? How are communication and language skills going to be enhanced during this course? What do you as a learner need to do to enhance your English language and communication skillsto get the best out of this course?

INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 8

Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. Writing - Writing emails / letters introducing oneself. Grammar - Present Tense (simple and progressive); Question types: Why/ Yes or No/ and Tags. Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).

UNIT II NARRATION AND SUMMATION 9

Reading - Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel& technical blogs. Writing - Guided writing-- Paragraph writing Short Report on an event (field trip etc.) Grammar –Past tense (simple); Subject-Verb Agreement; and Prepositions. Vocabulary - Wordforms (prefixes& suffixes); Synonyms and Antonyms. Phrasal verbs.

UNIT III DESCRIPTION OF A PROCESS / PRODUCT 9

Reading — Reading advertisements, gadget reviews; user manuals. Writing - Writing definitions; instructions; and Product /Process description. Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses. Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words).

UNIT IV CLASSIFICATION AND RECOMMENDATIONS 9

Reading – Newspaper articles; Journal reports –and Non Verbal Communication (tables, pie chartsetc,). Writing — Note-making / Note-taking (*Study skills to be taught, not tested); Writingrecommendations; Transferring information from non verbal (chart , graph etc, to verbal mode) Grammar – Articles; Pronouns - Possessive & Relative pronouns. Vocabulary - Collocations; Fixed / Semi fixed expressions.

UNIT V EXPRESSION 9

Reading – Reading editorials; and Opinion Blogs; Writing – Essay Writing (Descriptive or narrative). Grammar – Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences. Vocabulary - Cause & Effect Expressions – Content vs Functionwords.

TOTAL : 45 PERIODS

LEARNING OUTCOMES:

At the end of the course, learners will be able

- To use appropriate words in a professional context
- To gain understanding of basic grammatical structures and use them in right context.
- To read and infer the denotative and connotative meanings of technical texts
- To read and interpret information presented in tables, charts and other graphic forms
- To write definitions, descriptions, narrations and essays on various topics

TEXT BOOKS :

1. English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English, Anna University, (2020 edition)
2. English for Science & Technology Cambridge University Press, 2021.
   Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCE BOOKS:

1. Technical Communication – Principles And Practices By Meenakshi Raman & SangeetaSharma, Oxford Univ. Press, 2016, New Delhi.
2. A Course Book On Technical English By Lakshminarayanan, Scitech Publications (India) Pvt. Ltd.
3. English For Technical Communication (With CD) By Aysha Viswamohan, Mcgraw Hill Education, ISBN : 0070264244.
4. Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House.
5. Learning to Communicate – Dr. V. Chellammal, Allied Publishing House, New Delhi,2003.

ASSESSMENT PATTERN

Two internal assessments and an end semester examination to test students' reading and writing skills along with their grammatical and lexical competence.

CO-PO & PSO MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	1	1	1	1	3	3	3	1	3	-	3	-	-	-
2	1	1	1	1	1	3	3	3	1	3	-	3	-	-	-
3	2	3	2	3	2	3	3	3	2	3	3	3	-	-	-
4	2	3	2	3	2	3	3	3	2	3	3	3	-	-	-
5	2	3	3	3	-	3	3	3	2	3	-	3	-	-	-
AVg.	**1.6**	**2.2**	**1.8**	**2.2**	**1.5**	**3**	**3**	**3**	**1.6**	**3**	**3**	**3**	**-**	**-**	**-**

- 1-low, 2-medium, 3-high, '-"- no correlation
- **Note:** The average value of this course to be used for program articulation matrix.

21147S15 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the basics of algorithmic problem solving.
- To learn to solve problems using Python conditionals and loops.
- To define Python functions and use function calls to solve problems.
- To use Python data structures - lists, tuples, dictionaries to represent complex data.
- To do input/output with files in Python.

UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING 9

Fundamentals of Computing — Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS, STRINGS 9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

UNIT V FILES, MODULES, PACKAGES 9

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).

TOTAL : 45 PERIODS

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Develop algorithmic solutions to simple computational problems.
CO2: Develop and execute simple Python programs.
CO3: Write simple Python programs using conditionals and looping for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python lists, tuples, dictionaries etc.
CO6: Read and write data from/to files in Python programs.

TEXT BOOKS:

1. Allen B. Downey, “Think Python: How to Think like a Computer Scientist”, 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, “Computational Thinking: A Beginner's Guide to Problem Solving and programming”, 1st Edition, BCS Learning & Development Limited, 2017.

REFERENCES:

1. Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, “Computational Thinking: A Primer for Programmers and Data Scientists”, 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data‘‘, Third Edition, MIT Press 2021
4. Eric Matthes, “Python Crash Course, A Hands - on Project Based Introduction to Programming”, 2nd Edition, No Starch Press, 2019.

   https://www.python.org/

6. Martin C. Brown, “Python: The Complete Reference”, 4th Edition, Mc-Graw Hill, 2018.

COs- PO’s & PSO’s MAPPING

CO’s	PO’s												PSO’s		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	3	3	2	-	-	-	-	-	2	2	3	3	-
2	3	3	3	3	2	-	-	-	-	-	2	2	3	-	-
3	3	3	3	3	2	-	-	-	-	-	2	-	3	-	-
4	2	2	-	2	2	-	-	-	-	-	1	-	3	-	-
5	1	2	-	-	1	-	-	-	-	-	1	-	2	-	-
AVg.	2	2	-	-	2	-	-	-	-	-	1	-	2	-	-

1 - low, 2 - medium, 3 - high, ‘-' - no correlation

21150L16 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY

L T P C
0 0 4 2

COURSE OBJECTIVES:

- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To practice various computing strategies for Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

EXPERIMENTS:

Note: The examples suggested in each experiment are only indicative. The lab instructor is expected to design other problems on similar lines. The Examination shall not be restricted to the sample experiments listed here.

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list &tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)
11. Exploring Pygame tool.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: Develop algorithmic solutions to simple computational problems

CO2: Develop and execute simple Python programs.

CO3: Implement programs in Python using conditionals and loops for solving problems.

CO4: Deploy functions to decompose a Python program.

CO5: Process compound data using Python data structures.

CO6: Utilize Python packages in developing software applications.

TEXT BOOKS:

1. Allen B. Downey, "Think Python : How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

REFERENCES:

1. Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, “Computational Thinking: A Primer for Programmers andData Scientists”, 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data‘‘, Third Edition, MIT Press, 2021
4. Eric Matthes, “Python Crash Course, A Hands - on Project Based Introduction to Programming”, 2nd Edition, No Starch Press, 2019.
5. https://www.python.org/
6. Martin C. Brown, “Python: The Complete Reference”, 4th Edition, Mc-Graw Hill, 2018.

COs- PO’s & PSO’s MAPPING

CO’s	PO’s												PSO’s	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	3	3	3	3	-	-	-	-	-	3	2	3	3
2	3	3	3	3	3	-	-	-	-	-	3	2	3	-
3	3	3	3	3	2	-	-	-	-	-	2	-	3	-
4	3	2	-	2	2	-	-	-	-	-	1	-	3	-
5	1	2	-	-	1	-	-	-	-	-	1	-	2	-
6	2	-	-	-	2	-	-	-	-	-	1	-	2	-
AVg.	**2**	**3**	**3**	**3**	**2**	-	-	-	-	-	**2**	**2**	**3**	**3**

1 - low, 2 - medium, 3 - high, ‘-' - no correlation

21147L18 COMMUNICATION LABORATORY I

L T P C
0 0 2 1

OBJECTIVES :

- To improve the communicative competence of learners
- To help learners use language effectively in academic /work contexts
- To develop various listening strategies to comprehend various types of audio materials like lectures, discussions, videos etc.
- To build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
- To use language efficiently in expressing their opinions via various media.

UNIT I INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 6

Listening for general information-specific details- conversation: Introduction to classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form. Speaking - making telephone calls-Self Introduction; Introducing a friend; - politeness strategies- making polite requests, making polite offers, replying to polite requests and offers- understanding basic instructions(filling out a bank application for example).

UNIT II NARRATION AND SUMMATION 6

Listening - Listening to podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities. Speaking - Narrating personal experiences / events-Talking about current and temporary situations & permanent and regular situations* - describing experiences and feelings- engaging in small talk- describing requirements and abilities.

UNIT III DESCRIPTION OF A PROCESS / PRODUCT 6

Listening - Listen to product and process descriptions; a classroom lecture; and advertisements about products. Speaking — Picture description- describing locations in workplaces- Giving instruction to use the product- explaining uses and purposes- Presenting a product- describing shapes and sizes and weights- talking about quantities(large & small)-talking about precautions.

UNIT IV CLASSIFICATION AND RECOMMENDATIONS 6

Listening – Listening to TED Talks; Listening to lectures - and educational videos. Speaking – Small Talk; discussing and making plans-talking about tasks-talking about progress- talking about positions and directions of movement-talking about travel preparations- talking about transportation-

UNIT V EXPRESSION 6

Listening – Listening to debates/ discussions; different viewpoints on an issue; and panel discussions. Speaking –making predictions- talking about a given topic-giving opinions- understanding a website-describing processes

TOTAL : 30 PERIODS

LEARNING OUTCOMES:

At the end of the course, learners will be able

- To listen to and comprehend general as well as complex academic information
- To listen to and understand different points of view in a discussion
- To speak fluently and accurately in formal and informal communicative contexts
- To describe products and processes and explain their uses and purposes clearly and accurately
- To express their opinions effectively in both formal and informal discussions

ASSESSMENT PATTERN

- One online / app based assessment to test listening /speaking
- End Semester **ONLY** listening and speaking will be conducted online.
- Proficiency certification is given on successful completion of listening and speaking internal test and end semester exam.

CO-PO & PSO MAPPING

CO's	PO's												PSO's		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	3	3	1	3	3	3	3	3	3	3	-	-	-
2	3	3	3	3	1	3	3	3	3	3	3	3	-	-	-
3	3	3	3	3	1	3	3	3	3	3	3	3	-	-	-
4	3	3	3	3	1	3	3	3	3	3	3	3	-	-	-
5	3	3	3	3	1	3	3	3	3	3	3	3	-	-	-
AVg.	**3**	**3**	**3**	**3**	**1**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	-	-	-

1-low, 2-medium, 3-high, '-"- no correlation

Note: The average value of this course to be used for program articulation matrix.

21147S21 PROFESSIONAL ENGLISH - II

L T P C
3 0 0 3

OBJECTIVES:

- To engage learners in meaningful language activities to improve their reading and writing skills
- To learn various reading strategies and apply in comprehending documents in professional context.
- To help learners understand the purpose, audience, contexts of different types of writing
- To develop analytical thinking skills for problem solving in communicative contexts
- To demonstrate an understanding of job applications and interviews for internship andplacements

UNIT I MAKING COMPARISONS 6

Reading - Reading advertisements, user manuals, brochures; Writing – Professional emails, Email etiquette - Compare and Contrast Essay; Grammar – Mixed Tenses, Prepositional phrases

UNIT II EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING 6

Reading - Reading longer technical texts– Cause and Effect Essays, and Letters / emails of complaint, Writing - Writing responses to complaints. Grammar - Active Passive Voice transformations, Infinitive and Gerunds

UNIT III PROBLEM SOLVING 6

Reading - Case Studies, excerpts from literary texts, news reports etc. Writing – Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay. Grammar – Error correction; If conditional sentences

UNIT IV REPORTING OF EVENTS AND RESEARCH 6

Reading –Newspaper articles; Writing – Recommendations, Transcoding, Accident Report, Survey Report Grammar – Reported Speech, Modals Vocabulary – Conjunctions- use of prepositions

UNIT V THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY 6

Reading – Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; Writing – Job / Internship application – Cover letter & Resume; Grammar – Numerical adjectives, Relative Clauses.

TOTAL : 30 PERIODS

OUTCOMES:

At the end of the course, learners will be able

- To compare and contrast products and ideas in technical texts.
- To identify and report cause and effects in events, industrial processes through technical texts
- To analyse problems in order to arrive at feasible solutions and communicate them in the written format.
- To present their ideas and opinions in a planned and logical manner
- To draft effective resumes in the context of job search.

TEXT BOOKS :

1. English for Engineers & Technologists (2020 edition) Orient Blackswan Private Ltd. Department of English, Anna University.
2. English for Science & Technology Cambridge University Press 2021.
3. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCES:

1. Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press. New Delhi.
2. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, NewDelhi.
3. Learning to Communicate – Dr. V. Chellammal. Allied Publishers, New Delhi, 2003

4. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
5. Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.

ASSESSMENT PATTERN

Two internal assessments and an end semester examination to test students' reading and writing skills along with their grammatical and lexical competence.

21153S25A BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To introduce the basics of electric circuits and analysis
- To impart knowledge in the basics of working principles and application of electrical machines
- To introduce analog devices and their characteristics
- To educate on the fundamental concepts of digital electronics
- To introduce the functional elements and working of measuring instruments

UNIT I ELECTRICAL CIRCUITS 9

DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws –Independent and Dependent Sources – Simple problems- Nodal Analysis, Mesh analysiswith Independent sources only (Steady state)

Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLCcircuits (Simple problems only)

UNIT II ELECTRICAL MACHINES 9

Construction and Working principle- DC Separately and Self excited Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, Working principle and Applications of Transformer, Three phase Alternator, Synchronous motor and Three Phase Induction Motor.

UNIT III ANALOG ELECTRONICS 9

Resistor, Inductor and Capacitor in Electronic Circuits- Semiconductor Materials: Silicon &Germanium – PN Junction Diodes, Zener Diode –Characteristics Applications – Bipolar Junction Transistor-Biasing, JFET, SCR, MOSFET, IGBT — Types, I-V Characteristics and Applications, Rectifier and Inverters

UNIT IV DIGITAL ELECTRONICS 9

Review of number systems, binary codes, error detection and correction codes, Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps (Simple Problems only)

UNIT V MEASUREMENTS AND INSTRUMENTATION 9

Functional elements of an instrument, Standards and calibration, Operating Principle, types -Moving Coil and Moving Iron meters, Measurement of three phase power, Energy Meter, Instrument Transformers-CT and PT, DSO- Block diagram- Data acquisition.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completing this course, the students will be able to

1. Compute the electric circuit parameters for simple problems
2. Explain the working principle and applications of electrical machines
3. Analyze the characteristics of analog electronic devices
4. Explain the basic concepts of digital electronics
5. Explain the operating principles of measuring instruments

TEXT BOOKS:

1. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition, McGraw Hill Education, 2020
2. S.K. Bhattacharya "Basic Electrical and Electronics Engineering", Pearson Education, Second Edition, 2017.
3. Sedha R.S., "A text book book of Applied Electronics", S. Chand & Co., 2008
4. James A. Svoboda, Richard C. Dorf, "Dorf's Introduction to Electric Circuits", Wiley, 2018.
5. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015.

REFERENCES:
1. Kothari DP and I.J Nagrath, “Basic Electrical Engineering”, Fourth Edition, McGraw Hill Education, 2019.
2. Thomas L. Floyd, ‘Digital Fundamentals’, 11th Edition, Pearson Education, 2017.
3. Albert Malvino, David Bates, ‘Electronic Principles, McGraw Hill Education; 7th edition, 2017.
4. Mahmood Nahvi and Joseph A. Edminister, “Electric Circuits”, Schaum’ Outline Series, McGraw Hill, 2002.
5. H.S. Kalsi, ‘Electronic Instrumentation’, Tata McGraw-Hill, New Delhi, 2010

Mapping of COs with POs and PSOs

COs/POs&PSOs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	1					1				2			1
CO2	2	2	1					1				2			1
CO3	2	1	1					1				2			1
CO4	2	2	1					1				2			1
CO5	2	2	1					1				2			1
CO/PO & PSO Average	2	1.8	1					1				2			1
1 – Slight, 2 – Moderate, 3 – Substantial															

21154S24	ENGINEERING GRAPHICS	L T P C 2 0 4 4

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Drawing engineering curves.
2. Drawing freehand sketch of simple objects.
3. Drawing orthographic projection of solids and section of solids.
4. Drawing development of solids
5. Drawing isometric and perspective projections of simple solids.

CONCEPTS AND CONVENTIONS (Not for Examination)

Importance of graphics in engineering applications - Use of drafting instruments - BIS conventions and specifications — Size, layout and folding of drawing sheets — Lettering and dimensioning.

UNIT I PLANE CURVES 6+12

Basic Geometrical constructions, Curves used in engineering practices: Conics — Construction of ellipse, parabola and hyperbola by eccentricity method — Construction of cycloid — construction of involutes of square and circle — Drawing of tangents and normal to the above curves.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS AND FREEHAND SKETCHING 6+12

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method. Visualization concepts and Free Hand sketching: Visualization principles —Representation of Three Dimensional objects — Layout of views- Freehand sketching of multiple views from pictorial views of objects.

Practicing three dimensional modeling of simple objects by CAD Software (Not for examination)

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF **SURFACES** **6 +12**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other — obtaining true shape of section. Development oflateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders and cones.

Practicing three dimensional modeling of simple objects by CAD Software (Not for examination)

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+12

Principles of isometric projection — isometric scale - Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method. Practicing three dimensional modeling of isometric projection of simple objects by CAD Software (Not for examination)

TOTAL: (L=30; P=60) 90 PERIODS

OUTCOMES:

On successful completion of this course, the student will be able to

- Use BIS conventions and specifications for engineering drawing.
- Construct the conic curves, involutes and cycloid.
- Solve practical problems involving projection of lines.
- Draw the orthographic, isometric and perspective projections of simple solids.
- Draw the development of simple solids.

TEXTBOOK:

1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 53rd Edition, 2019.
2. Natrajan K.V., “A Text Book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2018.
3. Parthasarathy, N. S. and Vela Murali, “Engineering Drawing”, Oxford University Press, 2015

REFERENCES:

1. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, McGraw Hill, 2nd Edition, 2019.
2. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Publications, Bangalore, 27th Edition, 2017.
3. Luzzader, Warren.J. and Duff, John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
4. Parthasarathy N. S. and Vela Murali, “Engineering Graphics”, Oxford University, Press, New Delhi, 2015.
5. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson Education India, 2nd Edition, 2009.
6. Venugopal K. and Prabhu Raja V., “Engineering Graphics", New Age International (P) Limited, 2008.

Publication of Bureau of Indian Standards:

1. IS 10711 — 2001: Technical products Documentation — Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) — 2001: Technical products Documentation — Lettering.
3. IS 10714 (Part 20) — 2001 & SP 46 — 2003: Lines for technical drawings.
4. IS 11669 — 1986 & SP 46 —2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) — 2001: Technical drawings — Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	1	2		2					3		2	2	2	
2	3	1	2		2					3		2	2	2	
3	3	1	2		2					3		2	2	2	
4	3	1	2		2					3		2	2	2	
5	3	1	2		2					3		2	2	2	
Avg.	3	1	2		2					3		2	2	2	
Low (1) ; Medium (2) ; High (3)															

21154L21 ENGINEERING PRACTICES LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

The main learning objective of this course is to provide hands on training to the students in:

1. Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in commonhousehold wood work.
2. Wiring various electrical joints in common household electrical wire work.
3. Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
4. Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & ELECTRICAL)

PART I CIVIL ENGINEERING PRACTICES 15

PLUMBING WORK:

a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
b) Preparing plumbing line sketches.
c) Laying pipe connection to the suction side of a pump
d) Laying pipe connection to the delivery side of a pump.
e) Connecting pipes of different materials: Metal, plastic and flexible pipes used inhousehold appliances.

WOOD WORK:

a) Sawing,
b) Planing and
c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

Wood Work Study:

a) Studying joints in door panels and wooden furniture
b) Studying common industrial trusses using models.

PART II ELECTRICAL ENGINEERING PRACTICES 15

a) Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket
b) Staircase wiring
c) Fluorescent Lamp wiring with introduction to CFL and LED types.
d) Energy meter wiring and related calculations/ calibration
e) Study of Iron Box wiring and assembly
f) Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadrac)
g) Study of emergency lamp wiring/Water heater

GROUP – B (MECHANICAL AND ELECTRONICS)

PART III **MECHANICAL ENGINEERING PRACTICES** **15**

WELDING WORK:

a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
b) Practicing gas welding.

BASIC MACHINING WORK:

a) (simple)Turning.
b) (simple)Drilling.
c) (simple)Tapping.

ASSEMBLY WORK:

a) Assembling a centrifugal pump.
b) Assembling a household mixer.
c) Assembling an airconditioner.

SHEET METAL WORK:

a) Making of a square tray

FOUNDRY WORK:

a) Demonstrating basic foundry operations.

PART IV ELECTRONIC ENGINEERING PRACTICES 15

SOLDERING WORK:

a) Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:

a) Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:

a) Study an elements of smart phone.
b) Assembly and dismantle of LED TV.
c) Assembly and dismantle of computer/ laptop

COURSE OUTCOMES: TOTAL = 60 PERIODS

Upon completion of this course, the students will be able to:

1. Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.
2. Wire various electrical joints in common household electrical wire work.
3. Weld various joints in steel plates using arc welding work; Machine various simple processeslike turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.
4. Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2			1	1	1					2	2	1	1
2	3	2			1	1	1					2	2	1	1
3	3	2			1	1	1					2	2	1	1
Avg.	3	2			1	1	1					2	2	1	1
Low (1) ; Medium (2) ; High (3)															

21153L28C BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

L T P C
0 0 4 2

COURSE OBJECTIVES:

- To train the students in conducting load tests on electrical machines
- To gain practical experience in characterizing electronic devices
- To train the students to use DSO for measurements.

LIST OF EXPERIMENTS

1. Verification of ohms and Kirchhoff's Laws.
2. Load test on DC Shunt Motor.
3. Load test on Self Excited DC Generator
4. Load test on Single phase Transformer
5. Load Test on Induction Motor
6. Characteristics of PN and Zener Diodes
7. Characteristics of BJT, SCR and MOSFET
8. Half wave and Full Wave rectifiers
9. Study of Logic Gates
10. Implementation of Binary Adder and Subtractor
11. Study of DSO

TOTAL: 60 PERIODS

COURSE OUTCOMES:

After completing this course, the students will be able to

1. Use experimental methods to verify the Ohm's and Kirchhoff's Laws.
2. Analyze experimentally the load characteristics of electrical machines
3. Analyze the characteristics of basic electronic devices
4. Use DSO to measure the various parameters

Mapping of COs with POs and PSOs															
COs/POs&PSOs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2	1	1			1.5	2						1
CO2	3	3	2	1	1			1.5	2						1
CO3	3	3	2	1	1			1.5	2						1
CO4	3	3	2	1	1			1.5	2						1
CO5	3	3	2	1	1			1.5	2						1
CO/PO & PSO Average	3	3	2	1	1			1.5	2						1
1 – Slight, 2 – Moderate, 3 – Substantial															

21147L23 COMMUNICATION LABORATORY II L T P C 0 0 4 2

OBJECTIVES

- To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
- To analyse concepts and problems and make effective presentations explaining them clearly and precisely.
- To be able to communicate effectively through formal and informal writing.
- To be able to use appropriate language structures to write emails, reports and essays
- To give instructions and recommendations that are clear and relevant to the context

UNIT I 12

Speaking-Role Play Exercises Based on Workplace Contexts, - talking about competition-discussing progress toward goals-talking about experiences- talking about events in life- discussing past events-Writing: writing emails (formal & semi-formal).

UNIT II 12

Speaking: discussing news stories-talking about frequency-talking about travel problems-discussing travel procedures- talking about travel problems- making arrangements-describing arrangements-discussing plans and decisions- discussing purposes and reasons- understanding common technology terms-Writing: - writing different types of emails.

UNIT III 12

Speaking: discussing predictions-describing the climate-discussing forecasts and scenarios- talking about purchasing-discussing advantages and disadvantages- making comparisons- discussing likes and dislikes- discussing feelings about experiences-discussing imaginary scenarios Writing: short essays and reports-formal/semi-formal letters.

UNIT IV 12

Speaking: discussing the natural environment-describing systems-describing position and movement- explaining rules-(example- discussing rental arrangements)- understanding technical instructions-Writing: writing instructions-writing a short article.

UNIT V 12

Speaking: describing things relatively-describing clothing-discussing safety issues (making recommendations) talking about electrical devices-describing controlling actions- Writing:
job application (Cover letter + Curriculum vitae)-writing recommendations.

TOTAL: 60 PERIODS

LEARNING OUTCOMES

At the end of the course, learners will be able

- Speak effectively in group discussions held in ~~a~~ formal/semi formal contexts.
- Discuss, analyse and present concepts and problems from various perspectives to arrive at suitable solutions
- Write emails, letters and effective job applications.
- Write critical reports to convey data and information with clarity and precision
- Give appropriate instructions and recommendations for safe execution of tasks

Assessment Pattern

- One online / app based assessment to test speaking and writing skills
- Proficiency certification is given on successful completion of speaking and writing.

CO-PO & PSO MAPPING

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	3	3	3	1	3	3	3	3	3	3	3	-	-	-
2	2	3	3	3	1	3	3	3	3	3	3	3	-	-	-
3	2	2	3	3	1	3	3	3	3	3	3	3	-	-	-
4	3	3	3	3	3	3	3	3	3	3	3	3	-	-	-
5	3	3	3	3	3	3	3	3	3	3	3	3	-	-	-
AVg.	**2.4**	**2.8**	**3**	**3**	**1.8**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**

21154C32 **ENGINEERING MECHANICS**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1 To Learn the use scalar and vector analytical techniques for analysing forces in statically determinate structures
2 To introduce the equilibrium of rigid bodies, vector methods and free body diagram
3 To study and understand the distributed forces, surface, loading on beam and intensity.
4 To learn the principles of friction, forces and to determine the apply the concepts of frictional forces at the contact surfaces of various engineering systems.
5 To develop basic dynamics concepts – force, momentum, work and energy;

UNIT I STATICS OF PARTICLES 9

Fundamental Concepts and Principles, Systems of Units, Method of Problem Solutions, Statics of Particles -Forces in a Plane, Resultant of Forces, Resolution of a Force into Components, Rectangular Components of a Force, Unit Vectors. Equilibrium of a Particle- Newton's First Law of Motion, Space and Free-Body Diagrams, Forces in Space, Equilibrium of a Particle in Space.

UNIT II EQUILIBRIUM OF RIGID BODIES 9

Principle of Transmissibility, Equivalent Forces, Vector Product of Two Vectors, Moment of a Force about a Point, Varignon's Theorem, Rectangular Components of the Moment of a Force, Scalar Product of Two Vectors, Mixed Triple Product of Three Vectors, Moment of a Force about an Axis, Couple - Moment of a Couple, Equivalent Couples, Addition of Couples, Resolution of a Given Force into a Force -Couple system, Further Reduction of a System of Forces, Equilibrium in Two and Three Dimensions - Reactions at Supports and Connections.

UNIT III DISTRIBUTED FORCES 9

Centroids of lines and areas — symmetrical and unsymmetrical shapes, Determination of Centroids by Integration, Theorems of Pappus-Guldinus, Distributed Loads on Beams, Centre of Gravity of a Three- Dimensional Body, Centroid of a Volume, Composite Bodies, Determination of Centroids of Volumes by Integration. Moments of Inertia of Areas and Mass - Determination of the Moment of Inertia of an Area by Integration, Polar Moment of Inertia, Radius of Gyration of an Area, Parallel-Axis Theorem, Moments of Inertia of Composite Areas, Moments of Inertia of a Mass - Moments of Inertia of Thin Plates, Determination of the Moment of Inertia of a Three-Dimensional Body by Integration.

UNIT IV FRICTION 9

The Laws of Dry Friction, Coefficients of Friction, Angles of Friction, Wedge friction, Wheel Friction, Rolling Resistance, Ladder friction.

UNIT V DYNAMICS OF PARTICLES 9

Kinematics - Rectilinear Motion and Curvilinear Motion of Particles. Kinetics- Newton's Second Law of Motion -Equations of Motions, Dynamic Equilibrium, Energy and Momentum Methods - Work of a Force, Kinetic Energy of a Particle, Principle of Work and Energy, Principle of Impulse and Momentum, Impact of bodies.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students would be able to

- Illustrate the vector and scalar representation of forces and moments
- Analyse the rigid body in equilibrium
- Evaluate the properties of distributed forces
- Determine the friction and the effects by the laws of friction
- Calculate dynamic forces exerted in rigid body

TEXT BOOKS:

Beer Ferdinand P, Russel Johnston Jr., David F Mazurek, Philip J Cornwell, Sanjeev Sanghi, Vector Mechanics for Engineers: Statics and Dynamics, McGraw Higher Education., 12thEdition, 2019.
Vela Murali, "Engineering Mechanics-Statics and Dynamics", Oxford University Press, 2018.

REFERENCES:

1 Boresi P and Schmidt J, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning, 2008.
2 Hibbeller, R.C., Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 13th edition, Prentice Hall, 2013.
3 Irving H. Shames, Krishna Mohana Rao G, Engineering Mechanics – Statics and Dynamics, 4thEdition, Pearson Education Asia Pvt. Ltd., 2005.
4 Meriam J L and Kraige L G, Engineering Mechanics: Statics and Engineering Mechanics: Dynamics, 7th edition, Wiley student edition, 2013.
5 Timoshenko S, Young D H, Rao J V and SukumarPati, Engineering Mechanics, 5thEdition, McGraw Hill Higher Education, 2013.

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	2	1	2							2	3	1	1
2	3	2	2	1	2							2	3	1	1
3	3	2	3	1	2							2	3	1	2
4	3	2	3	1	2							2	3	1	2
5	3	2	3	1	2							2	3	1	2
Low (1); Medium (2); High (3)															

21154C35 **ENGINEERING MATERIALS AND METALLURGY**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1 To learn the constructing the phase diagram and using of iron-iron carbide phase diagram formicrostructure formation.
2 To learn selecting and applying various heat treatment processes and its microstructureformation.
3 To illustrate the different types of ferrous and non-ferrous alloys and their uses in engineeringfield.
4 To illustrate the different polymer, ceramics and composites and their uses in engineering field.
5 To learn the various testing procedures and failure mechanism in engineering field.

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 9

Constitution of alloys — Solid solutions, substitutional and interstitial — phase diagrams, Isomorphous, eutectic, eutectoid, peritectic, and peritectoid reactions, Iron — Iron carbide equilibrium diagram. Classification of steel and cast-Iron microstructure, properties and application.

UNIT II HEAT TREATMENT 9

Definition – Full annealing, stress relief, recrystallisation and spheroidising –normalizing, hardening and tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram – continuous cooling Transformation (CCT) diagram – Austempering, Martempering – Hardenability,Jominy end quench test -case hardening, carburizing, Nitriding, cyaniding, carbonitriding – Flame and Induction hardening – Vacuum and Plasma hardening – Thermo-mechanical treatments- elementaryideas on sintering.

UNIT III FERROUS AND NON-FERROUS METALS 9

Effect of alloying additions on steel (Mn, Si, Cr, Mo, Ni, V,Ti& W) – stainless and tool steels – HSLA - Maraging steels – Grey, white, malleable, spheroidal – alloy cast irons, Copper and its alloys – Brass, Bronze and Cupronickel – Aluminium and its alloys; Al-Cu – precipitation strengthening treatment – Titanium alloys, Mg-alloys, Ni-based super alloys – shape memory alloys- Properties and Applications- overview of materials standards

UNIT IV NON-METALLIC MATERIALS 9

Polymers – types of polymers, commodity and engineering polymers – Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PAI, PPO, PPS, PEEK, PTFE, Thermoset polymers –Urea and Phenol formaldehydes –Nylon, Engineering Ceramics – Properties and applications of Al2O3, SiC, Si3N4, PSZ and SIALON — intermetallics- Composites- Matrix and reinforcement Materials- applications of Composites - Nano composites.

UNIT V MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS 9

Mechanisms of plastic deformation, slip and twinning – Types of fracture – fracture mechanics- Griffith's theory- Testing of materials under tension, compression and shear loads — Hardness tests (Brinell, Vickers and Rockwell), Micro and nano-hardness tests, Impact test Izod and charpy, fatigue and creep failure mechanisms.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students would be able to

1. Explain alloys and phase diagram, Iron-Iron carbon diagram and steel classification.
2. Explain isothermal transformation, continuous cooling diagrams and different heat treatment processes.
3. Clarify the effect of alloying elements on ferrous and non-ferrous metals.
4. Summarize the properties and applications of non-metallic materials.
5. Explain the testing of mechanical properties.

TEXT BOOKS:

1. Kenneth G.Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of India

Private Limited, 9th edition ,2018.
2. Sydney H.Avner, “Introduction to Physical Metallurgy”, McGraw Hill Book Company, 1994

REFERENCES:

1. A. Alavudeen, N. Venkateshwaran, and J. T.WinowlinJappes, A Textbook of Engineering Materials and Metallurgy, Laxmi Publications, 2006.
2. Amandeep Singh Wadhwa, andHarvinder Singh Dhaliwal, A Textbook of Engineering Material and Metallurgy, University Sciences Press, 2008.
3. G.S. Upadhyay and Anish Upadhyay, “Materials Science and Engineering”, Viva Books Pvt.Ltd, New Delhi, 2020.
4. Raghavan.V, “Materials Science and Engineering”, Prentice Hall of India Pvt.Ltd. 6th edition, 2019.
5. Williams D Callister, “Material Science and Engineering” Wiley India Pvt Ltd, 2nd edition Re print 2019.

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	1	3	2								2	2	1	2
2	3	1	3	1		2		1				2	2	1	2
3	3	1	3									2	2	1	2
4	3	1	3				2					2	2	1	2
5	3	1	3	2	2							2	2	1	2
Low (1) ; Medium (2) ; High (3)															

21154C36 **MANUFACTURING PROCESSES**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To illustrate the working principles of various metal casting processes.
2. To learn and apply the working principles of various metal joining processes.
3. To analyse the working principles of bulk deformation of metals.
4. To learn the working principles of sheet metal forming process.
5. To study and practice the working principles of plastics molding.

UNIT – I METAL CASTING PROCESSES 9

Sand Casting – Sand Mould – Type of patterns - Pattern Materials – Pattern allowances – Molding sand Properties and testing – Cores –Types and applications – Molding machines – Types and applications– Melting furnaces – Principle of special casting processes- Shell, investment – Ceramic mould – Pressure die casting – low pressure, gravity- Tilt pouring, high pressure die casting- Centrifugal Casting – CO2 casting –- Defects in Sand casting process-remedies

UNIT II METAL JOINING PROCESSES 9

Fusion welding processes – Oxy fuel welding – Filler and Flux materials-–Arc welding, Electrodes, Coating and specifications – Gas Tungsten arc welding –Gas metal arc welding - Submerged arc welding – Electro slag welding– Plasma arc welding –– Resistance welding Processes -Electron beam welding – Laser beam Welding Friction welding – Friction stir welding – Diffusion welding – Thermit Welding, Weld defects – inspection &remedies – Brazing - soldering – Adhesive bonding.

UNIT III BULK DEFORMATION PROCESSES 9

Hot working and cold working of metals – Forging processes – Open, impression and closed die forging –cold forging- Characteristics of the processes – Typical forging operations – rolling of metals – Types of Rolling – Flat strip rolling – shape rolling operations – Defects in rolled parts – Principle of rod and wire drawing – Tube drawing – Principles of Extrusion – Types – Hot and Cold extrusion. Introduction to shapingoperations.

UNIT IV SHEET METAL PROCESSES 9

Sheet metal characteristics – Typical shearing, bending and drawing operations – Stretch forming operations – Formability of sheet metal – Test methods –special forming processes - Working principle and applications – Hydro forming – Rubber pad forming – Metal spinning – Introduction of Explosive forming, magnetic pulseforming, peen forming, Super plastic forming – Micro forming – Incremental forming.

UNIT V MANUFACTURE OF PLASTIC COMPONENTS 9

Types and characteristics of plastics – Molding of thermoplastics & Thermosetting polymers– working principles and typical applications – injection molding – Plunger and screw machines – Compression molding, Transfer Molding – Typical industrial applications – introduction to blow molding – Rotational molding – Film blowing – Extrusion – Thermoforming – Bonding of Thermoplastics- duff moulding.

TOTAL :45 PERIODS

OUTCOMES:

At the end of the course the students would be able to

1. Explain the principle of different metal casting processes.
2. Describe the various metal joining processes.
3. Illustrate the different bulk deformation processes.
4. Apply the various sheet metal forming process.
5. Apply suitable molding technique for manufacturing of plastics components.

TEXT BOOKS:

1. Kalpakjian. S, “Manufacturing Engineering and Technology”, Pearson Education India,4th Edition, 2013
2. P.N.Rao Manufacturing Technology Volume 1 Mc Grawhill Education 5th edition,2018.

REFERENCES:

1. Roy. A. Lindberg, Processes and materials of manufacture, PHI / Pearson education, 2006.
2. S. Gowri P. Hariharan, A.Suresh Babu, Manufacturing Technology I, Pearson Education, 2008.
3. Paul Degarma E, Black J.T and Ronald A. Kosher, Eligth Edition, Materials and Processes, in Manufacturing, Eight Edition, Prentice – Hall of India, 1997.
4. Hajra Chouldhary S.K and Hajra Choudhury. AK., Elements of workshop Technology, volume I and II,Media promoters and Publishers Private Limited, Mumbai, 1997
5. Sharma, P.C., A Text book of production Technology, S.Chand and Co. Ltd., 2004

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3		2			2	3	1	1	-	-	1	3	1	2
2	3		2			2	3	1	1	-	-	1	3	1	2
3	3		2			2	2	1	1	-	-	1	3	1	2
4	3		2			2	2	1	1	-	-	1	3	1	2
5	3		2		2	2	2	1	1	-	-	1	3	1	2
Low (1) ; Medium (2) ; High (3)															

21154L37 **COMPUTER AIDED MACHINE DRAWING**

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

1 To acquaint the skills and practical experience in handling 2D drafting and 3D modelling software systems, standard drawing practices using fits and tolerances.

2 To prepare assembly drawings both manually and using standard CAD packages.

3 To Preparing standard drawing layout for modeled parts, assemblies with BoM.

PART I DRAWING STANDARDS & FITS AND TOLERANCES 12

Code of practice for Engineering Drawing, BIS specifications — Welding symbols, riveted joints, keys, fasteners – Reference to hand book for the selection of standard components like bolts, nuts, screws, keys etc. - Limits, Fits — Tolerancing of individual dimensions IS919- Specification of Fits — Preparation of production drawings and reading of part and assembly drawings, basic principles of Geometric Dimensioning &Tolerancing.

PART II 2D DRAFTING 48

Drawing, Editing, Dimensioning, Layering, Hatching, Block, Array, Detailing, Detailed Drawing.

1. Bearings – Bush Bearing,
2. Valves – Safety and Non-return Valves.
3. Couplings – Flange, Oldham's, Muff, Gear couplings.
4. Joints – Universal, Knuckle, Gib& Cotter, Strap, Sleeve &Cotter joints.
5. Engine parts – Piston, Connecting Rod, Crosshead (vertical and horizontal), Stuffing box, multi-plate clutch.
6. Machine Components – Screw Jack, Machine Vice, LatheTail Stock, Lathe Chuck, Plummer Block, Vaneand Gear pumps.

Total: 20% of classes for theory classes and 80% of classes for practice

Note: 25% of assembly drawings must be done manually and remaining 75% of assembly drawings must be done by using any CAD software. The above tasks can be performed manually and using standard commercial 2D CAD software.

TOTAL:60 PERIODS

21154L38	**MANUFACTURING TECHNOLOGY LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

COURSE OBJECTIVES:

1 To Selecting appropriate tools, equipment's and machines to complete a given job.

2 To Performing various welding process using GMAW and fabricating gears using gear making machines.

3 To Performing various machining process such as rolling, drawing, turning, shaping, drilling, milling and analysing the defects in the cast and machined components.

LIST OF EXPERIMENTS

1. Fabricating simple structural shapes using Gas Metal Arc Welding machine.
2. Preparing green sand moulds with cast patterns.
3. Taper Turning and Eccentric Turning on circular parts using lathe machine.
4. Knurling, external and internal thread cutting on circular parts using lathe machine.
5. Shaping – Square and Hexagonal Heads on circular parts using shaper machine.
6. Drilling and Reaming using vertical drilling machine.
7. Milling contours on plates using vertical milling machine.
8. Cutting spur and helical gear using milling machine.
9. Generating gears using gear hobbing machine.
10. Generating gears using gear shaping machine.
11. Grinding components using cylindrical and centerless grinding machine.
12. Grinding components using surface grinding machine.
13. Cutting force calculation using dynamometer in milling machine
14. Cutting force calculation using dynamometer in lathe machine

TOTAL:60 PERIODS

OUTCOMES: At the end of the course the students would be able to

1. Demonstrate the safety precautions exercised in the mechanical workshop and join two metals using GMAW.
2. The students able to make the work piece as per given shape and size using machining processsuch as rolling, drawing, turning, shaping, drilling and milling.
3. The students become make the gears using gear making machines and analyze the defects in the cast and machined components

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3						1		2			1	1	2	2
2	3						1		2			1	1	2	2
3	3						1		2			1	1	2	2
Low (1) ; Medium (2) ; High (3)															

21154L39 PROFESSIONAL DEVELOPMENT

L T P C
0 0 2 1

OBJECTIVES:

To be proficient in important Microsoft Office tools: MS WORD, EXCEL, POWERPOINT.

- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize, interlink, and utilizing many more critical features offered
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations.

MS WORD: 10 Hours

Create and format a document
Working with tables
Working with Bullets and Lists
Working with styles, shapes, smart art, charts
Inserting objects, charts and importing objects from other office tools
Creating and Using document templates
Inserting equations, symbols and special characters
Working with Table of contents and References, citations
Insert and review comments
Create bookmarks, hyperlinks, endnotes footnote
Viewing document in different modes
Working with document protection and security
Inspect document for accessibility

MS EXCEL: 10 Hours

Create worksheets, insert and format data
Work with different types of data: text, currency, date, numeric etc.
Split, validate, consolidate, Convert data
Sort and filter data
Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.,)
Work with Lookup and reference formulae
Create and Work with different types of charts
Use pivot tables to summarize and analyse data
Perform data analysis using own formulae and functions
Combine data from multiple worksheets using own formulae and built-in functions to generate results
Export data and sheets to other file formats
Working with macros
Protecting data and Securing the workbook

MS POWERPOINT: 10
Hours

Select slide templates, layout and themes
Formatting slide content and using bullets and numbering
Insert and format images, smart art, tables, charts
Using Slide master, notes and handout master
Working with animation and transitions
Organize and Group slides
Import or create and use media objects: audio, video, animation
Perform slideshow recording and Record narration and create presentable videos

TOTAL: 30 PERIODS

21154C43	HYDRAULICS AND PNEUMATICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To provide the knowledge on the working principles of fluid power systems.
2. To study the fluids and components used in modern industrial fluid power system.
3. To develop the design, construction and operation of fluid power circuits.
4. To learn the working principles of pneumatic power system and its components.
5. To provide the knowledge of trouble shooting methods in fluid power systems.

UNIT I FLUID POWER PRINICIPLES AND HYDRAULIC PUMPS 9

Introduction to Fluid power – Advantages and Applications – Fluid power systems – Types of fluids - Properties of fluids and selection – Basics of Hydraulics – Pascal's Law – Principles of flow - Friction loss – Work, Power and Torque- Problems, Sources of Hydraulic power: Pumping Theory–– Pump Classification – Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criteria of pumps – Fixed and Variable displacement pumps – Problems

UNIT – II HYDRAULIC ACTUATORS AND CONTROL COMPONENTS 9

Hydraulic Actuators: Cylinders — Types and construction, Application, Hydraulic cushioning — RotaryActuators-Hydraulic motors - Control Components: Direction Control, Flow control and pressure control valves – Types, Construction and Operation – Accessories: Reservoirs, Pressure Switches – Filters – types andselection- Applications – Fluid Power ANSI Symbols – Problems

UNIT – III HYDRAULIC CIRCUITS AND SYSTEMS 9

Accumulators, Intensifiers, Industrial hydraulic circuits – Regenerative, Pump Unloading, Double-Pump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-Safe, Speed Control, Deceleration circuits, Sizing of hydraulic systems, Hydrostatic transmission, Electro hydraulic circuits, – Servoand Proportional valves – Applications- Mechanical, hydraulic servo systems.

UNIT – IV PNEUMATIC AND ELECTRO PNEUMATIC SYSTEMS 9

Properties of air –Air preparation and distribution – Filters, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust Valves, Pneumatic actuators, Design of Pneumatic circuit –classification- single cylinder and multi cylinder circuits-Cascade method –Integration of fringe circuits, Electro Pneumatic System – Elements – Ladder diagram – timer circuits-Problems, Introduction to fluidics and pneumatic logic circuits

UNIT – V TROUBLE SHOOTING AND APPLICATIONS 9

Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic systems, Conditioning of hydraulic fluids Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and Forklift applications- mobile hydraulics; Design of Pneumatic circuits for metal working, handling, clamping counter and timer circuits. – Low-cost Automation – Hydraulic and Pneumatic power packs, IOT in Hydraulics and pneumatics

Note: (Use of standard Design Data Book is permitted in the University examination)

TOTAL: 45 PERIODS

OUTCOMES: At the end of the course the students would be able to

1. Apply the working principles of fluid power systems and hydraulic pumps.
2. Apply the working principles of hydraulic actuators and control components.
3. Design and develop hydraulic circuits and systems.
4. Apply the working principles of pneumatic circuits and power system and its components.
5. Identify various troubles shooting methods in fluid power systems.

TEXT BOOKS:

1. Anthony Esposito, “Fluid Power with Applications”, Prentice Hall, 2009.
2. James A. Sullivan, “Fluid Power Theory and Applications”, Fourth Edition, Prentice Hall, 1997

REFERENCES:

1. Jagadeesha. T., “Pneumatics Concepts, Design and Applications “, Universities Press, 2015.
2. Joshi.P., Pneumatic Control”, Wiley India, 2008.
3. Majumdar, S.R., “Oil Hydraulics Systems – Principles and Maintenance”,TataMcGraw Hill, 2001.
4. Shanmugasundaram.K., “Hydraulic and Pneumatic Controls”. Chand & Co, 2006.
5. Srinivasan.R., “Hydraulic and Pneumatic Controls”, Vijay Nicole Imprints, 3rd edition,2019.

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	1	1								1	2	1	1
2	2	1	1	1								1	2	1	1
3	2	1	1	1								1	2	1	1
4	2	1	1	1								1	2	1	1
5	2	1	1	1								1	2	1	1
Low (1) ; Medium (2) ; High (3)															

21154C44 **MANUFACTURING TECHNOLOGY**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1 To study the concepts and basic mechanics of metal cutting and the factors affecting machinability
2 To learn working of basic and advanced turning machines.
3 To teach the basics of machine tools with reciprocating and rotating motions and abrasive finishing processes.
4 To study the basic concepts of CNC of machine tools and constructional features of CNC.
5 To learn the basics of CNC programming concepts to develop the part programme for Machine centre and turning centre

UNIT – I MECHANICS OF METAL CUTTING 9

Mechanics of chip formation, forces in machining, Types of chip, cutting tools — single point cutting tool nomenclature, orthogonal and oblique metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.

UNIT – II TURNING MACHINES 9

Centre lathe, constructional features, specification, operations — taper turning methods, thread cutting methods, special attachments, surface roughness in turning, machining time and power estimation. Special lathes - Capstan and turret lathes- tool layout – automatic lathes: semi-automatic – single spindle: Swiss type, automatic screw type – multi spindle

UNIT – III RECIPROCATING MACHINE TOOLS 9

Reciprocating machine tools: shaper, planer, slotter: Types and operations- Hole making: Drilling, reaming, boring, tapping, type of milling operations-attachments- types of milling cutters– machining time calculation - Gear cutting, gear hobbing and gear shaping – gear finishing methods Abrasive processes: grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, surface grinding, centreless grinding, internal grinding - micro finishing methods

UNIT – IV CNC MACHINES 9

Computer Numerical Control (CNC) machine tools, constructional details, special features — Drives, Recirculating ball screws, tool changers; CNC Control systems – Open/closed, point-to-point/continuous - Turning and machining centres – Work holding methods in Turning and machining centres, Coolant systems,Safety features.

UNIT – V PROGRAMMING OF CNC MACHINE TOOLS 9

Coordinates, axis and motion, Absolute vs Incremental, Interpolators, Polar coordinates, Program planning, G and M codes, Manual part programming for CNC machining centers and Turning centers — Fixed cycles, Loops and subroutines, Setting up a CNC machine for machining.

TOTAL 45 PERIODS

OUTCOMES: At the end of the course the students would be able to

1. Apply the mechanism of metal removal process and to identify the factors involved in improving machinability.
2. Describe the constructional and operational features of centre lathe and other special purpose lathes.
3. Describe the constructional and operational features of reciprocating machine tools.
4. Apply the constructional features and working principles of CNC machine tools.
5. Demonstrate the Program CNC machine tools through planning, writing codes and setting up CNC machine tools to manufacture a given component.

TEXT BOOKS:

1. Kalpakjian. S, “Manufacturing Engineering and Technology”, Pearson Education India,7th Edition, 2018.
2. Michael Fitzpatrick, Machining and CNC Technology, McGraw-Hill Education; 4th edition, 2018.

REFERENCES:

1. Roy. A. Lindberg, Processes and materials of manufacture, PHI / Pearson education, 2006.
2. Geofrey Boothroyd, “Fundamentals of Metal Machining and Machine Tools”, McGraw Hill, 1984.
3. Rao. P.N “Manufacturing Technology,” Metal Cutting and Machine Tools, Tata McGraw- Hill, New Delhi, 2009.
4. A. B. Chattopadhyay, Machining and Machine Tools, Wiley, 2nd edition, 2017.
5. Peter Smid, CNC Programming Handbook, Industrial Press Inc.;Third edition, 2007.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	1	1	1	3			3		2	3	3	2
2	3	3	3	1	1	1	3			3		2	3	2	2
3	3	3	3	1	1	1	3			3		2	3	2	2
4	3	3	2	1	1	1	3			3		2	3	2	2
5	3	3	3	1	1	1	3			3		2	3	2	3
Low (1) ; Medium (2) ; High (3)															

21154C45 STRENGTH OF MATERIALS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the concepts of stress, strain, principal stresses and principal planes.
- To study the concept of shearing force and bending moment due to external loads in determinatebeams and their effect on stresses.
- To determine stresses and deformation in circular shafts and helical spring due to torsion.
- To compute slopes and deflections in determinate beams by various methods.
- To study the stresses and deformations induced in thin and thick shells.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses - Deformation of simpleand compound bars – Thermal stresses – Elastic constants - Volumertric strains – Stresses on inclined planes – Principal stresses and principal planes – Mohr's circle of stress.

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM 9

Beams – Types - Transverse loading on beams – Shear force and Bending moment in beams – Cantilever, Simply supported and over hanging beams. Theory of simple bending – Bending stressdistribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.

UNIT III TORSION 9

Theory of Torsion – Stresses and Deformations in Solid and Hollow Circular Shafts – Combined bendingmoment and torsion of shafts - Power transmitted to shaft – Shaft in series and parallel – Closed andOpen Coiled helical springs – springs in series and parallel.

UNIT IV DEFLECTION OF BEAMS 9

Elastic curve – Governing differential equation - Double integration method - Macaulay's method - Area moment method - Conjugate beam method for computation of slope and deflection of determinant beams.

UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS 9

Stresses in thin cylindrical shell due to internal pressure - circumferential and longitudinal stresses - Deformation in thin cylinders – Spherical shells subjected to internal pressure – Deformation in sphericalshells — Thick cylinders - Lame's theory.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students would be able to

1. Understand the concepts of stress and strain in simple and compound bars, the importan of principal stresses and principal planes.
2. Understand the load transferring mechanism in beams and stress distribution due shearing force and bending moment.
3. Apply basic equation of torsion in designing of shafts and helical springs
4. Calculate slope and deflection in beams using different methods.
5. Analyze thin and thick shells for applied pressures.

TEXT BOOK

1. Rajput R.K. "Strength of Materials (Mechanics of Solids)", S.Chand & company Ltd., New Delhi, 7th edition, 2018.
2. Rattan S.S., "Strength of Materials", Tata McGraw Hill Education Pvt .Ltd., New Delhi, 2017.

REFERENCES:

1. Singh. D.K., “Strength of Materials”, Ane Books Pvt Ltd., New Delhi, 2021.
2. Egor P Popov, “Engineering Mechanics of Solids”, 2nd edition, PHI Learning Pvt. Ltd., New Delhi, 2015.
3. Beer. F.P. & Johnston. E.R. “Mechanics of Materials”, Tata McGraw Hill, 8th Edition, New Delhi 2019.
4. Vazirani. V.N, Ratwani. M.M, Duggal .S.K “Analysis of Structures: Analysis, Design and Detailing of Structures-Vol.1”, Khanna Publishers, New Delhi 2014.

CO	**PO**												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	2	3	1	3	2	3	1	3	3	2	3
2	3	3	3	3	2	3	1	3	2	3	1	3	3	2	3
3	3	3	3	3	2	3	1	3	2	3	1	3	3	2	3
4	3	3	3	3	2	3	1	3	2	3	1	3	3	2	3
5	3	3	3	3	2	3	1	3	2	3	1	3	3	2	3
Low (1) ; Medium (2) ; High (3)															

21149S46 ENVIRONMENTAL SCIENCES AND SUSTAINABILITY L T P C

3 0 0 3

COURSE OBJECTIVES:

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of global and Indian scenario of renewable and nonrenewable resources, causes of their degradation and measures to preserve them.
- To familiarize the concept of sustainable development goals and appreciate the interdependence of economic and social aspects of sustainability, recognize and analyze climate changes, concept of carbon credit and the challenges of environmental management.
- To inculcate and embrace sustainability practices and develop a broader understanding on green materials, energy cycles and analyze the role of sustainable urbanization.

UNIT I ENVIRONMENT AND BIODIVERSITY 6

Definition, scope and importance of environment — need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ.

UNIT II ENVIRONMENTAL POLLUTION 6

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts.

UNIT III RENEWABLE SOURCES OF ENERGY 6

Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.

UNIT IV SUSTAINABILITY AND MANAGEMENT 6

Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols-Sustainable Development Goals-targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.

UNIT V SUSTAINABILITY PRACTICES 6

Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles-carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio-economical and technological change.

TOTAL : 30 PERIODS

OUTCOMES:

- To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.
- To identify the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.
- To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
- To recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development.
- To demonstrate the knowledge of sustainability practices and identify green materials, energy cycles and the role of sustainable urbanization.

TEXT BOOKS:

1. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.
3. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
4. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.
6. Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
7. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.

REFERENCES :

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38 . Edition 2010.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015.
5. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

CO-PO & PSO MAPPING

CO	**PO**											**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	-	-	-	2	3	-	-	-	-	2	-	-	-
2	3	2	-	-	-	3	3	-	-	-	-	2	-	-	-
3	3	-	1	-	-	2	2	-	-	-	-	2	-	-	-
4	3	2	1	1	-	2	2	-	-	-	-	2	-	-	-
5	3	2	1	-	-	2	2	-	-	-	-	1	-	-	-
Avg.	**2.8**	**1.8**	**1**	**1**	**-**	**2.2**	**2.4**	**-**	**-**	**-**	**-**	**1.8**	-	-	-

1-low, 2-medium, 3-high, '-"- no correlation

21154L47 STRENGTH OF MATERIALS AND FLUID MACHINERY LABORATORY

L T P C
0 0 4 2

COURSE OBJECTIVE:

1. To study the mechanical properties of metals, wood and spring by testing in laboratory.
2. To verify the principles studied in fluid mechanics and machinery theory by performing experiments in laboratory.

UNIT – I STRENGTH OF MATERIALS 30

LIST OF EXPERIMENTS

1. Tension test on mild steel rod
2. Torsion test on mild steel rod
3. Hardness test on metal (Rockwell and Brinell Hardness)
4. Compression test on helical spring
5. Deflection test on carriage spring

UNIT – II FLUID MECHANICS AND MACHINES LABORATORY 30

LIST OF EXPERIMENTS

1. (a) Determination of coefficient of discharge of a venturimeter
   (b) Determination of friction factor for flow through pipes
2. (a) Determination of metacentric height
   (b) Determination of forces due to impact of jet on a fixed plate
3. Characteristics of centrifugal pumps
4. Characteristics of reciprocating pump
5. Characteristics of Pelton wheel turbine

TOTAL: 60 PERIODS

OUTCOMES: On completion of the course, the student is expected to be able to

1. Determine the tensile, torsion and hardness properties of metals by testing
2. Determine the stiffness properties of helical and carriage spring
3. Apply the conservation laws to determine the coefficient of discharge of a venturimeter and finding the friction factor of given pipe
4. Apply the fluid static and momentum principles to determine the metacentric height and forces due to impact of jet
5. Determine the performance characteristics of turbine, rotodynamic pump and positive displacement pump.

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	3	3	1	1	1	3	1	1	2	2	2	1
2	3	2	1	3	3	1	1	1	3	1	1	2	3	2	1
3	3	3	2	3	2	1	1	1	3	1	1	2	3	2	1
Low (1) ; Medium (2) ; High (3)															

21154C51	DESIGN OF MACHINE ELEMENTS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

1. To learn the various steps involved in the Design Process.
2. To Learn designing shafts and couplings for various applications.
3. To Learn the design of temporary and permanent Joints.
4. To Learn designing helical, leaf springs, flywheels, connecting rods and crank shafts for variousapplications.
5. To Learn designing and select sliding and rolling contact bearings, seals and gaskets.

(Use of PSG Design Data book is permitted)

UNIT – I FUNDAMENTAL CONCEPTS IN DESIGN 12

Introduction to the design process - factors influencing machine design, selection of materials based on mechanical properties - Preferred numbers- Direct, Bending and torsional loading- Modes of failure - Factor of safety – Combined loads – Principal stresses – Eccentric loading – curved beams – crane hook and 'C' frame- theories of failure – Design based on strength and stiffness – stress concentration – Fluctuating stresses – Endurance limit –Design for finite and infinite life under variable loading - Exposure to standards.

UNIT – II DESIGN OF SHAFTS AND COUPLINGS 12

Shafts and Axles - Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys andsplines — Rigid and flexible couplings.

UNIT – III DESIGN OF TEMPORARY AND PERMANENT JOINTS 12

Threaded fasteners - Bolted joints including eccentric loading, Knuckle joints, Cotter joints – Welded joints- Butt, Fillet and parallel transverse fillet welds – welded joints subjected to bending, torsional and eccentricloads, riveted joints for structures - theory of bonded joints.

UNIT – IV DESIGN OF ENERGY STORING ELEMENTS AND ENGINE COMPONENTS 12

Types of springs, design of helical and concentric springs–surge in springs, Design of laminated springs - rubber springs - Flywheels considering stresses in rims and arms for engines and punching machines-- Solid and Rimmed flywheels- connecting rods and crank shafts

UNIT – V DESIGN OF BEARINGS AND MISCELLANEOUS ELEMENTS 12

Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfeld Number, Raimondi & Boyd graphs, -- Selection of Rolling Contact bearings –Design of Seals and Gaskets.

TOTAL: 60 PERIODS

OUTCOMES: At the end of the course the students would be able to

1. Explain the design machine members subjected to static and variable loads.
2. Apply the concepts design to shafts, key and couplings.
3. Apply the concepts of design to bolted, Knuckle, Cotter, riveted and welded joints.
4. Apply the concept of design helical, leaf springs, flywheels, connecting rods and crank shafts.
5. Apply the concepts of design and select sliding and rolling contact bearings, seals and gaskets.

TEXT BOOKS:

1. Bhandari V B, "Design of Machine Elements", 4th Edition , Tata McGraw-Hill Book Co, 2016
2. Joseph Shigley, Richard G. Budynas and J. Keith Nisbett "Mechanical Engineering Design", 10th Edition, Tata McGraw-Hill , 2015.

REFERENCES:

1. Ansel C Ugural, "Mechanical Design – An Integral Approach", 1st Edition, Tata McGraw-Hill Book Co,2004.
2. Merhyle Franklin Spotts, Terry E. Shoup, and Lee EmreyHornberger, "Design of Machine Elements" 8th Edition, Printice Hall, 2004.
3. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine component Design",6th Edition, Wiley, 2017.

21154C52	METROLOGY AND MEASUREMENTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To learn basic concepts of the metrology and importance of measurements.
2 To teach measurement of linear and angular dimensions assembly and transmission elements.
3 To study the tolerance analysis in manufacturing.
4 To develop the fundamentals of GD & T and surface metrology.
5 To provide the knowledge of the advanced measurements for quality control in manufacturing industries.

UNIT – I BASICS OF METROLOGY 9

Measurement – Need, Process, Role in quality control; Factors affecting measurement - SWIPE; Errors in Measurements – Types – Control – Measurement uncertainty – Types, Estimation, Problems on Estimation of Uncertainty, Statistical analysis of measurement data, Measurement system analysis, Calibration of measuring instruments, Principle of air gauging- ISO standards.

UNIT – II MEASUREMENT OF LINEAR, ANGULAR DIMENSIONS, ASSEMBLY AND TRANSMISSION ELEMENTS 9

Linear Measuring Instruments – Vernier caliper, Micrometer, Vernier height gauge, Depth Micrometer, Bore gauge, Telescoping gauge; Gauge blocks – Use and precautions, Comparators – Working and advantages; Opto-mechanical measurements using measuring microscope and Profile projector - Angularmeasuring instruments – Bevel protractor, Clinometer, Angle gauges, Precision level, Sine bar, Autocollimator, Angle dekkor, Alignment telescope. Measurement of Screw threads - Single element measurements — Pitch Diameter, Lead, Pitch. Measurement of Gears — purpose — Analytical measurement – Runout, Pitch variation, Tooth profile, Tooth thickness, Lead – Functional checking – Rolling gear test.

UNIT – III TOLERANCE ANALYSIS 9

Tolerancing– Interchangeability, Selective assembly, Tolerance representation, Terminology, Limits and Fits, Problems (using tables IS919); Design of Limit gauges, Problems. Tolerance analysis in manufacturing, Process capability, tolerance stackup, tolerance charting.

UNIT – IV METROLOGY OF SURFACES 9

Fundamentals of GD & T- Conventional vs Geometric tolerance, Datums, Inspection of geometric deviations like straightness, flatness, roundness deviations; Simple problems – Measurement of Surface finish — Functionality of surfaces, Parameters, Comparative, Stylus based and Optical Measurement techniques, Filters, Introduction to 3D surface metrology- Parameters.

UNIT – V ADVANCES IN METROLOGY 9

Lasers in metrology - Advantages of lasers – Laser scan micrometers; Laser interferometers – Applications – Straightness, Alignment; Ball bar tests, Computer Aided Metrology - Basic concept of CMM – Types of CMM – Constructional features – Probes – Accessories – Software – Applications – Multi-sensor CMMs.
Machine Vision - Basic concepts of Machine Vision System – Elements – Applications - On-line and in-process monitoring in production - Computed tomography – White light Scanners.

TOTAL: 45 PERIODS

OUTCOMES: At the end of the course the students would be able to

1. Discuss the concepts of measurements to apply in various metrological instruments.
2. Apply the principle and applications of linear and angular measuring instruments, assembly and transmission elements.
3. Apply the tolerance symbols and tolerance analysis for industrial applications.
4. Apply the principles and methods of form and surface metrology.
5. Apply the advances in measurements for quality control in manufacturing Industries.

TEXT BOOKS:

1 Dotson Connie, “Dimensional Metrology”, Cengage Learning, First edition, 2012.
2 Mark Curtis, Francis T. Farago, “Handbook of Dimensional Measurement”, Industrial Press, Fifth edition, 2013.

REFERENCES:

1. AmmarGrous, J “Applied Metrology for Manufacturing Engineering”, Wiley-ISTE, 2011.
2. Galyer, J.F.W. Charles Reginald Shotbolt, “Metrology for Engineers”, Cengage Learning EMEA; 5th revised edition, 1990.
3. National Physical LaboratoryGuideNo. 40, No. 41, No. 42, No. 43, No. 80, No. 118, No. 130, No. 131.http://www.npl.co.uk.
4. Raghavendra N.V. and Krishnamurthy. L., Engineering Metrology and Measurements, Oxford University Press, 2013.
5. Venkateshan, S. P., “Mechanical Measurements”, Second edition, John Wiley &Sons, 2015.

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	2	2					1			1	3	2	1
2	3	2	2	2					1			1	3	2	1
3	3	2	2	2					1			1	3	2	1
4	3	2	2	2					1			1	3	2	1
5	3	2	2	2					1			1	3	2	1
Low (1) ; Medium (2) ; High (3)															

21154L58 METROLOGY AND DYNAMICS LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES

1. To study the different measurement equipment and use of this industry for quality inspection.
2. To supplements the principles learnt in dynamics of machinery.
3. To understand how certain measuring devices are used for dynamic testing.

UNIT – I METROLOGY **30**

LIST OF EXPERIMENTS

1. Calibration and use of linear measuring instruments — Vernier caliper, micrometer, Vernierheight gauge, depth micrometer, bore gauge, telescopic gauge, Comparators.
2. Measurement of angles using bevel protractor, sine bar, autocollimator, precision level.
3. Measurement of assembly and transmission elements - screw thread parameters — Screwthread Micrometers, Three wire method, Toolmaker's microscope.
4. Measurement of gear parameters – Micrometers, Vernier caliper, Gear tester.
5. Measurement of features in a prismatic component using Coordinate Measuring Machine (CMM), Programming of CNC Coordinate Measuring Machines for repeated measurements of identical components.
6. Non-contact (Optical) measurement using Measuring microscope / Profile projector and Video measurement system.
7. Surface metrology - Measurement of form parameters – Straightness, Flatness, Roundness, Cylindricity, Perpendicularity, Runout, Concentricity — in the given component using Roundness tester.
8. Measurement of Surface finish in components manufactured using various processes (turning, milling, grinding, etc.,) using stylus based instruments.

UNIT – II DYNAMICS LABORATORY 30

List of Experiments:

1. Study of gear parameters.
2. Epicycle gear Train.
3. Determination of moment of inertia of flywheel and axle system.
4. Determination of mass moment of inertia of a body about its axis of symmetry.
5. Undamped free vibrations of a single degree freedom spring-mass system.
6. Torsional Vibration (Undamped) of single rotor shaft system.
7. Dynamic analysis of cam mechanism.
8. Experiment on Watts Governor.
9. Experiment on Porter Governor.
10. Experiment on Proell Governor.
11. Experiment on motorized gyroscope.
12. Determination of critical speed of shafts.

TOTAL:60 PERIODS

OUTCOMES: At the end of the course the students would be able to

1. The students able to measure the gear tooth dimensions, angle using sine bar, straightness.
2. Determine mass moment of inertia of mechanical element, governor effort and range of sensitivity.
3. Determine the natural frequency and damping coefficient, critical speeds of shafts,

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1		2	2	3		2	2		1	2	2		3	2	2
2		2	2	3		2	2		1	2	2		2	2	2
3		2	2	3		2	2		1	2	2		3	2	2
Avg	-	2	2	3	-	2	2	-	1	2	2	-	2.6	2	2
Low (1) ; Medium (2) ; High (3)															

21154L68	CAD/CAM LABORATORY	L	T	P	C
		3	1	0	4
		0	0	4	2

COURSE OBJECTIVES

1 To gain practical experience in handling 2D drafting and 3Dmodelling software systems
2 Designing 3 Dimensional geometric model of parts, sub-assemblies, assemblies and exporting it to drawing
3 Programming G & M Code programming and simulate the CNC program and Generating part programming data through CAM software

3D GEOMETRIC MODELLING 30

1. CAD Introduction
   Sketch:
   Solid modeling: Extrude, Revolve, Sweep, Variational sweep and Loft.
   Surface modeling: Extrude, Sweep, Trim, Mesh of curves and Free form.
   Feature manipulation: Copy, Edit, Pattern, Suppress, History operations.
   Assembly: Constraints, Exploded Views, Interference check
   Drafting: Layouts, Standard & Sectional Views, Detailing & Plotting
2. Creation of 3D assembly model of following machine elements using 3D Modelling software
   1. Flange Coupling
   2. Plummer Block
   3. Screw Jack
   4. Lathe Tailstock
   5. Universal Joint
   6. Machine Vice
   7. Stuffing box
   8. Crosshead
   9. Safety Valves
   10. Non-return valves
   11. Connecting rod
   12. Piston
   13. Crankshaft

* Students may also be trained in manual drawing of some of the above components (specify the number – progressive arrangement of 3D)

30

MANUAL PART PROGRAMMING

1. CNC Machining Centre
   i) Linear Cutting.
   ii) Circular cutting.
   iii) Cutter Radius Compensation.
   iv) Canned Cycle Operations.

2. CNC Turning Centre
   i) Straight, Taper and Radial Turning.
   ii) Thread Cutting.
   iii) Rough and Finish Turning Cycle.
   iv) Drilling and Tapping Cycle.

3. COMPUTER AIDED PART PROGRAMMING
   i) Generate CL Data and Post process data using CAM packages for Machining and Turning Centre.
   ii) Application of CAPP in Machining and Turning

TOTAL:60 PERIODS

OUTCOMES: At the end of the course the students would be able to

1. Design experience in handling 2D drafting and 3D modelling software systems
2. Design 3 Dimensional geometric model of parts, sub-assemblies, assemblies and export it to drawing
3. Demonstrate manual part programming and simulate the CNC program and Generate part programming using G and M code through CAM software.

21154C75	MECHATRONICS AND IoT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To make students get acquainted with the sensors and the actuators, which are commonly used in mechatronics systems.
2 To provide insight into the signal conditioning circuits, and also to develop competency in PLC programming and control
3 To make students familiarize with the fundamentals of IoT and Embedded systems.
4 To impart knowledge about the Arduino and the Raspberry Pi.
5 To inculcate skills in the design and development of mechatronics and IoT based systems.

UNIT – I SENSORS AND ACTUATORS 9

Introduction to Mechatronics - Modular Approach, Sensors and Transducers: Static and Dynamic Characteristics, Transducers - Resistive, Capacitive, Inductive and Resonant, Optical Sensors — Photodetectors - Vision Systems – Laser - Fibre optic - Non-fibre Optic, Solid State Sensors, Piezoelectric and Ultrasonic Sensors. Actuators – Brushless Permanent Magnet DC Motor – PM, VR and Hybrid Stepper motors — DC and AC Servo Motors

UNIT – II SIGNAL CONDITIONING CIRCUITS AND PLC 9

Operational Amplifiers — Inverting and Non-Inverting Amplifier — Wheatstone bridge Amplifier — Instrumentation Amplifier – PID Controller, Protection Circuits, Filtering Circuits, Multiplexer, Data Logger and Data Acquisition System –, Switching Loads by Power Semiconductor Devices Circuits – Thyristors – TRIAC – Darlington Pair –MOSFET and Relays.
PLC – Architecture – Input / Output Processing – Logic Ladder Programming – Functional Block Programming using Timers and Counters — Applications.

UNIT – III FUNDAMENTALS OF IoT AND EMBEDDED SYSTEMS 9

The Internet of Things (IoT) - Introduction to the IoT Framework — IoT Enabling Technologies- The Effective Implementation of IoT: The Detailed Procedure. Embedded Systems: An Introduction - Single-Chip Microcontroller Systems - Single-Board Microcontroller Systems - Single-Board Computer Systems - Embedded Systems: Peripherals - Software Considerations

UNIT – IV CONTROLLERS 9

Foundation topics: Programming Languages: C++ and Python - The Linux Operating System. Arduino: The Arduino Boards - Arduino Peripherals- Arduino IDE — ESP8266 Wi-Fi module. Raspberry Pi: The Raspberry Pi Boards - The Raspberry Pi Peripherals - The Raspberry Pi Operating System. (typical peripherals) Interfacing and Controlling I/O devices by Arduino and Raspberry Pi: LEDs - Push buttons - Light intensity sensor - Ultrasonic distance sensor — Temperature sensor- Humidity sensor - Sensor and Actuator interactions

UNIT – V MECHATRONICS AND IoT CASE STUDIES 9

Mechatronics systems: Drone actuation and Control -Autonomous Robot with Vision System, Automotive Mechatronics: Electronic Ignition System - ABS - EBD - Adaptive Cruise Control. IoT case studies: Remote Monitoring Systems- Remotely Operated Autonomous Systems - Centralized Water Management System - IoT Enabled Robotic Camera Dolly - Portable, Wireless, Interactive IoT Sensors for Agriculture - IoT Vehicle Management System with Network Selection.

TOTAL:45 PERIODS

OUTCOMES: At the end of the course the students would be able to

1. Explain Select suitable sensors and actuators to develop mechatronics systems.
2. Discuss Devise proper signal conditioning circuit for mechatronics systems, and also able to implement PLC as a controller for an automated system.
3. Elucidate the fundamentals ofIot and Embedded Systems
4. Discuss Control I/O devices through Arduino and Raspberry Pi.
5. Design and develop an apt mechatronics/IoT based system for the given real-time application.

TEXT BOOKS:

1. Bradley D.A., Burd N.C., Dawson D., Loader A.J., "Mechatronics: Electronics in Products and Processes", Routledge, 2017.
2. Sami S.H and Kisheen Rao G "The Internet of Mechanical Things: The IoT Framework for Mechanical Engineers", CRC Press, 2022.

REFERENCES:

1. John Billingsley, "Essentials of Mechatronics", Wiley, 2006
2. David H., Gonzalo S., Patrick G.,Rob B. and Jerome H.,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", Pearson Education, 2018.
3. Nitin G and Sharad S, "Internet of Things: Robotic and Drone Technology", CRC Press, 2022
4. Newton C. Braga, "Mechatronics for The Evil Genius", McGrawHill, 2005.
5. Bell C., "Beginning Sensor Networks with Arduino and Raspberry Pi", Apress, 2013

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5	3	3	3	3	3	-	2	-	3	-	-	3	1	2	3
Low (1) ; Medium (2) ; High (3)															

21154C76	COMPUTER INTEGRATED MANUFACTURING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To provide the overview of evolution of automation, CIM and its principles.
2 To learn the various Automation tools, include various material handling system.
3 To train students to apply group technology and FMS.
4 To familiarize the computer aided process planning in manufacturing.
5 To introduce to basics of data transaction, information integration and control of CIM.

UNIT – I INTRODUCTION 9

Introduction to CAD, CAM, CAD/CAM and CIM - Evolution of CIM – CIM wheel and cycle – Production concepts and mathematical models – Simple problems in production models – CIM hardware and software – Major elements of CIM system – Three step process for implementation of CIM – Computers in CIM – Computer networks for manufacturing – The future automated factory – Management of CIM – safety aspectsof CIM– advances in CIM

UNIT – II AUTOMATED MANUFACTURING SYSTEMS 9

Automated production line – system configurations, work part transfer mechanisms – Fundamentals of Automated assembly system – System configuration, Part delivery at workstations – Design for automated assembly – Overview of material handling equipments – Consideration in material handling system design– The 10 principles of Material handling. Conveyor systems – Types of conveyors – Operations and features.Automated Guided Vehicle system – Types &applications – Vehicle guidance technology – Vehicle management and safety. Storage system performance – storage location strategies – Conventional storage methods and equipments – Automated storage/Retrieval system and Carousel storage system Deadlocks in Automated manufacturing systems – Petrinet models – Applications in Dead lock avoidance – smart manufacturing – Industry 4.0 - Digital manufacturing – Virtual manufacturing

UNIT – III GROUP TECHNOLOGY AND FMS 9

Part families – Visual – Parts classification and coding – Production flow analysis – Grouping of parts and Machines by rank order clustering method — Benefits of GT — Case studies. FMS — Components — workstations – FMS layout configurations – Computer control systems – FMS planning and implementation issues – Architecture of FMS – flow chart showing various operations in FMS – Machine cell design – Composite part concept, Holier method, Key machine concept – Quantitative analysis of FMS – Bottleneck model – Simple and complicated problems – Extended Bottleneck model - sizing the FMS — FMS applications, Benefits.

UNIT – IV PROCESS PLANNING 9

Process planning – Activities in process planning, Informations required. From design to process planning – classification of manufacturing processes – Selection of primary manufacturing processes – Sequencing of operations according to Anteriorities – various examples – forming of Matrix of Anteriorities – case study. Typical process sheet – case studies in Manual process planning. Computer Aided Process Planning – Process planning module and data base – Variant process planning – Two stages in VPP – Generative process planning – Flow chart showing various activities in generative PP – Semi generative process planning- Comparison of CAPP and Manual PP.

UNIT – V PROCESS CONTROL AND DATA ANALYSIS 9

Introduction to process model formulation – linear feedback control systems – Optimal control – Adaptivecontrol –Sequence control and PLC& SCADA. Computer process control – Computer process interface – Interface hardware – Computer process monitoring – Direct digital control and Supervisory computer controlOverview of Automatic identification methods — Bar code technology –Automatic data capture technologies.- Quality management (SPC) and automated inspection

TOTAL :45 PERIODS

OUTCOMES: At the end of the course the students would be able to

1. Discuss the basics of computer aided engineering.
2. Choose appropriate automotive tools and material handling systems.
3. Discuss the overview of group technology, FMS and automation identification methods.
4. Design using computer aided process planning for manufacturing of various components

5. Acquire knowledge in computer process control techniques.

TEXT BOOKS:

1. Shivanand H K, Benal M M and Koti V, Flexible Manufacturing System, New Age, 2016.
2. CIM: Computer Integrated Manufacturing: Computer Steered Industry Book by August-Wilhelm Scheer

REFERENCES:

1. Alavudeen and Venkateshwaran, Computer Integrated Manufacturing‖, PHI Learning Pvt. Ltd., New Delhi, 2013.
2. Gideon Halevi and Ronald D. Weill, Principles of Process Planning‖, Chapman Hall, 1995.
3. James A. Retrg, Herry W. Kraebber, Computer Integrated Manufacturing‖, Pearson Education,Asia,3rdEdition,2004.
4. Mikell P. Groover, Automation, Production system and Computer integrated Manufacturing, Prentice Hall of India Pvt. Ltd., 4thEdition, 2014.
5. Radhakrishnan P, Subramanian S and Raju V, CAD/CAM/CIM, New Age International Publishers, 3rd Edition, 2008.

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3	3	2	2	1	2				1			1	2	1	3

21147S71 **HUMAN VALUES ETHICS** **LT P C**
3 0 0 3

OBJECTIVES:

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I HUMAN VALUES 10

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV **SAFETY, RESPONSIBILITIES AND RIGHTS** 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT V GLOBAL ISSUES 8

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

TEXT BOOKS:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.

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	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1			1	1		3	2	3	2	3	2	3	1	1	1
2			1	1		3	2	3	2	3	2	3	1	1	1
3			1	1		3	2	3	2	3	2	3	1	1	1
4			1	1		3	2	3	2	3	2	3	1	1	1
5			1	1		3	2	3	2	3	2	3	1	1	1
Low (1) ; Medium (2) ; High (3)															

21154C77	INDUSTRIAL MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To study the basic concepts of management; approaches to management; Contributors tomanagement studies; various forms of business organization and trade unions function in professional organizations.
2 To study the planning; organizing and staffing functions of management in professional organization.
3 To study the leading; controlling and decision making functions of management in professional organization.
4 To learn the organizational theory in professional organization.
5 To learn the principles of productivity and modern concepts in management in professional organization.

UNIT – I INTRODUCTION TO MANAGEMENT 9

Management: Introduction; Definition and Functions – Approaches to the study of Management – Mintzberg's Ten Managerial Roles – Principles of Taylor; Fayol; Weber; Parker – Forms of Organization: Sole Proprietorship; Partnership; Company (Private and Public); Cooperative – Public Sector Vs Private Sector Organization – Business Environment: Economic; Social; Political; Legal – Trade Union: Definition; Functions; Merits & Demerits.

UNIT – II FUNCTIONS OF MANAGEMENT - I 9

Planning: Characteristics; Nature; Importance; Steps; Limitation; Planning Premises; Strategic Planning; Vision & Mission statement in Planning– Organizing: Organizing Theory; Principles; Types; Departmentalization; Centralization and Decentralization; Authority & Responsibility — Staffing: Systems Approach; Recruiting and SelectionProcess; Human Resource Development (HRD) Concept and Design.

UNIT – III FUNCTIONS OF MANAGEMENT - II 9

Directing (Leading): Leadership Traits; Style; Morale; Managerial Grids (Blake-Mounton, Reddin) – Communication: Purpose; Model; Barriers — Controlling: Process; Types; Levels; Guidelines; Audit (External, Internal, Merits); Preventive Control – Decision Making: Elements; Characteristics; Nature; Process; Classifications.

UNIT – IV ORGANIZATION THEORY 9

Organizational Conflict: Positive Aspects; Individual; Role; Interpersonal; Intra Group; Inter Group; Conflict Management — Maslow's hierarchy of needs theory; Herzberg's motivation-hygiene theory; McClelland's three needs motivation theory; Vroom's valence-expectancy theory — Change Management: Concept of Change; Lewin's Process of Change Model; Sources of Resistance; Overcoming Resistance; Guidelines to managing Conflict.

UNIT – V PRODUCTIVITY AND MODERN TOPICS 9

Productivity: Concept; Measurements; Affecting Factors; Methods to Improve — Modern Topics (concept, feature/characteristics, procedure, merits and demerits): Business Process Reengineering (BPR); Benchmarking; SWOT/SWOC Analysis; Total Productive Maintenance; Enterprise Resource Planning (ERP); Management of Information Systems (MIS), Industry 4.0.

TOTAL:45 PERIODS

OUTCOMES: At the end of the course the students would be able to

1. Discuss basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions function in professional organizations.
2. Discuss the planning; organizing and staffing functions of management in professional organization.
3. Apply the leading; controlling and decision making functions of management in professional organization.
4. Discuss the organizational theory in professional organization.
5. Apply principles of productivity and modern concepts in management in professional organization.

TEXT BOOKS:

1. M. Govindarajan and S. Natarajan, “Principles of Management”, Prentice Hall of India, New Delhi, 2009.
2. Koontz. H. and Weihrich. H., “Essentials of Management: An International Perspective”, 8th Edition, Tata McGrawhill, New Delhi, 2010.

REFERENCES:

1. Joseph J, Massie, “Essentials of Management”, 4th Edition, Pearson Education, 1987.
2. Saxena, P. K., “Principles of Management: A Modern Approach”, Global India Publications, 2009.
3. S.Chandran, “Organizational Behaviours”, Vikas Publishing House Pvt. Ltd., 1994.
4. Richard L. Daft, “Organization Theory and Design”, South Western College Publishing, 11th Edition, 2012.
5. S. TrevisCerto, “Modern Management Concepts and Skills”, Pearson Education, 2018.

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1			1	1		3	2	3	2	3	2	3	1	1	1
2			1	1		3	2	3	2	3	2	3	1	1	1
3			1	1		3	2	3	2	3	2	3	1	1	1
4			1	1		3	2	3	2	3	2	3	1	1	1
5			1	1		3	2	3	2	3	2	3	1	1	1
Low (1) ; Medium (2) ; High (3)															

21154L79	MECHATRONICS AND IoT LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives

1. To study the concept of mechatronics to design, modelling and analysis of basic electrical hydraulic systems.
2. To provide the hands on-training in the control of linear and rotary actuators.
3. To study the concepts and fundamentals of IoT, sensors, actuators and IoT boards

MECHATRONICS

LIST OF EXPERIMENTS:

1. Measurement of Linear/Angular of Position, Direction and Speed using Transducers.
2. Measurement of Pressure, Temperature and Force using Transducers.
3. Speed and Direction control of DC Servomotor, AC Servomotor and Induction motors.
4. Addition, Subtraction and Multiplication Programming in 8051.
5. Programming and Interfacing of Stepper motor and DC motor using 8051/PLC.
6. Programming and Interfacing of Traffic Light Interface using 8051.
7. Sequencing of Hydraulic and Pneumatic circuits.
8. Sequencing of Hydraulic, Pneumatic and Electro-pneumatic circuits using Software.
9. Electro-pneumatic/hydraulic control using PLC.
10. Vision based image acquisition and processing technique for inspection and classification.

INTERNET OF THINGS

1. Familiarization with concept of IoT and its open source microcontroller/SBC.
2. Write a program to turn ON/OFF motor using microcontroller/SBC through internet.
3. Write a program to interface sensors to display the data on the screen through internet.
4. Interface the sensors with microcontroller/SBC and write a program to turn ON/OFF Solenoid valve through internet when sensor data is detected.
5. To interface sensor with microcontroller/SBC and write a program to turn ON/OFF Linear/Rotary Actuator through IoT when sensor data is detected.
6. To interface Bluetooth/Wifi with microcontroller/SBC and write a program to send sensor data to smart phone using Bluetooth/wifi.

TOTAL : 60 PERIODS

21154E53A	CAD/CAM	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To Introduce and understand the Basic of Design.
2 To study the two dimensional drafting and bill of material creation.
3 To learn three dimensional modelling and its advantages.
4 To study the basic and purpose of assembling modeling.
5 To study the basics of computer aided machining and part programming.

UNIT – I BASICS OF DESIGNS **9**

Understanding of Projections, Scales, units, GD & T; its 14 symbols, Special characteristics & Title Block readings. Revision / ECN status of drawings – Customer Specific requirements – Drawing Gridreading

UNIT – II 2D DRAFTING **9**

Projection views – Orthographic view, Axillary view, Full & Half Section views, Broken Section view, Offset Section view – Title Block creation – BOM Creation – Notes creation – Ballooning of 2D drawing and its features for Inspection reporting

UNIT – III 3D MODELING **9**

Conversion of Views – 2D to 3D & 3D to 2D – Parametric and Non-Parametric Modeling – Tree features of 3D Modeling and its advantages – Surface Modeling – BIW (Body In White) – Solid Modeling, Boolean operations like Unites, Subtraction, Intersect, etc.

UNIT – IV ASSEMBLY MODELING **9**

Basics of Assembly modeling, Purpose of Assembly modeling & amp; its advantages – Top to Down & BottomUp modeling approaches – Analysis of Clearances – Undercuts – Interferences – Stack up analysis –Cumulative effect of Tolerances in after assembly conditions.- motion analysis

UNIT – V CAM 9

Basics of CNC Machining — 3, 4 & 5 Axis machines - CNC and Part Programing, CAM programing 2D & 3D. Elements of CAM Orientation, Boundary Creation, Cutter Path Selection, Cutter Compensation –Machining Stocks, Roughing, Re-roughing, Semi Finishing & Finishing - Tool Path Generation, Isl and Milling Programing. Machining program simulation, integration of program with machine; Estimation of CNC Cycle time. — Post Process NC Code conversion and Setup Sheet Preparation.

TOTAL : 45 PERIODS

OUTCOMES: At the end of the course the students would be able to

1. Discuss the basics of the design and concepts.
2. Develop the two dimensional drafting and projection views.
3. Discuss the three dimensional modeling, parametric and Non-parametric modeling
4. Discuss the assembly modeling and top down, bottom up approaches.
5. Develop the computer aided machining and wirting part programming.

TEXT BOOKS:

1. Computer Aided Design & Manufacturing - Jacob Moses & Ruchi Agarwal
2. CAD / CAM Principles & Application - J. Srinivas

REFERENCES:

1. CAD / CAM - Ibrahim Zaid (Text & Reference Book)
2. CAD / CAM – Chandandeep Grewal
3. CAD CAM & Automation - FarazdakHaideri (Text & Reference Book)
4. Computer Aided Design & Manufacturing – Anup Goel
5. CAD / CAM – PN Rao

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4	3	2	2	2	2				1			1	3	3	2
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Low (1) ; Medium (2) ; High (3)															

21154E53B VALUE EGNINEERING

L T P C
3 0 0 3

COURSE OBJECTIVES

1. To study the value engineering process and able to identify its functions within the process.
2. To determine the appropriate value engineering methodology for a given project and proposeappropriate training to centralized and decentralized modes.
3. To learn various decision-making processes and cost evaluation models and apply them inappropriately in the product development life-cycle.
4. To explore in-depth understanding of various value engineering applications in humanresources, manufacturing and marketing.
5. To demonstrate to implement value engineering solutions and propose to perfect them.

UNIT – I VALUE ENGINEERING BASICS 9

Origin of value engineering - Meaning of value engineering - Definition of value engineering and Value analysis- Value Management - Value Analysis Versus Value Engineering - Value Analysis versus Traditional cost reduction techniques - Types of Value function — Basic and Secondary functions - conceptof cost and worth - creativity In Value Engineering - uses, applications, advantages and limitations of Valueanalysis.

UNIT – II VALUE ENGINEERING JOB PLAN AND PROCESS 9

Seven phases of job plan - FAST Diagramming as Value Engineering Tool - Behavioral and organizational aspects of Value Engineering - Ten principles of Value analysis - Benefits of Value Engineering.

UNIT – III VALUE ENGINEERING TECHNIQUES 9

Creativity - Brain storming - Gordon technique - Morphological Analysis - ABC Analysis- Probabilistic approach - Make or Buy decisions — Function cost worth analysis (FCWA) - Function Analysis System technique (FAST) - Break Even Analysis - Life cycle cost(LCC)

UNIT – IV WORKSHEETS AND GUIDELINES 9

Preparation of worksheets - general and information phase - Function Classification, relationship and summary - Meaningful costs - Cost analysis - idea listing and comparison - Feasibility ranking - Investigator phase, study summary - guidelines for writing value engineering proposal - Financial aspects - List cycle cost analysis - Oral presentation - Audit - Case studies and Discussion.

UNIT – V VERSATILITY OF VALUE ENGINEERING 9

Value engineering operation in maintenance and repair activities - value engineering in non hardware projects - Initiating a value engineering programme Introduction - training plan - career development for value engineering specialties.

Total :45 Periods

OUTCOMES: At the end of the course the students would be able to

1. Estimate a product cost based on value engineering principles in terms of its values, functions and worthiness.
2. Discuss the product and articulate it in various phases of value engineering
3. Discuss and select appropriate methods, standards and apply them on value engineering project and propose appropriate training
4. Apply querying theory and FAST to prefect a value engineering project implementation.
5. Develop various case studies related to value engineering project implementation.

TEXT BOOKS:

1. Iyer. S.S., “Value Engineering”, New Age International (P) Limited, 9th Edition, 2009 3Ed”, , 2009.
2. Anil Kumar. and Mukhopadhyaya., “Value Engineering: Concepts Techniques and applications”, SAGE Publications, 1st Edition, 2003.

REFERENCES:

1. Del L. Younker., "Value Engineering: analysis and methodology", CRC Press, 2003.
2. Richard Park., "Value Engineering A Plan for Invention", CRC Press, 1998.
3. Arthur E. Mudge., "Value Engineering :A systematic approach", McGraw Hill, 1989.
4. Alphonse Dell'Isola., "Value Engineering: Practical Applications...for Design, Construction, Maintenance and Operations", R.S. Means Company, 1997.
5. Lawrence D. Miles., "Techniques of Value Analysis and Engineering", Lawrence D. Miles Value Foundation, 3rd Edition, 2015.

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	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
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3	1			1			1	2	1		3	1	1	2	1
4	1			1			1	2	1		3	1	1	2	1
5	1			1			1	2	1		3	1	1	2	1
Low (1) ; Medium (2) ; High (3)															

21154E53C **PRODUCT LIFE CYCLE MANAGEMENT**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. To study about the history, concepts and terminology in PLM
2. To learn the functions and features of PLM/PDM
3. To develop different modules offered in commercial PLM/PDM tools
4. To demonstrate PLM/PDM approaches for industrial applications
5. To use PLM/PDM with legacy data bases, Coax& ERP systems

UNIT – I HISTORY, CONCEPTS AND TERMINOLOGY OF PLM 9

Introduction to PLM, Need for PLM, opportunities of PLM, Different views of PLM - Engineering Data Management (EDM), Product Data Management (PDM), Collaborative Product Definition Management (cPDm), Collaborative Product Commerce (CPC), Product Lifecycle Management (PLM). PLM/PDM Infrastructure — Network and Communications, Data Management, Heterogeneous data sources and applications

UNIT – II PLM/PDM FUNCTIONS AND FEATURES 9

User Functions – Data Vault and Document Management, Workflow and Process Management, Product Structure Management, Product Classification and Programme Management. Utility Functions —Communication and Notification, data transport, data translation, image services, system administration and application integration

UNIT – III DETAILS OF MODULES IN A PDM/PLM SOFTWARE 9

Case studies based on top few commercial PLM/PDM tools — Teamcenter, Windchill, ENOVIA, Aras PLM, SAP PLM, Arena, Oracle Agile PLM and Autodesk Vault.-Architecture of PLM software- selection criterion of software for particular application - Brand name to be removed

UNIT – IV ROLE OF PLM IN INDUSTRIES 9

Case studies on PLM selection and implementation (like auto, aero, electronic) - other possible sectors, PLM visioning, PLM strategy, PLM feasibility study, change management for PLM, financial justification of PLM, barriers to PLM implementation, ten step approach to PLM, benefits of PLM for–business, organisation, users, product or service, process performance- process compliance and process automation

UNIT – V BASICS ON CUSTOMISATION/INTEGRATION OF PDM/PLM SOFTWARE 9

PLM Customization, use of EAI technology (Middleware), Integration with legacy data base, CAD, SLM and ERP

TOTAL: 45 PERIODS

OUTCOMES: At the end of the course the students would be able to

1. Summarize the history, concepts and terminology of PLM
2. Develop the functions and features of PLM/PDM
3. Discuss different modules offered in commercial PLM/PDM tools.
4. Interpret the implement PLM/PDM approaches for industrial applications.
5. Integrate PLM/PDM with legacy data bases, CAx& ERP systems

TEXT BOOKS:

1. Product Lifecycle Management for a Global Market, Springer; 2014 edition (29 September2016),ISBN-10 : 3662516330
2. Product Life Cycles and Product Management, Praeger Publishers Inc (27 March 1989)ISBN-10 : 0899303196

REFERENCES:

1. AnttiSaaksvuori and AnselmiImmonen, “Product Lifecycle Management”, Springer Publisher, 2008 (3rd Edition)

2. IvicaCrnkovic, Ulf Asklund and AnnitaPerssonDahlqvist, “Implementing and Integrating Product Data Management and Software Configuration Management”, Artech House Publishers, 2003.
3. John Stark, “Global Product: Strategy, Product Lifecycle Management and the Billion Customer Question”, Springer Publisher, 2007
4. John Stark, “Product Lifecycle Management: 21st Century Paradigm for Product Realisation”, Springer Publisher, 2011 (2nd Edition).
5. Michael Grieves, “Product Life Cycle Management”, Tata McGraw Hill, 2006.

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	1	1	3	1				1	1			1	1	3	3
2	1	1	3	1				1	1			1	1	3	3
3	1	1	3	1				1	1			1	1	3	3
4	1	1	3	1				1	1			1	1	3	3
5	1	1	3	1				1	1			1	1	3	3

Low (1) ; Medium (2) ; High (3)

21154E54A	ROBOTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To learn about basics of robots and their classifications
2. To understand the robot kinematics in various planar mechanisms
3. To learn about the concepts in robot dynamics
4. To understand the concepts in trajectory planning and programming
5. To know about the various applications of robots

UNIT – I BASICS OF ROBOTICS 8

Introduction- Basic components of robot-Laws of robotics- classification of robot- robot architecture, work space-accuracy-resolution –repeatability of robot.

UNIT – II ROBOT KINMEATICS 11

Robot kinematics: Introduction- Matrix representation- rigid motion & homogeneous transformation- D-H, forward & inverse kinematics of 2DOF and 3 DOF planar and spatial mechanisms

UNIT – III ROBOT DYNAMICS 9

Introduction - Manipulator dynamics – Lagrange - Euler formulation- Newton - Euler formulation

UNIT – IV TRAJECTORY, PATH PLANNING AND PROGRAMMING 8

Trajectory Planning- Joint space and Cartesian space technique, Introduction to robot control, Robot programming and Languages- Introduction to ROS

UNIT – V ROBOT AND ROBOT APPLICATIONS 9

Sensors and Actuators for Robots, Power transmission systems, Rotary to rotary motion, Rotary to linear motion, Harmonics drives — gear system - belt drives. Robot end effectors & Grippers: Introduction- types & classification- Mechanical gripper- gripper force analysis- other types & special purpose grippers. Robot Applications: pick and place, manufacturing, automotive, medical, space and underwater.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon completion of this course, the students can able to
CO1: State the basic concepts and terminologies of robots
CO2:Know the Procedures for Forward and Inverse Kinematics, Dynamics for Various Robots
CO3: Derive the Forward and Inverse Kinematics, Dynamics for Various Robots
CO4:Apply the various programming techniques in industrial applications
CO5: Analyze the use of various types of robots in different applications

Mapping of COs with POs and PSOs															
COs/POs&PSOs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3	1	2							1	2	1	3
CO2	3	2	3	1	2							1	2	1	3
CO3	3	2	3	1	2							1	2	1	3
CO4	3	2	3	1	2							1	2	2	3
CO5	3	2	3	1	3							1	2	2	3
CO/PO & PSO Average	3	2	3	1	2.2							1	2	1.4	3
1 – Slight, 2 – Moderate, 3 – Substantial															

TEXT BOOKS:

1. John.J.Craig, " Introduction to Robotics: Mechanics & control", Pearson Publication, Fourth edition, 2018.
2. K.S.Fu, R.C.Gonzalez, C.S.G.Lee, "Robotics: Sensing, Vision & Intelligence", Tata McGraw-Hill Publication, First Edition, 1987.

REFERENCES:

1. M.P.Groover, M.Weiss ,R.N. Nagal, N.G.Odrey, "Industrial Robotics - Technology, programming and Applications" Tata , McGraw-Hill Education Pvt Limited 2ndEdition, 2012.
2. Jazar, "Theory of Applied Robotics: Kinematics, Dynamics and Control", Springer, 2ndEdition, 2010
3. S K Saha, Introduction to Robotics, Tata McGraw-Hill, ISBN: 9789332902800, Second Edition, 9789332902800
4. Sathya Ranjan Deb, "Robotics Technology & flexible Automation" Second edition, Tata McGraw-Hill Publication, 2009.

21154E54B	SMART MOBILITY AND INTELLIGENT VEHICLES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The objectives of the course are:

1. To introduce students to the various technologies and systems used to implement smart mobility and intelligent vehicles.
2. To learn Basics of Radar Technology and Systems, Ultrasonic Sonar Systems, LIDAR Sensor Technology and Systems and other sensors for automobile vision system.
3. To learn Basic Control System Theory applied to Autonomous Automobiles.
4. To produce overall impact of automating like various driving functions, connecting the automobile to sources of information that assist with a task
5. To allow the automobile to make autonomous intelligent decisions concerning future actions of the vehicle that potentially impact the safety of the occupants through connected car & autonomous vehicle technology.

UNIT – I INTRODUCTION TO AUTOMATED, CONNECTED, AND INTELLIGENTVEHICLES 9

Concept of Automotive Electronics, Electronics Overview, History & Evolution, Infotainment, Body, Chassis, and Powertrain Electronics, Introduction to Automated, Connected, and Intelligent Vehicles. Case studies: Automated, Connected, and Intelligent Vehicles

UNIT – II SENSOR TECHNOLOGY FOR SMART MOBILITY 9

Basics of Radar Technology and Systems, Ultrasonic Sonar Systems, Lidar Sensor Technology and Systems, Camera Technology, Night Vision Technology, Other Sensors, Use of Sensor Data Fusion, Integration of Sensor Data to On-Board Control Systems

UNIT – III CONNECTED AUTONOMOUS VEHICLE 9

Basic Control System Theory applied to Automobiles, Overview of the Operation of ECUs, Basic Cyber-Physical System Theory and Autonomous Vehicles, Role of Surroundings Sensing Systems and Autonomy, Role of Wireless Data Networks and Autonomy

UNIT – IV VEHICLE WIRELESS TECHNOLOGY & NETWORKING 9

Wireless System Block Diagram and Overview of Components, Transmission Systems — Modulation/Encoding, Receiver System Concepts– Demodulation/Decoding, Wireless Networking and Applications to Vehicle Autonomy, Basics of Computer Networking — the Internet of Things, Wireless Networking Fundamentals, Integration of Wireless Networking and On-Board Vehicle Networks

UNIT – V CONNECTED CAR & AUTONOMOUS VEHICLE TECHNOLOGY 9

Connectivity Fundamentals, Navigation and Other Applications, Vehicle-to-Vehicle Technology and Applications, Vehicle-to-Roadside and Vehicle-to-Infrastructure Applications, Autonomous Vehicles - Driverless Car Technology, Moral, Legal, Roadblock Issues, Technical Issues, Security Issues

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon successful completion of the course, students should be able to:

CO1: Recognize the concept of cyber-physical control systems and their application to collision avoidance and autonomous vehicles

CO2: Select the concept of remote sensing and the types of sensor technology needed to implement remote sensing

CO3: Familiar with the concept of fully autonomous vehicles

CO4: Apply the basic concepts of wireless communications and wireless data networks

CO 5: Analyze the concept of the connected vehicle and its role in automated vehicles

Mapping of COs with POs and PSOs															
COs/POs &PSOs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1		1						1	2	1	1
CO2	3	2	1	1		1						1	2	1	1
CO3	3	2	1	1		1						1	2	1	1
CO4	3	2	1	1		1						1	2	1	1
CO5	3	2	1	1		1						1	2	1	1
CO/PO & PSO Average	3	2	1	1		1						1	2	1	1
1 – Slight, 2 – Moderate, 3 –															

TEXT BOOKS

1. “Intelligent Transportation Systems and Connected and Automated Vehicles”, 2016, Transportation Research Board
2. Radovan Miucic, “Connected Vehicles: Intelligent Transportation Systems”, 2019, Springer

REFERENCE:

1. Tom Denton, “Automobile Electrical and Electronic systems, Roultedge”, Taylor & Francis Group,5th Edition,2018.

21154E54C **ELECTRICAL DRIVES AND ACTUATORS**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To familiarize a relay and power semiconductor devices
2. To get a knowledge on drive characteristics
3. To obtain the knowledge on DC motors and drives.
4. To obtain the knowledge on AC motors and drives.
5. To obtain the knowledge on Stepper and Servo motor.

UNIT – I RELAY AND POWER SEMI-CONDUCTOR DEVICES 9

Study of Switching Devices – Relay and Types, Switching characteristics -BJT, SCR, TRIAC, GTO, MOSFET, IGBT and IGCT-: SCR, MOSFET and IGBT - Triggering and commutation circuit - Introduction to Driver and snubber circuits

UNIT – II DRIVE CHARACTERISTICS 9

Electric drive – Equations governing motor load dynamics – steady state stability – multi quadrant Dynamics: acceleration, deceleration, torque, and Direction starting & stopping – Selection ofmotor.

UNIT – III DC MOTORS AND DRIVES 9

DC Servomotor - Types of PMDC & BLDC motors - principle of operation- emf and torque equations - characteristics and control – Drives- H bridge - Single and Three Phases – 4 quadrantoperation — Applications

UNIT – IV AC MOTORS AND DRIVES 9

Introduction – Induction motor drives – Speed control of 3-phase induction motor – Stator voltage control – Stator frequency control – Stator voltage and frequency control – Stator current control– Static rotor resistance control – Slip power recovery control.

UNIT – V STEPPER AND SERVO MOTOR 9

Stepper Motor: Classifications- Construction and Principle of Operation – Modes of Excitation-Drive System-Logic Sequencer - Applications. Servo Mechanism – DC Servo motor-AC Servo motor — Applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the student able to:

CO 1: Recognize the principles and working of relays, drives and motors.
CO 2: Explain the working and characteristics of various drives and motors.
CO 3: Apply the solid state switching circuits to operate various types of Motors and Drivers
CO 4: Interpret the performance of Motors and Drives.
CO 5: Suggest the Motors and Drivers for given applications.

Mapping of COs with POs and PSOs															
COs/Pos&PSOs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1	2	1							1	1		3
CO2	3	1	2	2	1							1	1		3
CO3	3	1	2	2	1							1	1		3
CO4	3	1	1	2	2							1	1		3
CO5	3	1	1	2	2							1	1		3
CO/PO & PSO Average	3	1	1.4	2	1.4							1	1		3
1 – Slight, 2 – Moderate, 3 Substantial															

21154E55A **AUTOMOBILE ENGINEERING**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1 To study the construction and working principle of various parts of an automobile.
2 To study the practice for assembling and dismantling of engine parts and transmission system
3 To study various transmission systems of automobile.
4 To study about steering, brakes and suspension systems
5 To study alternative energy sources

UNIT – I VEHICLE STRUCTURE AND ENGINES 9

Types of automobiles vehicle construction and different layouts, chassis, frame and body, Vehicle aerodynamics (various resistances and moments involved), IC engines — components-functions and materials, variable valve timing (VVT).

UNIT – II ENGINE AUXILIARY SYSTEMS 9

Electronically controlled gasoline injection system for SI engines, Electronically controlled diesel injection system (Unit injector system, Rotary distributor type and common rail direct injection system), Electronic ignition system (Transistorized coil ignition system, capacitive discharge ignition system), Turbo chargers (WGT, VGT), Engine emission control by three way catalytic converter system, Emission norms (Euro and BS).

UNIT – III TRANSMISSION SYSTEMS 9

Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Overdrive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints, Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.

UNIT – IV STEERING, BRAKES AND SUSPENSION SYSTEMS 9

Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock Braking System (ABS),electronicbrake force distribution (EBD) and Traction Control.

UNIT – V ALTERNATIVE ENERGY SOURCES 9

Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles- Engine modifications required –Performance, Combustion and Emission Characteristics of SI and CI engines with these alternate fuels - Electric and Hybrid Vehicles, Fuel Cell Note: Practical Training in dismantling and assembling of Engine parts and Transmission Systems should be given to the students.

TOTAL:45 PERIODS

OUTCOMES: At the end of the course the students would be able to

1. Recognize the various parts of the automobile and their functions and materials.
2. Discuss the engine auxiliary systems and engine emission control.
3. Distinguish the working of different types of transmission systems.
4. Explain the Steering, Brakes and Suspension Systems.
5. Predict possible alternate sources of energy for IC Engines.

TEXT BOOKS:

1 Jain K.K. and Asthana .R.B, “Automobile Engineering” Tata McGraw Hill Publishers, New Delhi, 2002.

REFERENCES:

1. Ganesan V. “Internal Combustion Engines”, Third Edition, Tata McGraw-Hill, 2012.
2. Heinz Heisler, “Advanced Engine Technology,” SAE International Publications USA, 1998.
3. Joseph Heitner, “Automotive Mechanics,” Second Edition, East-West Press, 1999.
4. Martin W, Stockel and Martin T Stockle , “Automotive Mechanics Fundamentals,” The Good heart - Will Cox Company Inc, USA ,1978.
5. Newton, Steeds and Garet, “Motor Vehicles”, Butterworth Publishers,1989.

21154E55B	DESIGN CONCEPTS IN ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1	To study the various design requirements and get acquainted with the processes involvedin product development.
2	To study the design processes to develop a successful product.
3	To learn scientific approaches to provide design solutions.
4	Designing solution through relate the human needs and provide a solution.
5	To study the principles of material selection, costing and manufacturing in design.

UNIT – I DESIGN TERMINOLOGY 9

Definition-various methods and forms of design-importance of product design-static and dynamic products-various design projects-morphology of design-requirements of a good design-concurrent engineering-computer aided engineering-codes and standards-product and process cycles-bench marking.

UNIT – II INTRODUCTION TO DESIGN PROCESSES 9

Basic modules in design process-scientific method and design method-Need identification, importance of problem definition-structured problem, real life problem- information gathering -customer requirements-Quality Function Deployment (QFD)- product design specifications-generation of alternative solutions-Analysis and selection-Detail design and drawings-Prototype, modeling, simulation, testing and evaluation

UNIT – III CREATIVITY IN DESIGN 9

Creativity and problem solving-vertical and lateral thinking-invention-psychological view, mental blocks-Creativity methods-brainstorming, synectics, force fitting methods, mind map, concept map-Theory of innovative problem solving (TRIZ) - conceptual decomposition creating design concepts.

UNIT – IV HUMAN AND SOCIETAL ASPECTS IN PRODUCT DEVELOPMENT 9

Human factors in design, ergonomics, user friendly design-Aesthetics and visual aspects environmental aspects-marketing aspects-team aspects-legal aspects-presentation aspects

UNIT – V MATERIAL AND PROCESSES IN DESIGN 9

Material selection for performance characteristics of materials-selection for new design substitution for existing design-economics of materials-selection methods-recycling and material selection-types of manufacturing process, process systems- Design for Manufacturability (DFM) - Design for Assembly (DFA).

Total:45 periods

OUTCOMES: At the end of the course the students would be able to

1. Analyze the various design requirements and get acquainted with the processes involved in product development.
2. Apply the design processes to develop a successful product.
3. Apply scientific approaches to provide design solutions.
4. Design solution through relate the human needs and provide a solution.
5. Apply the principles of material selection, costing and manufacturing in design.

TEXT BOOKS:

1. Dieter. G. N., Linda C. Schmidt, “Engineering Design”, McGraw Hill, 2013..
2. Horenstein, M. N., Design Concepts for Engineers, Prentice Hall, 2010.

REFERENCES:

1. Dhillon, B. S., Advanced Design Concepts for Engineers, Technomic Publishing Co., 1998.
2. Edward B. Magrab, Satyandra K. Gupta, F. Patrick McCluskey and Peter A. Sandborn, “Integrated Product and Process Design and Development”, CRC Press, 2009.
3. James Garratt, “Design and Technology”, Cambridge University Press, 1996.
4. Joseph E. Shigley, Charles R.Mische, and Richard G. Budynas, “Mechanical Engineering Design”, McGraw Hill Professional, 2003.
5. Sumesh Krishnan and MukulSukla, Concepts in Engineering Design, Notion Press, 2016.

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	2	2	2					1			1	2	1	1
2	2	2	2	2					1			1	2	1	1
3	2	2	2	2					1			1	2	1	1
4	2	2	2	2					1			1	2	1	1
5	2	2	2	2					1			1	2	1	1
Low (1) ; Medium (2) ; High (3)															

21154E63C **TURBO MACHINES**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. To study the energy transfer in rotor and stator parts of the turbo machines.
2. To study the function of various elements of centrifugal fans and blowers.
3. To evaluating the working and performance of centrifugal compressor
4. To analyzing flow behavior and flow losses in axial flow compressor.
5. To study the types and working of axial and radial flow turbines.

UNIT – I WORKING PRINCIPLES 9

Classification of Turbomachines. Energy transfer between fluid and rotor - Euler equation and its interpretation. Velocity triangles. Efficiencies in Compressor and Turbine stages. Degree of reaction. Dimensionless parameters for Turbomachines.

UNIT – II CENTRIFUGAL FANS AND BLOWERS 9

Types – components – working. Flow analysis in impeller blades-volute and diffusers. Velocity triangles - h-s diagram. Stage parameters in fans and blowers. Performance characteristic curves – various losses. Fan – bearings, drives and noise.

UNIT – III CENTRIFUGAL COMPRESSOR 9

Components - blade types. Velocity triangles - h-s diagram, stage work. Slip factor and Degree of Reaction. Performance characteristics and various losses. Geometry and performance calculation.

UNIT – IV AXIAL FLOW COMPRESSOR 9

Construction details. Work done factor. Velocity triangles - h-s diagram, stage work. Work done factor. Performance characteristics, efficiency and stage losses – Stalling and Surging. Free and Forced vortexflow.

UNIT – V AXIAL AND RADIAL FLOW TURBINES 9

Axial flow turbines - Types – Elements - Stage velocity diagrams - h-s diagram, stage work - impulse and reaction stages. Compounding of turbines. Performance coefficients and losses. Radial flow turbines: Types -Elements - Stage velocity diagrams - h-s diagram, stage work Performance coefficients and losses.

TOTAL : 45 PERIODS

OUTCOMES: At the end of the course the students would be able to

1. Explain the energy transfer in rotor and stator parts of the turbo machines.
2. Explain the function of various elements of centrifugal fans and blowers
3. Evaluate the working and performance of centrifugal compressor.
4. Analyze flow behavior and flow losses in axial flow compressor.
5. Explain the types and working of axial and radial flow turbines

TEXT BOOKS:

1. Ganesan, V., “Gas Turbines”, 3rd Edition, Tata McGraw Hill, 2011. .
2. Yahya, S.M., “Turbines, Compressor and Fans”, 4th Edition, Tata McGraw Hill, 2011.

REFERENCES:

1. Dixon, S.L., “Fluid Mechanics and Thermodynamics of Turbomachinery”, 7th Edition, Butterworth-Heinemann, 2014.
2. Gopalakrishnan. G and Prithvi Raj. D,” A Treatise on Turbomachines”, Scitech Publications (India) Pvt. Ltd., 2nd Edition, 2008.
3. Lewis, R.I., “Turbomachinery Performance Analysis” 1st Edition, Arnold Publisher, 1996.
4. Saravanamutto, Rogers, Cohen, Straznicky., “Gas Turbine Theory” 6th Edition, Pearson Education Ltd, 2009.
5. Venkanna, B.K., “Fundamentals of Turbomachinery”, PHI Learning Pvt. Ltd., 2009.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	1	1					1			1	3	2	1

2	2	1	1	1					1			1	3	2	1
3	2	1	1	1					1			1	3	2	1
4	2	1	1	1					1			1	3	2	1
5	2	1	1	1					1			1	3	2	1
Low (1) ; Medium (2) ; High (3)															

21154E64A MATERIAL HANDLING AND SOLID PROCESSING **EQUIPMENT**

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES

1. To provide knowledge on materials handling equipment.
2. To provide knowledge on Industrial Vehicles
3. To provide knowledge on conveyor equipment.
4. To provide knowledge on Auxiliary Equipment and Hoisting Equipment.
5. To provide knowledge on Bulk Handling Equipment and Systems

UNIT – I INTRODUCTION TO MATERIALS HANDLING 9

Basic principles &objectives in material handling and its benefits - Classification of material handling equipment - selection of material handling equipments - guidelines for effective utilisation of material handling equipments -unit load concept

UNIT – II INDUSTRIAL VEHICLES 9

Introduction and types - Hand trucks - Two wheel Hand Trucks - Multiple wheel Hand Trucks - Hand Lift Trucks - Power Trucks - Fixed Platform Truck - Platform Lift Truck - Pallet Lift Truck - Walkie Truck - Straddle Carrier - Fork Lift Trucks - Specifications of FLT - FLT Attachments - Tractors - Industrial Tractor-Trailer-Self-propelled trucks and fork trucks - Automated guided vehicles Theory

UNIT – III CONVEYORS 9

Classification of conveyors- Definition - Description - General Characteristics - types and uses of belt Conveyors - Roller conveyors - Haulage Conveyors - Screw Conveyors - Bucket Conveyors - Chain Conveyors - Cable Conveyors - Pneumatic and Hydraulic conveyors - Computer controlled conveyor system.

UNIT – IV AUXILIARY EQUIPMENTAND HOISTING EQUIPMENT 9

Hoppers - Gates- Feeders- Chutes-positioners- Ball Table- Weighing and Control Equipment- Pallet loaders and unloaders -applications and advancements. - Hoisting Equipment - parts of hoisting equipment - Description and uses of hoists - Description and uses of ropes - description and purpose of crane hooks - Elevators - Cranes - Derricks - and its types

UNIT – V BULK HANDLING EQUIPMENT AND SYSTEMS 9

Storage of bulk solids - bulk handling equipment - Robotic handling - Materials handling at the workplace - Robots and their classification - Major components of a robot - classification of Robotic manipulators - Robotic handling applications

TOTAL:45 PERIODS

OUTCOMES: At the end of the course the students would be able to

1. Discuss the basic concepts of material handling equipment.
2. Explain the basic working principles of various industrial Vehicles.
3. Develop the basic working principles of various conveyors.
4. Elabrate the basic working principles of various Auxiliary Equipment and Hoisting Equipment.
5. Explain the basic working principles of various Bulk Handling Equipment and Systems.

TEXT BOOKS:

1. Allegri (Sr.), T.H., Material Handling — Principles and Practices, CBS Publishers and Distributors,Delhi, 1987.
2. Siddharta Ray, Introduction to Materials Handling, New Age International Publishers

REFERENCES:

1. Bolz, H. A and Hagemann, G. E (ed.), ''Materials Handling Handbook'', Ronald Press
2. 8005:1976, Classification of Unit Loads, Bureau of Indian Standards.
3. Apple, J.A., ''Material Handling System Design'', John Wiley & Sons
4. Theodore H., Allegre Sr., Material Handling Principles and Practice, CBS Publishers and Distributors
5. Immer J. R., Material Handling, Tata McGraw Hill Publication.

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	1	1	1				1			1	1	2	2
2	2	1	1	1	1				1			1	1	2	2
3	2	1	1	1	1				1			1	1	2	2
4	2	1	1	1	1				1			1	1	2	2
5	2	1	1	1	1				1			1	1	2	2
Low (1) ; Medium (2) ; High (3)															

21154E64B	THERMAL AND FIRED EQUIPMENT DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To introduce the concepts of thermal and fired equipment.
2. To study the basis, design and construction of boilers.
3. To study of typical fuel firing systems in the boiler.
4. To study of materials requirements for pressure parts.
5. To study of various boiler auxiliaries system.

UNIT – I INTRODUCTION 9

Principal equipment in Thermal Power Plant, Historical developments of Boiler, Utility, Industrial boilers, Morden trends in boiler design , Basic knowledge of different types of Thermal Fired Equipment ,sub critical and super critical boilers - Coal , Oil ,Gas , Pulverised fuel cyclone, FBC, CFBC , MSW , and Stoker firing, Boiler efficiency , auxiliary power consumption , Performance data , Performance Correction Curves

UNIT – II BASIS OF BOILERS AND DESIGN 9

Codes- Design and Construction, IBR, ISO, ASME, BS, Heat balance diagram, Boiler parameters, Fuel analysis and variations, Site conditions, Furnace heat loadings, FOT, Plan area loading, Volumetric loading Balanced Draft and Pressurised Furnace, Natural / Controlled Circulation, Constant and Sliding Pressure, Boiler heat transfer surfaces, Flue gas velocities, boiler auxiliaries, Boiler schemes, Boiler Layouts

UNIT – III FIRING SYSTEM- FUEL AND MILLING 9

Coal / Oil / Natural Gas in any combination, Lignite, Blast Furnace Gas / Coke Oven Gas / Corex Gas Carbon Monoxide / Tail gas, Asphalt, Black Liquor, Bagasse, Rice Husk, Washery Rejects, Wheat / Rice straw MSW, wind box, Burner, Type of Stokers, Pulverisers - Bowl mill, Tube mill, Direct firing, Indirect firing, Wall firing (Turbulent / Vortex Burners), Tangential firing (Jet Burners), Fire Ball.

UNIT – IV PRESSURE PARTS AND DESIGN AND MATERIALS 9

Economiser, Drums , Water Walls , Headers , Links , Super Hater , Super Heaters , Reheaters, Tubes , Spiral Tubes , Surface area , Free Gas Area , Metal temperature , LMTD , Acid Due Point Temperature , Carbon steel , Low alloy steel , Titanium alloy steel

UNIT – V BOILER AUXILIARIES 9

Air preheaters (APH) – bi sector APH , Tri sector APH, Cold PA System, Hot PA System, Tubular APH, Steam coil Air preheater , FANS – Axial, Radial, Performance curves, MILLS- Tube , Vertical mills , Air quality Control systems ,DustCollection System - Mechanical Precipitator, Electrostatic Precipitator, FGD , SCR , SNCR

TOTAL:45 PERIODS

OUTCOMES: At the end of the course the students would be able to

1. Explain the concepts of thermal and fired equipment.
2. Discuss the basis, design and construction of boilers.
3. Describe of typical fuel firing systems in the boiler.
4. Discuss the materials requirements for pressure parts.
5. Discuss of various boiler auxiliaries system.

TEXT BOOKS:

1. A Course in Power Plant Engineering; Dhanapat Rai and Sons - Domkundwar
2. Power Plant Engineering by B. Vijaya Ramnath C. Elanchezhian, L. Saravanakumar

REFERENCES:

1. Elwakil M, Power Plant Technology, McGraw Hill, New York, 1964
2. Steam Generators and Waste Heat Boilers: For Process and Plant Engineers (Mechanical Engineering) by V. Ganapathy
3. Steam Generators: Description and Design by Donatello Annaratone

4. An Introduction to Coal and Wood Firing Steam Generators (Power Plants Engineering) by JPaul Guyer
5. Advances in Power Boilers (JSME Series in Thermal and Nuclear Power Generation)by Mamoru Ozawa and Hitoshi Asano | 28 January 2021

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
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3	2	1	3	1					1			1	2	3	2
4	2	1	3	1					1			1	2	3	2
5	2	1	3	1					1			1	2	3	2
Low (1) ; Medium (2) ; High (3)															

21154E64C **DESIGN CODES AND STANDARDS**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. To study the Codes and Standards and Need for them in the Industry
2. To know the different sources and the bodies that publish Codes and Standards
3. To familiarize the Government Regulations and its applicability
4. To familiarize with different codes used in Different Industry
5. To familiarize the Codes and Standards used in Process Industry

UNIT – I INTRODUCTION 9

Introduction to Codes and Standards. What is code? What is Standard?Need for codes and standards. Objective of Codes and Standards. Codes, Standards and Good Engineering Practices.

UNIT – II CODES 9

Codes and Standards used in Different Industry. Material, Design, Inspection and Construction Codes. Process Industry Codes. Machinery Design codes. Codes used in Oil and Gas Industry. Welding Codes. Machine Design. Automotive. HVAC. Performance Test Codes. Other Discipline codes

UNIT – III STANDARDS 9

Sources of Codes and Standards. Who publishes Codes and Standards? International Societies and Professional Bodies. Process of Standardisation and Code publishing in Professional Bodies and Companies. Interdisciplinary Codes.

UNIT – IV REGULATIONS 9

Government and Federal Regulations. Need for them. Indian and International Regulations. Standards organisations. Weather and Climatic codes. IS, ISO, IBR, OISD. Certification Bodies. Authorities and Engineers to certify. PE, Chartered Engineers

UNIT – V DESIGN CODES 9

Codes and Standards applicable in Process Industry Equipment Design. Pressure Vessel Design Codes. Heat Exchanger Design Codes. Wind and Seismic Codes. Machinery Codes. Package Equipment Design Codes. Performance Test Codes. ASTM, ASME, API, AWS, ANSI, ISO, ASHRAE.

TOTAL:45 PERIODS

OUTCOMES: At the end of the course the students would be able to

1. Explain the need for codes and Standards in Industry.
2. Discuss the different codes and standards used in different industry.
3. Discuss the sources of different codes and standards and the societies that publish them and how these are evolved
4. Explain need for Government regulations and Certification authorities and familiar with common regulations in India and International
5. Discuss knowledge of codes and standards used in Process equipment design for Oil and Gas Industry.

TEXT BOOKS:

1. Mechanical Engg. Handbook. ASME. ASTM.API
2. Perrys Chemical Engg Handbook

REFERENCES:

1. ASME
2. API
3. ISO, IBR, OISD
4. AWS
5. ISHRAE

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	3						1			1	1	2	2
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4	2	1	3						1			1	1	2	2
5	2	1	3						1			1	1	2	2
Low (1) ; Medium (2) ; High (3)															

21154E65A **POWER PLANT ENGINEERING**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1 To study the coal based thermal power plants.
2 To study the diesel, gas turbine and combined cycle power plants.
3 To learn the basic of nuclear engineering and power plants.
4 To learn the power from renewable energy
5 To study energy, economic and environmental issues of power plants

UNIT – I COAL BASED THERMAL POWER PLANT 9

Rankine cycle - improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants — Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.

UNIT – II DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS 9

Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimisation. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.

UNIT – III NUCLEAR POWER PLANTS 9

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANada Deuterium- Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

UNIT – IV POWER FROM RENEWABLE ENERGY 9

Hydro Electric Power Plants — Classification, Typical Layout and associated components including Turbines.Principle, Construction and working of Wind, Tidal, Solar Photo Voltaic (SPV), Solar Thermal, Geo Thermal,Biogas and Fuel Cell power systems.

UNIT – V ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS 9

Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

TOTAL:45 PERIODS

OUTCOMES: At the end of the course the students would be able to

1. Explain the layout, construction and working of the components inside a thermal power plant.
2. Explain the layout, construction and working of the components inside a Diesel, Gas and Combined cycle power plants.
3. Explain the layout, construction and working of the components inside nuclear power plants.
4. Explain the layout, construction and working of the components inside Renewable energy power plants
5. Explain the applications of power plants while extend their knowledge to power plant economics and environmental hazards and estimate the costs of electrical energy production.

TEXT BOOKS:

1. Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008.
2. A Textbook of Power Plant Engineeringby R.K. Rajput | 1 January 2016

REFERENCES:

1. El-Wakil. M.M., "Power Plant Technology", Tata McGraw – Hill Publishing Company Ltd., 2010.
2. Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.
3. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, "Power Plant Engineering", Second Edition, Standard Handbook of McGraw – Hill, 1998.

4. Power Plant Engineeringby B. Vijaya Ramnath C. Elanchezhian, L. Saravanakumar | 1 November 2019
5. Power Plant Engineering, As per AICTE: Theory and Practice by Dipak Kumar Mandal, Somnath Chakrabarti, et al. | 1 January 2019

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	1	1	1		1	3			1		1	2	2	1
2	3	1	1	1		1	3			1		1	2	2	1
3	3	1	1	1		1	3			1		1	2	2	1
4	3	1	1	1		1	3			1		1	2	2	1
5	3	1	1	1		1	3			1		1	2	2	1
Low (1) ; Medium (2) ; High (3)															

21154E65B **ENERGY CONSERVATION IN INDUSTRIES**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. To learn Quantifying the energy demand and energy supply scenario of nation and explaining the need for energy auditing for becoming environmentally benign
2. To Analyzing factors behind energy billing and applying the concept of demand side management for lowering energy costs
3. To learn Computing the stoichiometric air requirement for any given fuel and quantifying the energy losses associated with thermal utilities of industries
4. To Diagnosing the causes for under performance of various electrical utilities and suggesting remedies for improving their efficiency
5. To Applying CUSUM and other financial evaluation techniques to estimating the accruable energy savings/monetary benefits for any energy efficiency project

UNIT – I INTRODUCTION 9

Energy scenario of World, India and TN - Environmental aspects of Energy Generation — Material and Energy balancing - Energy Auditing: Need, Types, Methodology and Barriers. Role of Energy Managers. Basic instruments for Energy Auditing.

UNIT – II ELECTRICAL SUPPLY SYSTEMS 9

Electricity Tariff structures – Typical Billing - Demand Side Management - HT and LT supply - Power Factor – Energy conservation in Transformers – Harmonics

UNIT – III ENERGY CONSERVATION IN MAJOR THERMAL UTILITIES 9

Stoichiometry - Combustion principles. Energy conservation in: Boilers - Steam Distribution Systems - Furnaces - Thermic Fluid Heaters — Cooling Towers — D.G. sets. Insulation and Refractories - Waste HeatRecovery Devices.

UNIT – IV ENERGY CONSERVATION IN MAJOR ELECTRICAL UTILITIES 9

Energy conservation in: Motors - Pumps – Fans – Blowers - Compressed Air Systems - Refrigeration and Air Conditioning Systems - Illumination systems

UNIT – V ENERGY MONITORING, TARGETING, LABELLING AND ECONOMICS 9

Elements of Monitoring & Targeting System – CUSUM - Energy / Cost index diagram – Energy Labelling -Energy Economics – Cost of production and Life Cycle Costing - Economic evaluation techniques – Discounting and Non-Discounting - ESCO concept – PAT scheme

TOTAL :45 PERIODS

OUTCOMES: At the end of the course the students would be able to

1. Discuss Quantify the energy demand and energy supply scenario of nation and appreciate the need for energy auditing for becoming environmentally benign
2. Analyse factors behind energy billing and apply the concept of demand side management for lowering energy costs
3. Compute the stoichiometric air requirement for any given fuel and quantify the energy losses associated with thermal utilities of industries
4. Diagnose the causes for under performance of various electrical utilities and suggest remedies for improving their efficiency
5. Apply CUSUM and other financial evaluation techniques to estimate the accruable energy savings/monetary benefits for any energy efficiency project

TEXT BOOKS:

1. Guide book for National Certification Examination for “Energy Managers and Energy Auditors” (4 Volumes). Available at http://www.em-ea.org/gbook1.asp. This website is administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India.
2. K. Nagabhushan Raju, Industrial Energy Conservation Techniques: (concepts, Applications and Case Studies), Atlantic Publishers &Dist, 2007.

REFERENCES:

1. Abbi Y P, Shashank Jain., Handbook on Energy Audit and Environment Management, TERI Press, 2006.
2. Albert Thumann and Paul Mehta D, “Handbook of Energy Engineering”, 7thEdition, The Fairmont Press, 2013.
3. Murphy.W.R. and McKay.G, “Energy Management”, Butterworth, London 1982.
4. Paul W.O'Callaghan, Design and management for energy conservation: A handbook for energy managers, plant engineers, and designers, Pergamon Press, 1981.
5. Steve Doty, Wayne Turner C, Energy Management Handbook 7th Edition, The Fairmont Press, 2009.

21154E65C **BIOENERGY CONVERSION TECHNOLOGIES**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. To elucidate on biomass, types, availability, and characteristics
2. To study the bio-methanation process.
3. To impart knowledge on combustion of biofuels
4. To describe on the significance of equivalence ratio on thermochemical conversion ofbiomass
5. To provide insight to the possibilities of producing liquid fuels from biomass

UNIT – I **INTRODUCTION** **9**

Biomass: types – advantages and drawbacks – typical characteristics – proximate & ultimate analysis – comparison with coal - Indian scenario - carbon neutrality – biomass assessment studies – typical conversion mechanisms - densification technologies

UNIT – II **BIOMETHANATION** **9**

Biomethenation process – influencing parameters – typical feed stocks – Biogas plants: types and design, Biogas appliances – burner, luminaries and power generation systems – Industrial effluentbased biogas plants.

UNIT – III **COMBUSTION** **9**

Perfect, complete and incomplete combustion – stoichiometric air requirement for biofuels - equivalence ratio – fixed Bed and fluid Bed combustion

UNIT – IV **GASIFICATION, PYROLYSIS AND CARBONISATION** **9**

Chemistry of gasification - types – comparison – typical application – performance evaluation – economics. Pyrolysis - Classification - process governing parameters – Typical yield rates. Carbonization – merits of carbonized fuels – techniques adopted for carbonisation

UNIT – V **LIQUIFIED BIOFUELS** **9**

Straight Vegetable Oil (SVO) as fuel - Biodiesel production from oil seeds, waste oils and algae - Process and chemistry - Biodiesel Vs. Diesel – comparison on emission and performance fronts. Production of alcoholic fuels (methanol and ethanol) from biomass – engine modifications

TOTAL:45 PERIODS

OUTCOMES: At the end of the course the students would be able to

1. Estimate the surplus biomass availability of any given area.
2. Design a biogas plant for a variety of biofuels.
3. Determine and compare the cost of steam generation from biofuels with that of coal and petroleum fuels.

21154E66B	OPERATIONAL RESEARCH	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. To learn Selecting the constraints on the availability of resources and developing a model andrendering an optimal solution for the given circumstances.
2. To study Appraising the challenges in the transportation and production problems and furnishing a rational solution to maximize the benefits.
3. To learn Planning the purchase/ manufacturing policies, managing the spares/ stocks and meeting the customer demands.
4. To Analysing the queue discipline and exploring the avenues for better customer service.
5. To Investigating the nature of the project and offering methodical assistance towards decision making in maintenance.

UNIT – I INTRODUCTION TO OPERATIONS RESEARCH AND LINEAR PROGRAMMING 9

Operation Research: Definition – Models – Steps – Important topics – Scope - Tools. Linear Programing(LP): Introduction – Concept (Problem mix, Assumption, Properties) –Development (Problem formulation)
– Problems in: Graphical method, Simplex methods, Big M method.

UNIT – II TRANSPORTATION, ASSIGNMENT AND PRODUCTION SCHEDULING PROBLEMS 9

Transportation problems: Introduction, Model, Types — Problems in: Initial Basic (feasible) solution: Northwest Corner Cell method; Least Cost Cell method; Vogel's Approximation method and Optimal solution MODI (U-V) method. Assignment problems: Introduction,Types, Problems in Hungarian method. Production Scheduling problems: Introduction –Problems in Single Machine Scheduling: SPT; WSPT, EDDmethods – Problems inJohnson's Algorithm: n job 2 machines, n job 3 machines.

UNIT – III INVENTORY CONTROL MODELS & SYSTEMS 9

Inventory Control: Introduction, Models – Problems in Purchase and Production(Manufacturing) models with and without shortages – Theory on types of inventory control systems: P& Q, ABC, VED, FNS, XYZ, SDE and HML.

UNIT – IV QUEUING THEORY 9

Queuing Theory: Introduction; Applications; Terminology, Poisson process and exponential distribution – Problems in Single Server and Multi Server Queuing Models –Case study on simulation using Monte Carlotechnique.

UNIT – V PROJECT MANAGEMENT AND REPLACEMENT MODELS 9

Project Management: Introduction; Guidelines for Networking AOA Diagrams – Problems in Critical Path Method (CPM) & Program Evaluation Review Technique (PERT) – Differences of CPM & PERT. Replacement Problems: Types – Problems in: Determination of Economic Life of an Asset – Problems in:
Individual and Group Replacement Policies , Apply OR software

TOTAL :45 PERIODS

OUTCOMES: At the end of the course the students would be able to

1. Discuss the selection of the constraints on the availability of resources, develop a model and render an optimal solution for the given circumstances.
2. Explain the appraise the challenges in the transportation and production problems and furnish a rational solution to maximize the benefits.

3. Explain plan the purchase/ manufacturing policies, manage the spares/ stocks, and meet the customer demands.
4. Analyze the queue discipline and explore the avenues for better customer service.
5. Investigate the nature of the project and offer methodical assistance towards decision making in maintenance.

TEXT BOOKS:

1. Pannerselvam R, "Operations Research", 2nd Edition, PHI, 2009.
2. Hamdy A. Taha, "Operations Research an Introduction", 10th Edition, PHI/Pearson Education, 2017.

REFERENCES:

1. Ravindran, Phillips and Solberg, "Operations Research Principles and Practice", 2nd Edition, Wiley India, 2007.
2. Srinivasan G, "Operations Research Principles and Applications", 3 rd Edition EEEPHI, 2017.
3. Sharma J K, "Operations Research Theory and Applications",5th Edition, Macmillan India, 2013.
4. Premkumar Gupta and D.S.Hira, "Problems in Operations Research", S.Chand,2009.
5. Wayne L. Winston, "Operations Research Applications and Algorithms", 4th Edition, Cengage Learning, 2004.

CO	PO												PSO		
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1	2	3	3	2	2	1	1	1	1	1	2	2	2	2	2
2	2	3	3	2	2	1	1	1	1	1	2	2	2	2	2
3	2	3	3	2	2	1	1	1	1	1	2	2	2	2	2
4	2	3	3	2	2	1	1	1	1	1	2	2	2	2	2
5	2	3	3	2	2	1	1	1	1	1	2	2	2	2	2
Low (1) ; Medium (2) ; High (3)															

21154E66C PROCESS PLANNING AND COST ESTIMATION

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1 To introduce the process planning concepts to make cost estimation for various products after process planning
2 To Learn the various Process Planning Activities
3 To provide the knowledge of importance of costing and estimation.
4 To provide the knowledge of estimation of production costing.
5 To learn the knowledge of various Machining time calculations

UNIT – I INTRODUCTION TO PROCESS PLANNING 9

Introduction- methods of process planning-Drawing Interpretation-Material evaluation – steps in process selection-. Production equipment and tooling selection

UNIT – II PROCESS PLANNING ACTIVITIES 9

Process parameters calculation for various production processes-Selection jigs and fixture selection of quality assurance methods - Set of documents for process planning-Economics of process planning- case studies

UNIT – III INTRODUCTION TO COST ESTIMATION 9

Importance of costing and estimation –methods of costing-elements of cost estimation –Types of estimates – Estimating procedure- Estimation labor cost, material cost- allocation of overhead charges- Calculation of depreciation cost

UNIT – IV PRODUCTION COST ESTIMATION 9

Estimation of Different Types of Jobs - Estimation of Forging Shop, Estimation of Welding Shop,Estimation of Foundry Shop

UNIT – V MACHINING TIME CALCULATION 9

Estimation of Machining Time - Importance of Machine Time Calculation- Calculation of Machining Time for Different Lathe Operations, Drilling and Boring - Machining Time Calculation for Milling,Shaping and Planning -Machining Time Calculation for Grinding.

Total:45 periods

OUTCOMES: At the end of the course the students would be able to

1. Discus select the process, equipment and tools for various industrial products.
2. Explain the prepare process planning activity chart.
3. Explain the concept of cost estimation.
4. Compute the job order cost for different type of shop floor.
5. Calculate the machining time for various machining operations.

TEXT BOOKS:

1. Peter scalon, “Process planning, Design/Manufacture Interface”, Elsevier science technology Books, Dec 2002.
2. Sinha B.P, “Mechanical Estimating and Costing”, Tata-McGraw Hill publishing co, 1995.

REFERENCES:

1. Chitale A.V. and Gupta R.C., “Product Design and Manufacturing”, 2nd Edition, PHI, 2002.
2. Ostwalal P.F. and Munez J., “Manufacturing Processes and systems”, 9th Edition, John Wiley,1998.
3. Russell R.S and Tailor B.W, “Operations Management”, 4th Edition, PHI, 2003.
4. Mikell P. Groover, “Automation, Production, Systems and Computer Integrated Manufacturing”,Pearson Education 2001.
5. K.C. Jain & L.N. Aggarwal, “Production Planning Control and Industrial Management”, KhannaPublishers 1990.

21147MC51B DISASTER MANAGEMENT L T P C
3 0 0 0

COURSE OBJECTIVE

- To impart knowledge on concepts related to disaster, disaster risk reduction, disaster management
- To acquaint with the skills for planning and organizing disaster response

UNIT I HAZRADS, VULNERABILITY AND DISASTER RISKS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Types of Disasters: Natural, Human induced, Climate change induced –Earthquake, Landslide, Flood, Drought, Fire etc – Technological disasters- Structural collapse, Industrial accidents, oil spills -Causes, Impacts including social, Economic, political, environmental, health, psychosocial, etc.- Disaster vulnerability profile of India and Tamil Nadu - Global trends in disasters: urban disasters, pandemics, Complex emergencies,Inter relations between Disasters and Sustainable development Goals

UNIT II DISASTER RISK REDUCTION (DRR) 9

Sendai Framework for Disaster Risk Reduction**,** Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community Based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions / Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Early Warning System — Advisories from Appropriate Agencies.- Relevance of indigenous Knowledge, appropriate technology and Local resources.

UNIT III DISASTER MANAGEMENT 9

Components of Disaster Management – Preparedness of rescue and relief, mitigation, rehabilitation and reconstruction- Disaster Risk Management and post disaster management – Compensation and Insurance- Disaster Management Act (2005) and Policy - Other related policies, plans, programmers and legislation - Institutional Processes and Framework at State and Central Level- (NDMA –SDMA-DDMA-NRDF- Civic Volunteers)

UNIT IV TOOLS AND TECHNOLOGY FOR DISASTER MANAGEMENT 9

Early warning systems -Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster — Disaster Damage Assessment. - Elements of Climate Resilient Development –Standard operation Procedure for disaster response – Financial planning for disasterManagement

UNIT V DISASTER MANAGEMENT: CASE STUDIES 9

Discussion on selected case studies to analyse the potential impacts and actions in the contest of disasters-Landslide Hazard Zonation: Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.- Field work-Mock drill -

TOTAL : 45 PERIODS

TEXT BOOKS:

1 Taimpo (2016), Disaster Management and Preparedness, CRC Publications
2 Singh R (2017), Disaster Management Guidelines for earthquakes, Landslides, Avalanches and tsunami, Horizon Press Publications
3 Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
4 Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]

REFERENCES

1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005.
2. Government of India, National Disaster Management Policy, 2009.

3. Shaw R (2016), Community based Disaster risk reduction, Oxford University Press

COURSE OUTCOME:

CO1: To impart knowledge on the concepts of Disaster, Vulnerability and Disaster Risk reduction (DRR)

CO2: To enhance understanding on Hazards, Vulnerability and Disaster Risk Assessment prevention and risk reduction

CO3: To develop disaster response skills by adopting relevant tools and technology

CO4: Enhance awareness of institutional processes for Disaster response in the country and

CO5: Develop rudimentary ability to respond to their surroundings with potential Disaster response in areas where they live, with due sensitivity

MANDATORY COURSES II

21147MC61B	SAFETYIN ENGINEERING INDUSTRY	L T P C 3 0 0 0

OBJECTIVES

- To Understand the Introduction and basic Terminologies safety.
- To enable the students to learn about the Important Statutory Regulations and standards.
- To enable students to Conduct and participate the various Safety activities in the Industry.
- To have knowledge about Workplace Exposures and Hazards.
- To assess the various Hazards and consequences through various Risk Assessment Techniques.

UNIT I SAFETY TERMINOLOGIES

Hazard-Types of Hazard- Risk-Hierarchy of Hazards Control Measures-Lead indicators- lag Indicators-Flammability- Toxicity Time-weighted Average (TWA) - Threshold LimitValue (TLV) - Short Term Exposure Limit (STEL)- Immediately dangerous to life or health (IDLH)- acute and chronic Effects- Routes of Chemical Entry-Personnel Protective Equipment- Health and Safety Policy-Material Safety Data Sheet MSDS

UNIT II STANDARDS AND REGULATIONS

Indian Factories Act-1948- Health- Safety- Hazardous materials and Welfare- ISO 45001:2018 occupational health and safety (OH&S) - Occupational Safety and Health Audit IS14489:1998- Hazard Identification and Risk Analysis- code of practice IS 15656:2006

UNIT III SAFETY ACTIVITIES

Toolbox Talk- Role of safety Committee- Responsibilities of Safety Officers and Safety Representatives- Safety Training and Safety Incentives- Mock Drills- On-site Emergency Action Plan- Off-site Emergency Action Plan- Safety poster and Display- Human Error Assessment

UNIT IV WORKPLACE HEALTH AND SAFETY

Noise hazard- Particulate matter- musculoskeletal disorder improper sitting poster and lifting Ergonomics RULE & REBA- Unsafe act & Unsafe Condition- Electrical Hazards- Crane Safety-Toxic gas Release

UNIT V HAZARD IDENTIFICATION TECHNIQUES

Job Safety Analysis-Preliminary Hazard Analysis-Failure mode and Effects Analysis- Hazard and Operability- Fault Tree Analysis- Event Tree Analysis Qualitative and Quantitative Risk Assessment-Checklist Analysis- Root cause analysis- What-If Analysis- and Hazard Identification and Risk Assessment

Course outcomes on completion of this course the student will be able:

- Understand the basic concept of safety.
- Obtain knowledge of Statutory Regulations and standards.
- Know about the safety Activities of the Working Place.
- Analyze on the impact of Occupational Exposures and their Remedies
- Obtain knowledge of Risk Assessment Techniques.

TEXTBOOKS

1. R.K. Jain and Prof. Sunil S. Rao Industrial Safety, Health and Environment Management Systems KHANNA PUBLISHER
2. L. M. Deshmukh Industrial Safety Management: Hazard Identification and Risk Control McGraw-Hill Education

REFERENCES

1. Frank Lees (2012) ‘Lees’ Loss Prevention in Process Industries.Butterworth-Heinemann publications, UK, 4th Edition.
2. John Ridley & John Channing (2008)Safety at Work: Routledge, 7th Edition.
3. Dan Petersen (2003) Techniques of Safety Management: A System Approach.
4. Alan Waring.(1996).Safety management system: Chapman &Hall,England

5. Society of Safety Engineers, USA

ONLINE RESOURCES

ISO 45001:2018 occupational health and safety (OH&S) International Organization for Standardization https://www.iso.org/standard/63787.html

Indian Standard code of practice on occupational safety and health audit https://law.resource.org/pub/in/bis/S02/is.14489.1998.pdf

Indian Standard code of practice on Hazard Identification and Risk Analysis IS 15656:2006 https://law.resource.org/pub/in/bis/S02/is.15656.2006.pdf

OPEN ELECTIVE I AND II

21150OE72A ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING FUNDAMENTALS L T P C
3 0 0 3

OBJECTIVES:
The main objectives of this course are to:
1. Understand the importance, principles, and search methods of AI
2. Provide knowledge on predicate logic and Prolog.
3. Introduce machine learning fundamentals
4. Study of supervised learning algorithms.
5. Study about unsupervised learning algorithms.

UNIT I INTELLIGENT AGENT AND UNINFORMED SEARCH 6
Introduction - Foundations of AI - History of AI - The state of the art - Risks and Benefits of AI - **Intelligent Agents** - Nature of Environment - Structure of Agent - Problem Solving Agents - Formulating Problems - **Uninformed Search** - Breadth First Search - Dijkstra's algorithm or uniform-cost search - Depth First Search - Depth Limited Search

UNIT II PROBLEM SOLVING WITH SEARCH TECHNIQUES 6
Informed Search - Greedy Best First - A* algorithm - Adversarial Game and Search - **Game theory** - Optimal decisions in game - Min Max Search algorithm - Alpha-beta pruning - **Constraint Satisfaction Problems (CSP)** - Examples - Map Coloring - Job Scheduling - Backtracking Search for CSP

UNIT III LEARNING 6
Machine Learning: Definitions — Classification - Regression - approaches of machine learning models - Types of learning - Probability - Basics - Linear Algebra – Hypothesis space and inductive bias, Evaluation. Training and test sets, cross validation, Concept of over fitting, under fitting, Bias and Variance - **Regression**: Linear Regression - Logistic Regression

UNIT IV SUPERVISED LEARNING 6
Neural Network: Introduction, Perceptron Networks — Adaline - Back propagation networks - **Decision Tree:** Entropy – Information gain - Gini Impurity - classification algorithm - Rule basedClassification - **Naïve Bayesian classification** - **Support Vector Machines** (SVM)

UNIT V UNSUPERVISED LEARNING 6
Unsupervised Learning – Principle Component Analysis - **Neural Network**: Fixed Weight Competitive Nets - Kohonen Self-Organizing Feature Maps – **Clustering**: Definition - Types of Clustering – Hierarchical clustering algorithms – k-means algorithm

TOTAL : 30 PERIODS

PRACTICAL EXERCISES: 30 PERIODS
Programs for Problem solving with Search
1. Implement breadth first search
2. Implement depth first search
3. Analysis of breadth first and depth first search in terms of time and space
4. Implement and compare Greedy and A* algorithms.

Supervised learning
5. Implement the non-parametric locally weighted regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs
6. Write a program to demonstrate the working of the decision tree based algorithm.
7. Build an artificial neural network by implementing the back propagation algorithm and test the same using appropriate data sets.
8. Write a program to implement the naïve Bayesian classifier.

Unsupervised learning
9. Implementing neural network using self-organizing maps
10. Implementing k-Means algorithm to cluster a set of data.
11. Implementing hierarchical clustering algorithm.

Note:

- Installation of gnu-prolog, Study of Prolog (gnu-prolog).
- The programs can be implemented in using C++/JAVA/ Python or appropriate tools can be used by designing good user interface
- Data sets can be taken from standard repositories (https://archive.ics.uci.edu/ml/datasets.html) or constructed by the students.

OUTCOMES:

CO1: Understand the foundations of AI and the structure of Intelligent Agents
CO2: Use appropriate search algorithms for any AI problem
CO3: Study of learning methods
CO4: Solving problem using Supervised learning
CO5: Solving problem using Unsupervised learning

TOTAL: 60 PERIODS

TEXT BOOKS:

1. S. Russell and P. Norvig, “Artificial Intelligence: A Modern Approach”, Prentice Hall, Fourth Edition, 2021
2. S.N.Sivanandam and S.N.Deepa, Principles of soft computing-Wiley India.3 rd ed,

REFERENCES

1. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.
2. I. Bratko, “Prolog: Programming for Artificial Intelligencell, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.
3. C. Muller & Sarah Alpaydin, Ethem. Introduction to machine learning. MIT press, 2020.

21150OE61A IOT CONCEPTS AND APPLICATIONS L T P C
3 0 0 3

OBJECTIVES:

- To apprise students with basic knowledge of IoT that paves a platform to understand physical and logical design of IOT
- To teach a student how to analyse requirements of various communication models and protocols for cost-effective design of IoT applications on different IoT platforms.
- To introduce the technologies behind Internet of Things(IoT).
- To explain the students how to code for an IoT application using Arduino/Raspberry Pi open platform.
- To apply the concept of Internet of Things in real world scenario.

UNIT I INTRODUCTION TO INTERNET OF THINGS 5

Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT Models – Simplified IoT Architecture and Core IoT FunctionalStack — Fog, Edge and Cloud in IoT

UNIT II COMPONENTS IN INTERNET OF THINGS 5

Functional Blocks of an IoT Ecosystem – Sensors, Actuators, and Smart Objects – Control Units -Communication modules (Bluetooth, Zigbee,Wifi, GPS, GSM Modules)

UNIT III PROTOCOLS AND TECHNOLOGIES BEHIND IOT 6

IOT Protocols - IPv6, 6LoWPAN, MQTT, CoAP - RFID, Wireless Sensor Networks, BigData Analytics, Cloud Computing, Embedded Systems.

UNIT IV OPEN PLATFORMS AND PROGRAMMING 7

IOT deployment for Raspberry Pi /Arduino platform-Architecture –Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.

UNIT V IOT APPLICATIONS 7

Business models for the internet of things, Smart city, Smart mobility and transport, Industrial IoT, Smart health, Environment monitoring and surveillance – Home Automation – Smart Agriculture

30 PERIODS

PRACTICAL EXERCISES: 30 PERIODS

1. Introduction to Arduino platform and programming
2. Interfacing Arduino to Zigbee module
3. Interfacing Arduino to GSM module
4. Interfacing Arduino to Bluetooth Module
5 Introduction to Raspberry PI platform and python programming
6. Interfacing sensors to Raspberry PI
7. Communicate between Arduino and Raspberry PI using any wireless medium
8. Setup a cloud platform to log the data
9. Log Data using Raspberry PI and upload to the cloud platform
10.Design an IOT based system

OUTCOMES:

CO 1: Explain the concept of IoT.
CO 2: Understand the communication models and various protocols for IoT.
CO 3: Design portable IoT using Arduino/Raspberry Pi /open platform
CO 4: Apply data analytics and use cloud offerings related to IoT.
CO 5: Analyze applications of IoT in real time scenario.

TOTAL:60 PERIODS

TEXTBOOKS

1. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017
2. Samuel Greengard, The Internet of Things, The MIT Press, 2015

REFERENCES

1. Perry Lea, "Internet of things for architects", Packt, 2018
2. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Keyapplications and Protocols", Wiley, 2012
3. IOT (Internet of Things) Programming: A Simple and Fast Way of Learning, IOT Kindle Edition.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011.
5. ArshdeepBahga, Vijay Madisetti, "Internet of Things — A hands-on approach", UniversitiesPress, 2015
6. https://www.arduino.cc/
   https://www.ibm.com/smarterplanet/us/en/?ca=v_smarterplanet

211500E72B DATA SCIENCE FUNDAMENTALS

	L T P C
	3 0 0 3

COURSE OBJECTIVES:

- Familiarize students with the data science process.
- Understand the data manipulation functions in Numpy and Pandas.
- Explore different types of machine learning approaches.
- Understand and practice visualization techniques using tools.
- Learn to handle large volumes of data with case studies.

UNIT I INTRODUCTION 6

Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – data preparation - Exploratory Data analysis – build the model – presenting findings and building applications - Data Mining - Data Warehousing – Basic statistical descriptions of Data

UNIT II DATA MANIPULATION 9

Python Shell - Jupyter Notebook - IPython Magic Commands - NumPy Arrays-Universal Functions – Aggregations – Computation on Arrays – Fancy Indexing – Sorting arrays – Structured data – Data manipulation with Pandas – Data Indexing and Selection – Handling missing data – Hierarchical indexing – Combining datasets – Aggregation and Grouping – String operations – Working with time series — High performance

UNIT III MACHINE LEARNING 5

The modeling process - Types of machine learning - Supervised learning - Unsupervised learning - Semi-supervised learning- Classification, regression - Clustering – Outliers and Outlier Analysis

UNIT IV DATA VISUALIZATION 5

Importing Matplotlib – Simple line plots – Simple scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn

UNIT V HANDLING LARGE DATA 5

Problems - techniques for handling large volumes of data - programming tips for dealing with large data sets- Case studies: Predicting malicious URLs, Building a recommender system - Tools and techniques needed - Research question - Data preparation - Model building — Presentation and automation.

30 PERIODS

PRACTICAL EXERCISES: **30 PERIODS**

LAB EXERCISES

1. Download, install and explore the features of Python for data analytics.
2. Working with Numpy arrays
3. Working with Pandas data frames
4. Basic plots using Matplotlib
5. Statistical and Probability measures
    a) Frequency distributions
    b) Mean, Mode, Standard Deviation
    c) Variability
    d) Normal curves
    e) Correlation and scatter plots
    f) Correlation coefficient
    g) Regression

6. Use the standard benchmark data set for performing the following:

a) Univariate Analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.

b) Bivariate Analysis: Linear and logistic regression modelling.

7. Apply supervised learning algorithms and unsupervised learning algorithms on any data set.
8. Apply and explore various plotting functions on any data set.

Note: Example data sets like: UCI, Iris, Pima Indians Diabetes etc.

21150OE61B AUGMENTED REALITY /VIRTUAL REALITY **L T P C**

3 0 0 3

OBJECTIVES:

- To impart the fundamental aspects and principles of AR/VR technologies.
- To know the internals of the hardware and software components involved in the development of AR/VR enabled applications.
- To learn about the graphical processing units and their architectures.
- To gain knowledge about AR/VR application development.
- To know the technologies involved in the development of AR/VR based applications.

UNIT I INTRODUCTION 7

Introduction to Virtual Reality and Augmented Reality – Definition – Introduction to Trajectories and Hybrid Space-Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Benefits ofVirtual Reality – Components of VR System – Introduction to AR-AR Technologies-Input Devices – 3D Position Trackers – Types of Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces – Types of Gesture Input Devices – Output Devices – Graphics Display – Human VisualSystem – Personal Graphics Displays – Large Volume Displays – Sound Displays – Human Auditory System**.**

UNIT II VR MODELING 6

Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – KinematicsModeling – Transformation Matrices – Object Position – Transformation Invariants –ObjectHierarchies — Viewing the 3D World — Physical Modeling — Collision Detection — Surface Deformation – Force Computation – Force Smoothing and Mapping – Behavior Modeling – ModelManagement.

UNIT III VR PROGRAMMING 6

VR Programming – Toolkits and Scene Graphs – World ToolKit – Java 3D – Comparison of WorldToolKit and Java 3D

UNIT IV APPLICATIONS 6

Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR andSociety-Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications
– Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR in Robotics – Information Visualization – VR in Business – VR in Entertainment – VR in Education.

UNIT V AUGMENTED REALITY 5

Introduction to Augmented Reality-Computer vision for AR-Interaction-Modelling and Annotation-Navigation-Wearable devices

30 PERIODS

PRACTICAL EXERCISES: 30 PERIODS

1. Study of tools like Unity, Maya, 3DS MAX, AR toolkit, Vuforia and Blender.
2. Use the primitive objects and apply various projection types by handling camera.
3. Download objects from asset store and apply various lighting and shading effects.
4. Model three dimensional objects using various modelling techniques and apply textures over them.
5. Create three dimensional realistic scenes and develop simple virtual reality enabled mobile applications which have limited interactivity.
6. Add audio and text special effects to the developed application.
7. Develop VR enabled applications using motion trackers and sensors incorporating full haptic interactivity.
8. Develop AR enabled applications with interactivity like E learning environment, Virtual walkthroughs and visualization of historic places.
9. Develop AR enabled simple applications like human anatomy visualization, DNA/RNA structure visualization and surgery simulation.
10. Develop simple MR enabled gaming applications.

TOTAL:60 PERIODS

OUTCOMES:

On completion of the course, the students will be able to:

CO1: Understand the basic concepts of AR and VR

CO2: Understand the tools and technologies related to AR/VR

CO3: Know the working principle of AR/VR related Sensor devices

CO4: Design of various models using modeling techniques
CO5: Develop AR/VR applications in different domains

TEXTBOOKS:

1. Charles Palmer, John Williamson, “Virtual Reality Blueprints: Create compelling VR experiences for mobile”, Packt Publisher, 2018
2. Dieter Schmalstieg, Tobias Hollerer, “Augmented Reality: Principles & Practice”, Addison Wesley, 2016
3. John Vince, “Introduction to Virtual Reality”, Springer-Verlag, 2004.
4. William R. Sherman, Alan B. Craig: Understanding Virtual Reality – Interface, Application,Design”, Morgan Kaufmann, 2003

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	1	3	3	1	3	3	3	3	1	3	1	3	-	-	-
2	2	3	3	2	3	3	3	3	1	3	3	3	-	-	-
3	3	3	3	3	3	3	3	3	3	3	3	3	-	-	-
4	2	2	2	2	2	2	2	2	3	3	3	3	-	-	-
5	2	2	2	2	2	2	2	2	2	3	2	3	-	-	-
AVg.	**2**	**2.6**	**2.6**	**2**	**2.6**	**2.6**	**2.6**	**2.6**	**2**	**3**	**2.4**	**3**	**-**	**-**	**-**

OPEN ELCTIVE III

21150E73A ENGLISH FOR COMPETITIVE EXAMINATIONS L T P C

3 0 0 3

COURSE DESCRIPTION:

Students aspiring to take up competitive exams of which the English language is a vital component will find this course useful. Designed for students in the higher semesters, the course will help students to familiarise themselves with those aspects of English that are tested in these examinations.

Objectives:

- To train the students in the language components essential to face competitive examinations both at the national (UPSC, Banking, Railway, Defence) and the international level (GRE, TOEFL, IELTS).
- To enhance an awareness of the specific patterns in language testing and the respective skills to tackle verbal reasoning and verbal ability tests.
- To inculcate effective practices in language-learning in order to improve accuracy in usage of grammar and coherence in writing.
- To improve students' confidence to express their ideas and opinions in formal contexts
- To create awareness of accuracy and precision in communication

UNIT I 9

Orientation on different formats of competitive exams - Vocabulary – Verbal ability – Verbal reasoning - Exploring the world of words – Essential words – Meaning and their usage – Synonyms- antonyms – Word substitution – Word analogy – Idioms and phrases – Commonly confused words -Spellings – Word expansion – New words in use.

UNIT II 9

Grammar – Sentence improvement –Sentence completion – Rearranging phrases into sentences – Error identification –Tenses – Prepositions – Adjectives – Adverbs – Subject-verb agreement – Voice – Reported speech – Articles – Clauses – Speech patterns.

UNIT III 9

Reading - Specific information and detail – Identifying main and supporting ideas – Speed reading techniques – Improving global reading skills – Linking ideas – Summarising – Understanding argument – Identifying opinion/attitude and making inferences - Critical reading.

UNIT IV 9

Writing – Pre-writing techniques – Mindmap - Describing pictures and facts - Paragraph structure – organising points – Rhetoric writing – Improving an answer – Drafting, writing and developing an argument – Focus on cohesion – Using cohesive devices –Analytic writing – Structure and types ofessay — Mind maps — Structure of drafts, letters, memos, emails — Statements of Purpose — Structure, Content and Style.

UNIT V 9

Listening and Speaking – Contextual listening – Listening to instructions – Listening for specific information – Identifying detail, main ideas – Following signpost words – Stress, rhythm and intonation - Speaking to respond and elicit ideas – Guided speaking – Opening phrases – Interactive communication – Dysfluency -Sentence stress – Speaking on a topic – Giving opinions – Giving anoral presentation – Telling a story or a personal anecdote – Talking about oneself - Utterance – Speech acts- Brainstorming ideas – Group discussion.

TOTAL: 45 PERIODS

LEARNING OUTCOMES:

At the end of the course, learners will be able

- Expand their vocabulary and gain practical techniques to read and comprehend a wide range of texts with the emphasis required

- Identify errors with precision and write with clarity and coherence
- Understand the importance of task fulfilment and the usage of task-appropriate vocabulary
- Communicate effectively in group discussions, presentations and interviews
- Write topic based essays with precision and accuracy

CO-PO & PSO MAPPING

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	1	3	3	1	3	3	3	3	1	3	1	3	-	-	-
2	2	3	3	2	3	3	3	3	1	3	3	3	-	-	-
3	3	3	3	3	3	3	3	3	3	3	3	3	-	-	-
4	2	2	2	2	2	2	2	2	3	3	3	3	-	-	-
5	2	2	2	2	2	2	2	2	2	3	2	3	-	-	-
AVg.	**2**	**2.6**	**2.6**	**2**	**2.6**	**2.6**	**2.6**	**2.6**	**2**	**3**	**2.4**	**3**	**-**	**-**	**-**

1-low, 2-medium, 3-high, '-"- no correlation

Note: The average value of this course to be used for program articulation matrix.

Teaching Methods:

Instructional methods will involve discussions, taking mock tests on various question papers — Objective, multiple-choice and descriptive. Peer evaluation, self-check on improvement and peer feedback - Practice sessions on speaking assessments, interview and discussion — Using multimedia.

Evaluative Pattern:

Internal Tests – 50%
End Semester Exam - 50%

TEXTBOOKS:

1. R.P.Bhatnagar - *General English for Competitive Examinations.* Macmillan India Limited, 2009.

REFERENCES:

1. Educational Testing Service - The Official Guide to the GRE Revised General Test, Tata McGraw Hill, 2010.
2. The Official Guide to the TOEFL Test, Tata McGraw Hill, 2010.
3. R Rajagopalan- General English for Competitive Examinations, McGraw Hill Education (India) Private Limited, 2008.

Websites

http://www.examenglish.com/, http://www.ets.org/ , http://www.bankxams.com/
http://civilservicesmentor.com/, http://www.educationobserver.com
http://www.cambridgeenglish.org/in/

21152OE73A REMOTE SENSING CONCEPTS

L T P C
3 0 0 3

OBJECTIVES:

- To introduce the concepts of remote sensing processes and its components.
- To expose the various remote sensing platforms and sensors and to introduce the elements of data interpretation

UNIT I REMOTE SENSING AND ELECTROMAGNETIC RADIATION 9

Definition – components of RS – History of Remote Sensing – Merits and demerits of data collation between conventional and remote sensing methods - Electromagnetic Spectrum – Radiation principles - Wave theory, Planck's law, Wien's Displacement Law, Stefan's Boltzmann law, Kirchoff's law – Radiation sources: active & passive - Radiation Quantities

UNIT II EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIAL 9

Standard atmospheric profile – main atmospheric regions and its characteristics – interaction of radiation with atmosphere – Scattering, absorption and refraction – Atmospheric windows - Energy balance equation — Specular and diffuse reflectors — Spectral reflectance & emittance — Spectroradiometer – Spectral Signature concepts – Typical spectral reflectance curves for vegetation, soil and water – solid surface scattering in microwave region.

UNIT III ORBITS AND PLATFORMS 9

Motions of planets and satellites – Newton's law of gravitation - Gravitational field and potential - Escape velocity - Kepler's law of planetary motion - Orbit elements and types – Orbital perturbations and maneuvers – Types of remote sensing platforms - Ground based, Airborne platforms and Space borne platforms – Classification of satellites – Sun synchronous and Geosynchronous satellites –Lagrange Orbit.

UNIT IV SENSING TECHNIQUES 9

Classification of remote sensors – Resolution concept : spatial, spectral, radiometric and temporal resolutions - Scanners - Along and across track scanners – Optical-infrared sensors – Thermal sensors – microwave sensors – Calibration of sensors - High Resolution Sensors - LIDAR , UAV –Orbital and sensor characteristics of live Indian earth observation satellites

UNIT V DATA PRODUCTS AND INTERPRETATION 9

Photographic and digital products — Types, levels and open source satellite data products —- selection and procurement of data– Visual interpretation: basic elements and interpretation keys - Digital interpretation – Concepts of Image rectification, Image enhancement and Image classification

TOTAL:45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to

CO 1 Understand the concepts and laws related to remote sensing
CO 2 Understand the interaction of electromagnetic radiation with atmosphere and earth material
CO 3 Acquire knowledge about satellite orbits and different types of satellites
CO 4 Understand the different types of remote sensors
CO 5 Gain knowledge about the concepts of interpretation of satellite imagery

TEXTBOOKS: 106

1. Thomas M.Lillesand, Ralph W. Kiefer and Jonathan W. Chipman, Remote Sensing and Image interpretation, John Wiley and Sons, Inc, New York,2015.
2. George Joseph and C Jeganathan, Fundamentals of Remote Sensing,Third Edition Universities Press (India) Private limited, Hyderabad, 2018

REFERENCES:
1. Janza, F.Z., Blue H.M. and Johnson,J.E. Manual of Remote Sensing. Vol.1, AmericanSocietyof Photogrametry, Virginia, USA, 2002.
2. Verbyla, David, Satellite Remote Sensing of Natural Resources. CRC Press, 1995
3. Paul Curran P.J. Principles of Remote Sensing. Longman, RLBS, 1988.

4. Introduction to Physics and Techniques of Remote Sensing , Charles Elachi and JacobVan Zyl, 2006 Edition II, Wiley Publication.
5. Basudeb Bhatta, Remote Sensing and GIS, Oxford University Press, 2011

CO-PO MAPPING

PO	Graduate Attribute	Course Outcome					Average
		CO1	CO2	CO3	CO4	CO5	
PO1	Engineering Knowledge	3	3	3	3	3	3
PO2	Problem Analysis				3	3	3
PO3	Design/Development of Solutions				3	3	3
PO4	Conduct Investigations of Complex Problems				3	3	3
PO5	Modern Tool Usage				3	3	3
PO6	The Engineer and Society						
PO 7	Environment and Sustainability						
PO 8	Ethics						
PO 9	Individual and Team Work						
PO 10	Communication						
PO 11	Project Management and Finance						
PO 12	Life-long Learning	3		3	3	3	3
PSO 1	Knowledge of Geoinformatics discipline	3	3	3	3	3	3
PSO 2	Critical analysis of Geoinformatics Engineering problems and innovations	3	3	3	3	3	3
PSO 3	Conceptualization and evaluation of Design solutions	3	3	3	3	3	3

21152OE73B DRINKING WATER SUPPLY AND TREATMENT L T P C

3 0 0 3

OBJECTIVE:

- To equip the students with the principles and design of water treatment units and distribution system.

UNIT I SOURCES OF WATER 9

Public water supply system – Planning, Objectives, Design period, Population forecasting; Water demand – Sources of water and their characteristics, Surface and Groundwater – Impounding Reservoir – Development and selection of source – Source Water quality – Characterization – Significance – Drinking Water quality standards.

UNIT II CONVEYANCE FROM THE SOURCE 9

Water supply – intake structures – Functions; Pipes and conduits for water – Pipe materials – Hydraulics of flow in pipes – Transmission main design – Laying, jointing and testing of pipes – appurtenances – Types and capacity of pumps – Selection of pumps and pipe materials.

UNIT III WATER TREATMENT 9

Objectives – Unit operations and processes – Principles, functions, and design of water treatment plant units, aerators of flash mixers, Coagulation and flocculation –- sand filters - Disinfection -–Construction, Operation and Maintenance aspects.

UNIT IV ADVANCED WATER TREATMENT 9

Water softening – Desalination- R.O. Plant – demineralization – Adsorption - Ion exchange– Membrane Systems - Iron and Manganese removal - Defluoridation - Construction and Operation and Maintenance aspects

UNIT V WATER DISTRIBUTION AND SUPPLY 9

Requirements of water distribution – Components – Selection of pipe material – Service reservoirs - Functions – Network design – Economics - Computer applications – Appurtenances – Leak detection - Principles of design of water supply in buildings – House service connection – Fixtures and fittings, systems of plumbing and types of plumbing.

TOTAL: 45 PERIODS

OUTCOMES

CO1: An understanding of water quality criteria and standards, and their relation to public health

CO2: The ability to design the water conveyance system

CO3: The knowledge in various unit operations and processes in water treatment

CO4: An ability to understand the various systems for advanced water treatment

CO5: An insight into the structure of drinking water distribution system

TEXT BOOKS :

1. Garg. S.K., "Water Supply Engineering", Khanna Publishers, Delhi, September 2008.
2. Punmia B.C, Arun K.Jain, Ashok K.Jain, " Water supply Engineering" Lakshmi publication private limited, New Delhi, 2016.
3. Rangwala "Water Supply and Sanitary Engineering", February 2022
4. Birdie.G.S., "Water Supply and Sanitary Engineering", Dhanpat Rai and sons, 2018.

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REFERENCES :

1. Fair. G.M., Geyer.J.C., "Water Supply and Wastewater Disposal", John Wiley and Sons,1954
2. abbit.H.E, and Donald.J.J, "Water Supply Engineering" , McGraw Hill book Co, 1984.
3. Steel. E.W.et al., "Water Supply Engineering" , Mc Graw Hill International book Co, 1984.

4. Duggal. K.N., “Elememts of public Health Engineering”, S.Chand and Company Ltd, New Delhi, 1998.

CO’s- PO’s & PSO’s MAPPING

CO’s	PO’s												PSO’s		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1		3						3		3			3		
2		3		2		2				3			3		
3				2		2				3			3		
4			3	2				3	2	3			3		
5			3	2			1		2	3		1			
Avg.		3	3	2		2	1	3	2	3		1	3		

1. low, 2-medium, 3-high, ‘-“- no correlation

Note: The average value of this course to be used for program articulation matrix.

I - VIII SEMESTER CURRICULUM AND SYLLABI

B.TECH (FT) MECHANICAL [Regulation 2020]

SEMESTER I

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	20147S11	Communicative English	4	0	0	4
2.	20148S12	Engineering Mathematics - I	4	0	0	4
3.	20149S13	Engineering Physics	3	0	0	3
4.	20149S14	Engineering Chemistry	3	0	0	3
5.	20154S15	Engineering Graphics	2	0	4	4
6.	20150S16	Problem Solving andPython Programming	3	0	0	3
PRACTICAL						
7.	20150L17	Problem Solving and Python Programming Laboratory	0	0	4	2
8.	20149L18	Physics and ChemistryLaboratory	0	0	4	2
9.	201VEA19	Value Education				-
TOTAL			**19**	**2**	**12**	**25**

SKILL DEVELOPMENT

SEMESTER II

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	20147S21	Technical English	4	0	0	4
2.	20148S22	Engineering Mathematics II	4	0	0	4
3	20149S23C	Material Science	3	0	0	3
4.	20149S24A	Environmental Science And Engineering	3	0	0	3
5.	20153S25D	Basic Electrical, Electronics And Instrumentation Engineering	3	0	0	3
6.	20154S26D	Engineering Mechanics	3	2	0	4
PRACTICAL						
7.	20154L27	Engineering Practices Lab . (All Branches)	0	0	3	2
8.	20153L28D	Basic Electrical, Electronics and Instrumentation Engineering Lab	0	0	3	2
9.	201ICA29	Fundamentals of Indian constitution and Economy				-
TOTAL			**20**	**2**	**6**	**25**

SKILL DEVELOPMENT

SEMESTER III

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	20148S31C	Transforms and Partial Differential Equations	4	0	0	4
2.	20154C32	Engineering Thermodynamics	3	2	0	4
3.	20154C33	Fluid Mechanics and Machinery	4	0	0	4
4.	20154C34	Production Technology - I	3	0	0	3
5.	20154S35	Electrical Drives and Controls	3	0	0	3
PRACTICAL						
6.	20154L36	Production Technology Laboratory - I	0	0	3	2
7.	20154L37	Computer Aided Machine Drawing	0	0	3	2
8.	20154L38	Electrical Engineering Laboratory	0	0	3	2
9.	20154L39	Interpersonal Skills / Listening & Speaking	0	0	2	1
TOTAL			**17**	2	**11**	**25**

SKILL DEVELOPMENT

SEMESTER IV

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	20148S41D	Statistics and Numerical Methods	4	0	0	4
2.	20154C42	Theory of Machines-I	3	0	0	3
3.	20154C43	Production Technology – II	3	0	0	3
4.	20154C44	Engineering Metallurgy	3	0	0	3
5.	20154C45	Strength of Materials for Mechanical Engineers	3	0	0	3
6.	20154C46	Thermal Engineering- I	3	0	0	3
Practical						
7.	20154L47	Production Technology Laboratory - II	0	0	3	2
8.	20154L48	Strength of Materials and Fluid Mechanics and Machinery Laboratory	0	0	3	2
9.	20154L49	Advanced Reading and Writing	0	0	2	1
TOTAL			**19**	**0**	**8**	**24**

EMPLOYABILITY

ENTREPRENUEURSHIP

SKILL DEVELOPMENT

SEMESTER V

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	20154C51	Thermal Engineering- II	3	0	0	3
2.	20154C52	Design of Machine Elements	3	0	0	3
3.	20154C53	Metrology and Measurements	3	0	0	3
4.	201_ _OE54_	Open Elective I	3	0	0	3
5.	20154C55	Theory of Machines-II	3	2	0	4
PRACTICAL						
6.	20154L56	Theory of Machines Laboratory	0	0	3	2
7.	20154L57	Thermal Engineering Laboratory	0	0	3	2
8.	20154L58	Metrology and Measurements Laboratory	0	0	3	2
TOTAL			**16**	**6**	**9**	**22**

EMPLOYABILITY

ENTREPRENUEURSHIP

SKILL DEVELOPMENT

SEMESTER VI

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	20154C61	Design of Transmission Systems	3	0	0	3
2.	20154C62	Computer Aided Design And Manufacturing	3	0	0	3
3.	20154C63	Heat and Mass Transfer	3	2	0	4
4.	20154C64	Finite Element Analysis	3	0	0	3
5.	20154C65	Hydraulics And Pneumatics	3	0	0	3
6.	20154E66_	Elective - I	3	0	0	3
PRACTICAL						
7.	20154L67	CAD / CAM Laboratory	0	0	3	2
8.	20154L68	Design and Fabrication Project	0	0	3	2
9.	20154L69	Professional Communication	0	0	2	1
TOTAL			**18**	**2**	**8**	**24**

EMPLOYABILITY

ENTREPRENUEURSHIP

SKILL DEVELOPMENT ENT

SEMESTER VII

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	20154C71	Power Plant Engineering	3	0	0	3
2.	20154C72	Process Planning and Cost Estimation	3	0	0	3
3.	20154C73	Mechatronics	3	0	0	3
4.	201_ _ OE74_	Open ElectiveII	3	0	0	3
5.	20154E75_	Elective II	3	0	0	3
6.	20154E76_	Elective III	3	0	0	3
PRACTICAL						
7.	20154L77	Simulation and Analysis Laboratory	0	0	3	2
8.	20154L78	Mechatronics Laboratory	0	0	3	2
9.	20154L79	Technical Seminar	0	0	2	1
TOTAL			**20**	**2**	**8**	23

EMPLOYABILITY

ENTREPRENUEURSHIP

SKILL DEVELOPMENT

SEMESTER VIII

S.No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	20154S81	Principles of Management	3	0	0	3
2.	20154E82_	Elective– IV	3	0	0	3
PRACTICAL						
3.	20154P83	Project Work	0	0	20	10
TOTAL			**6**	**0**	**20**	**13**

ENTREPRENUEURSHIP

.ELECTIVE – I (VI SEMESTER)

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	20154E66A	Automobile Engineering	3	0	0	3
2.	20154E66B	Artificial and Neural Network	3	0	0	3
3.	20154E66C	Refrigeration and Air Conditioning	3	0	0	3
4.	20154E66D	Machine Tool Design	3	0	0	3
5	2015E66E	Plant Layout and Material handling	3	0	0	3

EMPLOYABILITY

ELECTIVE – II (VII SEMESTER)

	COURSE CODE	COURSE TITLE	L	T	P	C
1.	20154E75A	Computational Fluid Dynamics	3	0	0	3
2.	20154E75B	Jet propulsion and Rocket Engine	3	0	0	3
3.	20154E75C	Mechanical Vibration	3	0	0	3
4.	20154E75D	Total Quality Management	3	0	0	3
5	20154E75E	Solar Energy Technology	3	0	0	3

EMPLOYABILITY

ENTREPRENUEURSHIP

ELECTIVE – III (VII SEMESTER)

SI. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	20154E76A	Robotics	3	0	0	3
2.	20154E76B	Industrial Management	3	0	0	3
3.	20154E76C	Production and Operation Management	3	0	0	3
4.	20154E76D	Tribology	3	0	0	3
5.	20154E75E	Maintenance and Safety Engineering	3	0	0	3

EMPLOYABILITY

ENTREPRENUEURSHIP

ELECTIVE – IV (VIII SEMESTER)

SI. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	20154E82A	Production Planning and Control	3	0	0	3
2.	20154E82B	Electric and Hybrid Vehicle	3	0	0	3
3.	20154E82C	Disaster Management	3	0	0	3
4.	20154E82D	Nano Technology	3	0	0	3
5.	20154E82E	IC Engine and Gas Turbines	3	0	0	3

EMPLOYABILITY

ENTREPRENUEURSHIP

SKILL DEVELOPMENT

OPEN ELECTIVE– I

Sl. No	DEPT	COURSE CODE	COURSE TITLE	L	T	P	C
1.	CSE	20150OE54A	Data Base management systems	3	0	0	3
2.		20150OE54B	Cloud computing	3	0	0	3
3.	ECE	20152OE54A	Basics Of Bio Medical Instrumentation	3	0	0	3
4.		20152OE54B	Sensors And Transducers	3	0	0	3
5.	EEE	20153OE54A	Industrial Nano Technology	3	0	0	3
6.		20153OE54B	Energy Conservation and Management	3	0	0	3
7.	CIVIL	20155OE54A	Air Pollution And Control Engineering	3	0	0	3
8.		20155OE54B	Geographic Information Systems	3	0	0	3

OPEN ELECTIVE– II

Sl. No	DEPT	COURSE CODE	COURSE TITLE	L	T	P	C
1	CSE	20150OE74A	Introduction to C programming	3	0	0	3
2.		20150OE74B	Data structures and algorithms	3	0	0	3
3.	ECE	20152OE74A	Robotics	3	0	0	3
4.		20150OE74B	Electronic devices	3	0	0	3
5.	EEE	20153OE74A	Basic circuit theory	3	0	0	3
6.		20153OE74B	Introduction to renewable energy systems	3	0	0	3
7.	CIVIL	20155OE74A	Green building design	3	0	0	3
8.		20155OE74B	Waste water treatment	3	0	0	3

EMPLOYABILITY

ENTREPRENUEURSHIP

SKILL DEVELOPMENT

201VEA19 VALUE EDUCATION

	L	T	P	C
	0	**0**	**0**	**1**

UNIT – I
Concept of Human Values, Value Education Towards Personal Development
Aim of education and value education; Evolution of value oriented education; Concept of Human values; types of values; Components of value education.
Personal Development :
Self analysis and introspection; sensitization towards gender equality, physically challenged, intellectually challenged. Respect to - age, experience, maturity, family members, neighbours, co-workers.
Character Formation Towards Positive Personality:
Truthfulness, Constructivity, Sacrifice, Sincerity, Self Control, Altruism, Tolerance, Scientific Vision.

UNIT – II
Value Education Towards National and Global Development National and International Values:

Constitutional or national values - Democracy, socialism, secularism, equality, justice, liberty, freedom and fraternity.

Social Values - Pity and probity, self control, universal brotherhood.
Professional Values - Knowledge thirst, sincerity in profession, regularity, punctuality and faith.
Religious Values - Tolerance, wisdom, character.
Aesthetic values - Love and appreciation of literature and fine arts and respect for the same.
National Integration and international understanding.

UNIT – III Impact of Global Development on Ethics and Values
Conflict of cross-cultural influences, mass media, cross-border education, materialistic values, professional challenges and compromise.

Modern Challenges of Adolescent Emotions and behavior; Sex and spirituality: Comparision and competition; positive and negative thoughts.

Adolescent Emotions, arrogance, anger, sexual instability, selfishness, defiance.

UNIT - IV Theraupatic Measures

Control of the mind through
a. Simplified physical exercise
b. Meditation – Objectives, types, effect on body, mind and soul
c. Yoga – Objectives, Types, Asanas

d. Activities:

(i) Moralisation of Desires
(ii) Neutralisation of Anger
(iii)Eradication of Worries
(iv) Benefits of Blessings

UNIT; V Human Rights

1. Concept of Human Rights – Indian and International Perspectives
   a. Evolution of Human Rights
   b. Definitions under Indian and International documents

2. Broad classification of Human Rights and Relevant Constitutional Provisions.
   a. Right to Life, Liberty and Dignity
   b. Right to Equality
   c. Right against Exploitation
   d. Cultural and Educational Rights
   e. Economic Rights
   f. Political Rights
   g. Social Rights

3. Human Rights of Women and Children
   a. Social Practice and Constitutional Safeguards
      (i) Female Foeticide and Infanticide
      (ii) Physical assault and harassment
      (iii) Domestic violence
      (iv) Conditions of Working Women

4. Institutions for Implementation
   a. Human Rights Commission
   b. Judiciary

5. Violations and Redressel
   a. Violation by State
   b. Violation by Individuals
   c. Nuclear Weapons and terrorism
   d. Safeguards.

201ICA29 FUNDAMENTALS OF INDIAN CONSTITUTION AND ECONOMY L P T C
1 0 0 1

UNIT-I: THE MAKING OF INDIAN CONSTITUTION

The Constituent Assembly: Organization- Character- Work-Salient feature of the constitution- Writtern and detailed constitution- Socialism- Secularism- Democracy and Republic.

UNIT-II: FUNDAMENTAL RIGHTS AND FUNDAMENTAL DUTIES OF THE CITIZENS

Right of equality- Right of freedom-Right against exploitation-Right to freedom of religion- Cultural and Educational rights-Right to constitutional remedies- Fundamental duties.

UNIT-III: DIRECTIVE PRINCIPLES OF STATE POLICY

Socialistic principles- Gandhian principles- Liberal and general principles-Differences between Fundamental Rights and Directive principles

UNIT-IV: THE UNION EXECUTIVE, UNION PARLIAMENT AND SUPREME COURT

Powers and Positions of the president- Qualification-Method of election of president and Vice President- Prime minister- Rajya sabha- Lok sabha- The Supreme Court- High Court- Functions and Positions of Supreme Court and High Court.

UNIT V: STATE COUNCIL- ELECTION SYSTEM AND PARLIMENTARY DEMOCRACY IN INDIA

State Council of Ministers- Chief Minister- Election Systems in India- Main Features-Election Commission – Features of Indian Democracy.

REFERENCES:

1. Palekar. S.A., Indian constitution government and politics, ABD
Publications , India
2.Aiyer, Alladi Krishnaswami, Constitution and Fundamental rights 1955
3. Markandan. K.C., Directive Principles in the Indian Constitution 1966.
4. Kashyap, Subash C., Our Parliament , National Book Trust , New Delhi 1989.

		L	T	P	C
20154L39	**INTERPERSONAL SKILLS/LISTENING & SPEAKING**	**0**	**0**	**2**	**1**

OBJECTIVES: The Course will enable learners to:

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- improve general and academic listening skills
- Make effective presentations.

UNIT I

Listening as a key skill- its importance- speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification Improving pronunciation - pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

UNIT II

Listen to a process information- give information, as part of a simple explanation - conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

UNIT III

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk - greet - respond to greetings - describe health and symptoms - invite and offer - accept - decline - take leave - listen for and follow the gist- listen for detail

UNIT IV

Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and lectures conversational speech listening to and participating in conversations - persuade.

UNIT V

Formal and informal talk - listen to follow and respond to explanations, directions and instructions in academic and business contexts - strategies for presentations and interactive communication - group/pair presentations - negotiate disagreement in group work.

TOTAL : 30 PERIODS

OUTCOMES: At the end of the course Learners will be able to:

- Listen and respond appropriately.
- Participate in group discussions
- Make effective presentations
- Participate confidently and appropriately in conversations both formal and informal

TEXT BOOKS:

1. Brooks,Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press, Oxford: 2011.

2. Richards,C. Jack. & David Bholke. Speak Now Level 3. Oxford University Press, Oxford: 2010

REFERENCES

1. Bhatnagar, Nitin and MamtaBhatnagar. Communicative English for Engineers and Professionals. Pearson: New Delhi, 2010.
2. Hughes, Glyn and Josephine Moate. Practical English Classroom. Oxford University Press: Oxford, 2014.
3. Ladousse, Gillian Porter. Role Play. Oxford University Press: Oxford, 2014
4. Richards C. Jack. Person to Person (Starter). Oxford University Press: Oxford, 2006.
5. Vargo, Mari. Speak Now Level 4. Oxford University Press: Oxford, 2013.

1. ” Tata McGraw-Hill Publishers, 2007

20154L47 **PRODUCTION TECHNOLOGY LABORATORY – II**

L	T	P	C
0	0	3	2

OBJECTIVE:

- To Study and acquire knowledge on various basic machining operations in special purpose machines and its applications in real life manufacture of components in the industry

LIST OF EXPERIMENTS:

1. Contour milling using vertical milling machine
2. Spur gear cutting in milling machine
3.
4. Helical Gear Cutting in milling machine
5. Gear generation in hobbing machine
6. Gear generation in gear shaping machine
7. Plain Surface grinding
8. Cylindrical grinding
9. Tool angle grinding with tool and Cutter Grinder
10. Measurement of cutting forces in Milling / Turning Process
11. CNC Part Programming

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 use different machine tools to manufacturing gears
CO2 Ability to use different machine tools to manufacturing gears.
CO3 Ability to use different machine tools for finishing operations
CO4 Ability to manufacture tools using cutter grinder
CO5 Develop CNC part programming

TOTAL: 45

PERIODS LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Turret and Capstan Lathes	1 No each
2	Horizontal Milling Machine	2 No
3	Vertical Milling Machine	1 No
4	Surface Grinding Machine	1 No.
5	Cylinderical Grinding Machine	1 No.
6	Radial Drilling Machine	1 No.
7	lathe Tool Dynamometer	1 No
8	Milling Tool Dynamometer	1 No
9	Gear Hobbing Machine	1 No
10	Tool Makers Microscope	1 No
11	CNC Lathe	1 No
12	CNC Milling machine	1 No
13	Gear Shaping machine	1 No
14	Centerless grinding machine	1 No
15	Tool and cutter grinder	1 No

20154L48	STRENGTH OF MATERIALS AND FLUID MECHANICS AND MACHINERY LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES:

- To study the mechanical properties of materials when subjected to different types of loading.
- To verify the principles studied in Fluid Mechanics theory by performing experiments in lab.

STRENGTH OF MATERIALS **23**

LIST OF EXPERIMENTS

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels.
10. Tempering- Improvement Mechanical properties Comparison
    (i) Unhardened specimen
    (ii) Quenched Specimen and
    (iii) Quenched and tempered specimen.
11. Microscopic Examination of
    (i) Hardened samples and
    (ii) Hardened and tempered samples.

OUTCOME:

- Ability to perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Universal Tensile Testing machine with double 1 shear attachment – 40 Ton Capacity	1
2	Torsion Testing Machine (60 NM Capacity)	1
3	Impact Testing Machine (300 J Capacity)	1
4	Brinell Hardness Testing Machine	1
5	Rockwell Hardness Testing Machine	1
6	Spring Testing Machine for tensile and compressive loads (2500 N)	1
7	Metallurgical Microscopes	3
8	Muffle Furnace (800 C)	1

FLUID MECHANICS AND MACHINES LABORATORY **22**

LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.

7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course, the students will be able to:

- Perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.
- Use the measurement equipments for flow measurement.
- Perform test on different fluid machinery.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. NO.	NAME OF THE EQUIPMENT	Qty.
1	Orifice meter setup	1
2	Venturi meter setup	1
3	Rotameter setup	1
4	Pipe Flow analysis setup	1
5	Centrifugal pump/submergible pump setup	1
6	Reciprocating pump setup	1
7	Gear pump setup	1
8	Pelton wheel setup	1
9	Francis turbine setup	1
10	Kaplan turbine setup	1

20154L 49 **ADVANCED READING AND WRITING**

L	T	P	C
0	0	2	1

OBJECTIVES:

- Strengthen the reading skills of students of engineering.
- Enhance their writing skills with specific reference to technical writing.
- Develop students' critical thinking skills.
- Provide more opportunities to develop their project and proposal writing skills.

UNIT I

Reading - Strategies for effective reading-Use glosses and footnotes to aid reading comprehension-Read and recognize different text types-Predicting content using photos and title Writing-Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence –Write a descriptive paragraph

UNIT II

Reading-Read for details-Use of graphic organizers to review and aid comprehension Writing-State reasons and examples to support ideas in writing- Write a paragraph with reasons and examples- Write an opinion paragraph

UNIT III

Reading- Understanding pronoun reference and use of connectors in a passage- speed reading techniques-Writing- Elements of a good essay-Types of essays- descriptive-narrative- issue-based-argumentative-analytical.

UNIT IV

Reading- Genre and Organization of Ideas- Writing- Email writing- resumes – Job application- project writing-writing convincing proposals.

UNIT V

Reading- Critical reading and thinking- understanding how the text positions the reader- identify
Writing- Statement of Purpose- letter of recommendation- Vision statement

TOTAL: 30 PERIODS

OUTCOMES: At the end of the course Learners will be able to:

- Write different types of essays.
- Write winning job applications.
- Read and evaluate texts critically.
- Display critical thinking in various professional contexts.

TEXT BOOKS:

1. Debra Daise, CharlNorloff, and Paul Carne Reading and Writing (Level 4) Oxford University Press: Oxford, 2011
2. Gramer F. Margot and Colin S. Ward Reading and Writing (Level 3) Oxford University Press: Oxford, 2011

REFERENCES

1. Davis, Jason and Rhonda LIss.Effective Academic Writing (Level 3) Oxford University Press: Oxford, 2006
2. E. Suresh Kumar and et al. Enriching Speaking and Writing Skills. Second Edition. Orient Black swan: Hyderabad, 2012
3. Withrow, Jeans and et al. Inspired to Write. Readings and Tasks to develop writing skills. Cambridge University Press: Cambridge, 2004
4. Goatly, Andrew. Critical Reading and Writing. Routledge: United States of America, 2000
5. Petelin, Roslyn and Marsh Durham. The Professional Writing Guide: Knowing Well and Knowing Why. Business & Professional Publishing: Australia, 2004

20154C52 **DESIGN OF MACHINE ELEMENTS**

L	T	P	C
3	2	0	4

OBJECTIVES

- To familiarize the various steps involved in the Design Process
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data
- To learn to use catalogues and standard machine components
- (Use of P S G Design Data Book is permitted)

UNIT I STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS 9+6

Introduction to the design process - factors influencing machine design, selection of materials based on mechanical properties - Preferred numbers, fits and tolerances – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – curved beams – crane hook and 'C' frame- Factor of safety - theories of failure – Design based on strength and stiffness – stress concentration – Design for variable loading.

UNIT II SHAFTS AND COUPLINGS 9+6

Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys, keyways and splines - Rigid and flexible couplings.

UNIT III TEMPORARY AND PERMANENT JOINTS 9+6

Threaded fastners - Bolted joints including eccentric loading, Knuckle joints, Cotter joints – Welded joints, riveted joints for structures - theory of bonded joints.

UNIT IV ENERGY STORING ELEMENTS AND ENGINE COMPONENTS 9+6

Various types of springs, optimization of helical springs - rubber springs - Flywheels considering stresses in rims and arms for engines and punching machines- Connecting Rods and crank shafts.

UNIT V BEARINGS 9+6

Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfeld Number, Raimondi and Boyd graphs, -- Selection of Rolling Contact bearings.

TOTAL: 45+30= 75 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Explain the influence of steady and variable stresses in machine component design.
CO2 Apply the concepts of design to shafts, keys and couplings.
CO3 Apply the concepts of design to temporary and permanent joints.
CO4 Apply the concepts of design to energy absorbing members, connecting rod and crank shaft.
CO5 Apply the concepts of design to bearings.

TEXT BOOKS:

1. Bhandari V, "Design of Machine Elements", 4th Edition, Tata McGraw-Hill Book Co, 2016.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 9th Edition, Tata McGraw-Hill, 2011.

REFERENCES:

1. Alfred Hall, Halowenko, A and Laughlin, H., “Machine Design”, Tata McGraw-Hill BookCo.(Schaum’s Outline), 2010
2. Ansel Ugural, “Mechanical Design – An Integral Approach", 1st Edition, Tata McGraw-Hill Book Co, 2003.
3. P.C. Gope, “Machine Design – Fundamental and Application”, PHI learning private ltd, New Delhi, 2012.
4. R.B. Patel, “Design of Machine Elements”, MacMillan Publishers India P Ltd., Tech-Max Educational resources, 2011.
5. Robert C. Juvinall and Kurt M Marshek, “Fundamentals of Machine Design”, 4th Edition, Wiley, 2005
6. Sundararajamoorthy T. V. Shanmugam .N, “Machine Design”, Anuradha Publications, Chennai, 2015.

20154C53	METROLOGY AND MEASUREMENTS	L	T	P	C
		4	0	0	4

OBJECTIVES:

- To provide knowledge on various Metrological equipments available to measure the dimension of the components.
- To provide knowledge on the correct procedure to be adopted to measure the dimension of the components.

UNIT I BASICS OF METROLOGY 12

Introduction to Metrology – Need – Elements – Work piece, Instruments – Persons – Environment – their effect on Precision and Accuracy – Errors – Errors in Measurements – Types – Control – Types of standards.

UNIT II LINEAR AND ANGULAR MEASUREMENTS 12

Linear Measuring Instruments – Evolution – Types – Classification – Limit gauges – gauge design – terminology – procedure – concepts of interchange ability and selective assembly – Angular measuring instruments – Types – Bevel protractor clinometers angle gauges, spirit levels sine bar – Angle alignment telescope – Autocollimator – Applications.

UNIT III ADVANCES IN METROLOGY 12

Basic concept of lasers Advantages of lasers – laser Interferometers – types – DC and AC Lasers interferometer – Applications – Straightness – Alignment. Basic concept of CMM – Types of CMM
– Constructional features – Probes – Accessories – Software – Applications – Basic concepts of Machine Vision System – Element – Applications.

UNIT IV FORM MEASUREMENT 12

Principles and Methods of straightness – Flatness measurement – Thread measurement, gear measurement, surface finish measurement, Roundness measurement – Applications.

UNIT V MEASUREMENT OF POWER, FLOW AND TEMPERATURE 12

Force, torque, power - mechanical , Pneumatic, Hydraulic and Electrical type. Flow measurement: Venturimeter, Orifice meter, rotameter, pitot tube – Temperature: bimetallic strip, thermocouples, electrical resistance thermometer – Reliability and Calibration – Readability and Reliability.

TOTAL : 60 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Describe the concepts of measurements to apply in various metrological instruments
CO2 Outline the principles of linear and angular measurement tools used for industrial Applications
CO3 Explain the procedure for conducting computer aided inspection
CO4 Demonstrate the techniques of form measurement used for industrial components
CO5 Discuss various measuring techniques of mechanical properties in industrial applications

TEXT BOOKS:

1. Gupta. I.C., “Engineering Metrology”, Dhanpatrai Publications, 2005.
2. Jain R.K. “Engineering Metrology”, Khanna Publishers, 2009.

REFERENCES:

1. Alan S. Morris, “The essence of Measurement”, Prentice Hall of India 1996.
2. Beckwith, Marangoni, Lienhard, “Mechanical Measurements”, Pearson Education , 2014.
3. Charles Reginald Shotbolt, “Metrology for Engineers”, 5th edition, Cengage Learning EMEA,1990.
4. Donald Peckman, “Industrial Instrumentation”, Wiley Eastern, 2004.
5. Raghavendra ,Krishnamurthy “Engineering Metrology & Measurements”, Oxford Univ. Press, 2013.

20154L57 **THERMAL ENGINEERING LABORATORY**

L	T	P	C
0	0	3	2

OBJECTIVES:

- To study the value timing-V diagram and performance of IC Engines
- To Study the characteristics of fuels/Lubricates used in IC Engines
- To study the Performance of steam generator/ turbine
- To study the heat transfer phenomena predict the relevant coefficient using implementation
- To study the performance of refrigeration cycle / components

LIST OF EXPERIMENTS

I.C. ENGINE LAB

1. Valve Timing and Port Timing diagrams.
2. Actual p-v diagrams of IC engines.
3. Performance Test on 4 – stroke Diesel Engine.
4. Heat Balance Test on 4 – stroke Diesel Engine.
5. Morse Test on Multi-cylinder Petrol Engine.
6. Retardation Test on a Diesel Engine.
7. Determination of Flash Point and Fire Point of various fuels / lubricants.

STEAM LAB

1. Study on Steam Generators and Turbines.
2. Performance and Energy Balance Test on a Steam Generator.
3. Performance and Energy Balance Test on Steam Turbine.

HEAT TRANSFER LAB:

1. Thermal conductivity measurement using guarded plate apparatus.
2. Thermal conductivity measurement of pipe insulation using lagged pipe apparatus.
3. Determination of heat transfer coefficient under natural convection from a vertical cylinder.
4. Determination of heat transfer coefficient under forced convection from a tube.
5. Determination of Thermal conductivity of composite wall.
6. Determination of Thermal conductivity of insulating powder.
7. Heat transfer from pin-fin apparatus (natural & forced convection modes)
8. Determination of Stefan – Boltzmann constant.
9. Determination of emissivity of a grey surface.
10. Effectiveness of Parallel / counter flow heat exchanger.

REFRIGERATION AND AIR CONDITIONING LAB

1. Determination of COP of a refrigeration system
2. Experiments on Psychrometric processes
3. Performance test on a reciprocating air compressor
4. Performance test in a HC Refrigeration System
5. Performance test in a fluidized Bed Cooling Tower

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 conduct tests on heat conduction apparatus and evaluate thermal conductivity of materials.

CO2 conduct tests on natural and forced convective heat transfer apparatus and evaluate heat transfer coefficient.

CO3 conduct tests on radiative heat transfer apparatus and evaluate Stefan Boltzmann constant and emissivity.

CO4 conduct tests to evaluate the performance of parallel/counter flow heat exchanger apparatus and reciprocating air compressor.

CO5 conduct tests to evaluate the performance of refrigeration and airconditioning test rigs.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

	NAME OF THE EQUIPMENT	Qty.
1	I.C Engine – 2 stroke and 4 stroke model	1 set
2	Apparatus for Flash and Fire Point	1 No.
3	4-stroke Diesel Engine with mechanical loading.	1 No
4	4-stroke Diesel Engine with hydraulic loading.	1 No.
5	4-stroke Diesel Engine with electrical loading.	1 No.
6	Multi-cylinder Petrol Engine	1 No.
7	Single cylinder Petrol Engine	1 No.
8	Data Acquisition system with any one of the above engines	1 No.
9	Steam Boiler with turbine setup	1 No.

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Guarded plate apparatus	1 No.
2	Lagged pipe apparatus	1 No.
3	Natural convection-vertical cylinder apparatus	1 No.
4	Forced convection inside tube apparatus	1 No.
5	Composite wall apparatus	1 No.
6	Thermal conductivity of insulating powder apparatus	1 No.
7	Pin-fin apparatus	1 No.
8	Stefan-Boltzmann apparatus	1 No.
9	Emissivity measurement apparatus	1 No.
10	Parallel/counter flow heat exchanger apparatus	1 No.
11	Single/two stage reciprocating air compressor	1 No.
12	Refrigeration test rig	1 No.
13	Air-conditioning test rig	1 No.

20154L58	METROLOGY AND MEASUREMENTS LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVE:

- To familiar with different measurement equipments and use of this industry for quality inspection.

LIST OF EXPERIMENTS

1. Calibration and use of measuring instruments – Vernier caliper, micrometer, Vernier height gauge – using gauge blocks
2. Calibration and use of measuring instruments – depth micrometer, bore gauge, telescopic gauge
3. Measurement of linear dimensions using Comparators
4. Measurement of angles using bevel protractor and sine bar
5. Measurement of screw thread parameters – Screw thread Micrometers and Three wire method '(floating carriage micrometer)
6. Measurement of gear parameters – disc micrometers, gear tooth vernier caliper
7. Measurement of features in a prismatic component using Coordinate Measuring Machine (CMM)
8. Programming of CNC Coordinate Measuring Machines for repeated measurements of identical components
9. Non-contact (Optical) measurement using Toolmaker's microscope / Profile projector and Video measurement system
10. Measurement of Surface finish in components manufactured using various processes (turning, milling, grinding, etc.,) using stylus based instruments.
11. Machine tool metrology – Level tests using precision level; Testing of straightness of a machine tool guide way using Autocollimator, spindle tests.
12. Measurement of force, torque and temperature

TOTAL: 45 PERIODS

OUTCOMES

Upon the completion of this course the students will be able to

CO1 Measure the gear tooth dimensions, angle using sine bar, straightness and flatness, thread parameters, temperature using thermocouple, force, displacement, torque and vibration.

CO2 Calibrate the vernier, micrometer and slip gauges and setting up the comparator for the inspection.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Micrometer	5
2	Vernier Caliper	5
3	Vernier Height Gauge	2
4	Vernier depth Gauge	2
5	Slip Gauge Set	1
6	Gear Tooth Vernier	1
7	Sine Bar	1
8	Floating Carriage Micrometer	1
9	Profile Projector / Tool Makers Microscope	1
10	Parallel / counter flow heat exchanger apparatus	1
11	Mechanical / Electrical / Pneumatic Comparator	1
12	Autocollimator	1
13	Temperature Measuring Setup	1

14	Force Measuring Setup	1
15	Torque Measuring Setup	1
16	Coordinate measuring machine	1
17	Surface finish measuring equipment	1
18	Bore gauge	1
19	Telescope gauge	1

20154C61 **DESIGN OF TRANSMISSION SYSTEMS**

L	T	P	C
3	2	0	4

OBJECTIVES:

- To gain knowledge on the principles and procedure for the design of Mechanical power Transmission components.
- To understand the standard procedure available for Design of Transmission of Mechanical elements
- To learn to use standard data and catalogues (Use of P S G Design Data Book permitted)

UNIT I DESIGN OF FLEXIBLE ELEMENTS 9+6

Design of Flat belts and pulleys - Selection of V belts and pulleys – Selection of hoisting wire ropes and pulleys – Design of Transmission chains and Sprockets.

UNIT II SPUR GEARS AND PARALLEL AXIS HELICAL GEARS 9+6

Speed ratios and number of teeth-Force analysis -Tooth stresses - Dynamic effects – Fatigue strength - Factor of safety - Gear materials – Design of straight tooth spur & helical gears based on strength and wear considerations – Pressure angle in the normal and transverse plane- Equivalent number of teeth-forces for helical gears.

UNIT III BEVEL, WORM AND CROSS HELICAL GEARS 9+6

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears. Worm Gear: Merits and demerits- terminology. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the worm gear pair. Cross helical: Terminology-helix angles-Estimating the size of the pair of cross helical gears.

UNIT IV GEAR BOXES 9+6

Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box - Design of multi speed gear box for machine tool applications - Constant mesh gear box - Speed reducer unit. – Variable speed gear box, Fluid Couplings, Torque Converters for automotive applications.

UNIT V CAMS, CLUTCHES AND BRAKES 9+6

Cam Design: Types-pressure angle and under cutting base circle determination-forces and surface stresses. Design of plate clutches –axial clutches-cone clutches-internal expanding rim clutches- Electromagnetic clutches. Band and Block brakes - external shoe brakes – Internal expanding shoe brake.

TOTAL : 45+30=75 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 apply the concepts of design to belts, chains and rope drives.
CO2 apply the concepts of design to spur, helical gears.
CO3 apply the concepts of design to worm and bevel gears.
CO4 apply the concepts of design to gear boxes .
CO5 apply the concepts of design to cams, brakes and clutches

TEXT BOOKS:

1. Bhandari V, "Design of Machine Elements", 4th Edition, Tata McGraw-Hill Book Co, 2016.

2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 8th Edition, Tata McGraw-Hill, 2008.

REFERENCES:
1. Merhyle F. Spotts, Terry E. Shoup and Lee E. Hornberger, "Design of Machine Elements" 8th Edition, Printice Hall, 2003.
2. Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.
3. Prabhu. T.J., "Design of Transmission Elements", Mani Offset, Chennai, 2000.
4. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine Design", 4th Edition, Wiley, 2005
5. Sundararajamoorthy T. V, Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.

20154C62 **COMPUTER AIDED DESIGN AND MANUFACTURING** **L T P C**

3 2 0 4

OBJECTIVES:

- To provide an overview of how computers are being used in mechanical component design
- To understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.

UNIT I INTRODUCTION 9+6

Product cycle- Design process- sequential and concurrent engineering- Computer aided design – CAD system architecture- Computer graphics – co-ordinate systems- 2D and 3D transformations- homogeneous coordinates - Line drawing -Clipping- viewing transformation-Brief introduction to CAD and CAM – Manufacturing Planning, Manufacturing control- Introduction to CAD/CAM – CAD/CAM concepts —Types of production - Manufacturing models and Metrics – Mathematical models of Production Performance

UNIT II GEOMETRIC MODELING 9+6

Representation of curves- Hermite curve- Bezier curve- B-spline curves-rational curves-Techniques for surface modeling – surface patch- Coons and bicubic patches- Bezier and B-spline surfaces. Solid modeling techniques- CSG andB-rep

UNIT III CAD STANDARDS 9+6

Standards for computer graphics- Graphical Kernel System (GKS) - standards for exchange images- Open Graphics Library (OpenGL) - Data exchange standards - IGES, STEP, CALS etc. - communication standards.

UNIT IV FUNDAMENTAL OF CNC AND PART PROGRAMING 9+6

Introduction to NC systems and CNC - Machine axis and Co-ordinate system- CNC machine tools- Principle of operation CNC- Construction features including structure- Drives and CNC controllers- 2D and 3D machining on CNC- Introduction of Part Programming, types - Detailed Manual part programming on Lathe & Milling machines using G codes and M codes- Cutting Cycles, Loops, Sub program and Macros- Introduction of CAM package.

UNIT V CELLULAR MANUFACTURING AND FLEXIBLE MANUFACTURING SYSTEM (FMS) 9+6

Group Technology(GT),Part Families–Parts Classification and coding–Simple Problems in Opitz Part Coding system–Production flow Analysis–Cellular Manufacturing–Composite part concept–Types of Flexibility - FMS – FMS Components – FMS Application & Benefits – FMS Planning and Control– Quantitative analysis in FMS

TOTAL : 45+30=75 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1	Explain the 2D and 3D transformations, clipping algorithm, Manufacturing models and Metrics
CO2	Explain the fundamentals of parametric curves, surfaces and Solids
CO3	Summarize the different types of Standard systems used in CAD
CO4	Apply NC & CNC programming concepts to develop part programme for Lathe & Milling Machines
CO5	Summarize the different types of techniques used in Cellular Manufacturing and FMS

TEXT BOOKS:

1. Ibrahim Zeid “Mastering CAD CAM” Tata McGraw-Hill PublishingCo.2007
2. Mikell.P.Groover “Automation, Production Systems and Computer Integrated Manufacturing”, Prentice Hall of India, 2008.
3. Radhakrishnan P, SubramanyanS.andRaju V., “CAD/CAM/CIM”, 2nd Edition, New Age International (P) Ltd, New Delhi,2000.

REFERENCES:

1. Chris McMahon and Jimmie Browne “CAD/CAM Principles", "Practice and Manufacturing management “ Second Edition, Pearson Education, 1999.
2. Donald Hearn and M. Pauline Baker “Computer Graphics”’. Prentice Hall, Inc,1992.
3. Foley, Wan Dam, Feiner and Hughes - "Computer graphics principles & practice" Pearson Education -2003
4. William M Neumann and Robert F.Sproul “Principles of Computer Graphics”, McGraw Hill Book Co. Singapore, 1989.

20154C64 **FINITE ELEMENT ANALYSIS**

L	T	P	C
3	2	0	4

OBJECTIVES:

- To introduce the concepts of Mathematical Modeling of Engineering Problems.
- To appreciate the use of FEM to a range of Engineering Problems.

UNIT I INTRODUCTION 9+6

Historical Background – Mathematical Modeling of field problems in Engineering – Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems– Weighted Residual Methods – Variational Formulation of Boundary Value Problems – Ritz Technique – Basic concepts of the Finite Element Method.

UNIT II ONE-DIMENSIONAL PROBLEMS 9+6

One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher order Elements – Derivation of Shape functions and Stiffness matrices and force vectors- Assembly of Matrices - Solution of problems from solid mechanics and heat transfer. Longitudinal vibration frequencies and mode shapes. Fourth Order Beam Equation –Transverse deflections and Natural frequencies of beams.

UNIT III TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS 9+6

Second Order 2D Equations involving Scalar Variable Functions – Variational formulation –Finite Element formulation – Triangular elements – Shape functions and element matrices and vectors. Application to Field Problems - Thermal problems – Torsion of Non circular shafts –Quadrilateral elements – Higher Order Elements.

UNIT IV TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS 9+6

Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Body forces and temperature effects – Stress calculations - Plate and shell elements.

UNIT V ISOPARAMETRIC FORMULATION 9+6

Natural co-ordinate systems – Isoparametric elements – Shape functions for iso parametric elements – One and two dimensions – Serendipity elements – Numerical integration and application to plane stress problems - Matrix solution techniques – Solutions Techniques to Dynamic problems – Introduction to Analysis Software.

TOTAL : 45+30=75 PERIODS

OUTCOMES

CO1 Summarize the basics of finite element formulation.
CO2 Apply finite element formulations to solve one dimensional Problems.
CO3 Apply finite element formulations to solve two dimensional scalar Problems.
CO4 Apply finite element method to solve two dimensional Vector problems.
CO5 Apply finite element method to solve problems on iso parametric element and dynamic Problems.

TEXT BOOKS:

1. Reddy. J.N., "An Introduction to the Finite Element Method", 3rd Edition, Tata McGraw-Hill, 2005
2. Seshu, P, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., New Delhi, 2007.

REFERENCES:

1. Bhatti Asghar M, "Fundamental Finite Element Analysis and Applications", John Wiley & Sons, 2005 (Indian Reprint 2013)*
2. Chandrupatla & Belagundu, “Introduction to Finite Elements in Engineering”, 3rd Edition, Prentice Hall College Div, 1990
3. Logan, D.L., “A first course in Finite Element Method”, Thomson Asia Pvt. Ltd., 2002
4. Rao, S.S., “The Finite Element Method in Engineering”, 3rd Edition, Butterworth Heinemann, 2004
5. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, “Concepts and Applications of Finite Element Analysis”, 4th Edition, Wiley Student Edition, 2002.

20154C65 **HYDRAULICS AND PNEUMATICS**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide student with knowledge on the application of fluid power in process, construction and manufacturing Industries.
- To provide students with an understanding of the fluids and components utilized in modern industrial fluid power system.
- To develop a measurable degree of competence in the design, construction and operation of fluid power circuits.

UNIT I FLUID POWER PRINICIPLES AND HYDRAULIC PUMPS 9

Introduction to Fluid power – Advantages and Applications – Fluid power systems – Types offluids - Properties of fluids and selection – Basics of Hydraulics – Pascal's Law – Principles of flow - Friction loss – Work, Power and Torque Problems, Sources of Hydraulic power : Pumping Theory – Pump Classification – Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criteria of Linear and Rotary – Fixed and Variable displacement pumps – Problems.

UNIT II HYDRAULIC ACTUATORS AND CONTROL COMPONENTS 9

Hydraulic Actuators: Cylinders – Types and construction, Application, Hydraulic cushioning – Hydraulic motors - Control Components : Direction Control, Flow control and pressure control valves – Types, Construction and Operation – Servo and Proportional valves – Applications – Accessories : Reservoirs, Pressure Switches – Applications – Fluid Power ANSI Symbols – Problems.

UNIT III HYDRAULIC CIRCUITS AND SYSTEMS 9

Accumulators, Intensifiers, Industrial hydraulic circuits – Regenerative, Pump Unloading, Double-Pump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-Safe, Speed Control, Hydrostatic transmission, Electro hydraulic circuits, Mechanical hydraulic servo systems.

UNIT IV PNEUMATIC AND ELECTRO PNEUMATIC SYSTEMS 9

Properties of air – Perfect Gas Laws – Compressor – Filters, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust Valves, Pneumatic actuators, Design of Pneumatic circuit – Cascade method – Electro Pneumatic System – Elements – Ladder diagram – Problems, Introduction to fluidics and pneumatic logic circuits.

UNIT V TROUBLE SHOOTING AND APPLICATIONS 9

Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic systems, Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and Forklift applications. Design of Pneumatic circuits for Pick and Place applications and tool handling in CNC Machine tools – Low cost Automation – Hydraulic and Pneumatic power packs.

TOTAL:45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Explain the Fluid power and operation of different types of pumps.

CO2 Summarize the features and functions of Hydraulic motors, actuators and Flow control valves

CO3 Explain the different types of Hydraulic circuits and systems

CO4 Explain the working of different pneumatic circuits and systems

CO5 Summarize the various trouble shooting methods and applications of hydraulic and pneumatic systems.

TEXT BOOKS:

1. Anthony Esposito, "Fluid Power with Applications", Pearson Education 2005.
2. Majumdar S.R., "Oil Hydraulics Systems- Principles and Maintenance", Tata McGraw-Hill, 2001.

REFERENCES:

1. Anthony Lal, "Oil hydraulics in the service of industry", Allied publishers, 1982.
2. Dudelyt, A. Pease and John T. Pippenger, "Basic Fluid Power", Prentice Hall, 1987.
3. Majumdar S.R., "Pneumatic systems – Principles and maintenance", Tata McGraw Hill, 1995
4. Michael J, Prinches and Ashby J. G, "Power Hydraulics", Prentice Hall, 1989.
5. Shanmugasundaram.K, "Hydraulic and Pneumatic controls", Chand & Co, 2006.

20154L67 **CAD / CAM LABORATORY**

L	T	P	C
0	0	3	2

OBJECTIVES:

- To gain practical experience in handling 2D drafting and 3D modelling software systems.
- To study the features of CNC Machine Tool.
- To expose students to modern control systems (Fanuc, Siemens etc.,)
- To know the application of various CNC machines like CNC lathe, CNC Vertical Machining centre, CNC EDM and CNC wire-cut and studying of Rapid prototyping.

LIST OF EXPERIMENTS

1. 3D GEOMETRIC MODELLING **23 PERIODS**

List of Experiments

1. Introduction of 3D Modelling software

Creation of 3D assembly model of following machine elements using 3D Modelling software

2. Flange Coupling
3. Plummer Block
4. Screw Jack
5. Lathe Tailstock
6. Universal Joint
7. Machine Vice
8. Stuffing box
9. Crosshead
10. Safety Valves
11. Non-return valves
12. Connecting rod
13. Piston
14. Crankshaft

* Students may also be trained in manual drawing of some of the above components

2. Manual Part Programming. **22 PERIODS**

(i) Part Programming - CNC
Machining Centre a) Linear Cutting.
b) Circular cutting.
c) Cutter Radius
Compensation. d) Canned
Cycle Operations.
(ii) Part Programming - CNC Turning
Centre a) Straight, Taper and Radius
Turning.
b) Thread Cutting.
c) Rough and Finish Turning
Cycle. d) Drilling and
Tapping Cycle.

3. Computer Aided Part Programming

e) CL Data and Post process generation using CAM packages.
f) Application of CAPP in Machining and Turning Centre.

TOTAL: 45 PERIODS

OUTCOMES

CO1 Draw 3D and Assembly drawing using CAD software
CO2 Demonstrate manual part programming with G and M codes using CAM

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	Description of Equipment	Qty
HARDWARE		
1.	Computer Server	1
2.	Computer nodes or systems (High end CPU with atleast 1 GB main memory) networked to the server	30
3.	A3 size plotter	1
4.	Laser Printer	1
5.	CNC Lathe	1
6.	CNC milling machine	1
SOFTWARE		
7.	Any High end integrated modeling and manufacturing CAD / CAM software	15 licenses
8.	CAM Software for machining centre and turning centre (CNC Programming and tool path simulation for FANUC / Sinumeric and Heidenhain controller)	15 licenses
9.	Licensed operating system	Adequate
10.	Support for CAPP	Adequate

20154L68 DESIGN AND FABRICATION PROJECT

L	T	P	C
0	0	3	2

OBJECTIVE:

- The main objective is to give an opportunity to the student to get hands on training in the fabrication of one or more components of a complete working model, which is designed by them.

GUIDELINE FOR REVIEW AND EVALUATION

The students may be grouped into 2 to 4 and work under a project supervisor. The device/ system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL : 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 design and Fabricate the machine element or the mechanical product.

CO2 demonstrate the working model of the machine element or the mechanical product.

20154L69 **PROFESSIONAL COMMUNICATION**

L	T	P	C
0	0	2	1

OBJECTIVES: The course aims to:

- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employable Graduates
- Develop their confidence and help them attend interviews successfully.

UNIT I

Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs

UNIT II

Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations

UNIT III

Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic -— questioning and clarifying –GD strategies- activities to improve GD skills

UNIT IV

Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews

UNIT V

Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long- term career plan-making career changes

TOTAL : 30 PERIODS

OUTCOMES: At the end of the course Learners will be able to:

- Make effective presentations
- Participate confidently in Group Discussions.
- Attend job interviews and be successful in them.
- Develop adequate Soft Skills required for the workplace

Recommended Software

1. Globearena
2.Win English

REFERENCES:

1. Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015
3. Interact English Lab Manual for Undergraduate Students,. OrientBalckSwan: Hyderabad, 2016.
4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
5. S. Hariharanetal. Soft Skills. MJP Publishers: Chennai, 2010.

20154C71 **POWER PLANT ENGINEERING**

L	T	P	C
4	0	0	4

OBJECTIVE:

- Providing an overview of Power Plants and detailing the role of Mechanical Engineers in their operation and maintenance.

UNIT I COAL BASED THERMAL POWER PLANTS 15

Rankine cycle - improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.

UNIT II DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS 15

Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimisation. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.

UNIT III NUCLEAR POWER PLANTS 15

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : Boil*ing Water Reactor* (BWR), P*ressurized Water Reactor* (PWR), CANada Deuterium- Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

UNIT IV POWER FROM RENEWABLE ENERGY 15

Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, *Solar* Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.

UNIT V ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS 15

Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

TOTAL : 60 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Explain the layout, construction and working of the components inside a thermal power plant.

CO2 Explain the layout, construction and working of the components inside a Diesel, Gas and Combined cycle power plants.

CO3 Explain the layout, construction and working of the components inside nuclear power plants.

CO4 Explain the layout, construction and working of the components inside Renewable energy power plants.

CO5 Explain the applications of power plants while extend their knowledge to power plant economics and environmental hazards and estimate the costs of electrical energy production.

TEXT BOOK:

1. Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008.

REFERENCES:

1. El-Wakil. M.M., "Power Plant Technology", Tata McGraw – Hill Publishing Company Ltd., 2010.
2. Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.
3. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, "Power Plant Engineering", Second Edition, Standard Handbook of McGraw – Hill, 1998.

20154C72 **PROCESS PLANNING AND COST ESTIMATION**

L	T	P	C
3	2	0	4

OBJECTIVE:

- To introduce the process planning concepts to make cost estimation for various products after process planning

UNIT I INTRODUCTION TO PROCESS PLANNING 9+6

Introduction- methods of process planning-Drawing interpretation-Material evaluation – steps in process selection-.Production equipment and tooling selection

UNIT II PROCESS PLANNING ACTIVITIES 9+6

Process parameters calculation for various production processes-Selection jigs and fixtures election of quality assurance methods - Set of documents for process planning-Economics of process planning- case studies

UNIT III INTRODUCTION TO COST ESTIMATION 9+6

Importance of costing and estimation –methods of costing-elements of cost estimation –Types of estimates – Estimating procedure- Estimation labor cost, material cost- allocation of over head charges- Calculation of depreciation cost

UNIT IV PRODUCTION COST ESTIMATION 9+6

Estimation of Different Types of Jobs - Estimation of Forging Shop, Estimation of Welding Shop, Estimation of Foundry Shop

UNIT V MACHINING TIME CALCULATION 9+6

Estimation of Machining Time - Importance of Machine Time Calculation- Calculation of Machining Time for Different Lathe Operations ,Drilling and Boring - Machining Time Calculation for Milling, Shaping and Planning -Machining Time Calculation for Grinding.

TOTAL: 45+30=75 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 select the process, equipment and tools for various industrial products.
CO2 prepare process planning activity chart.
CO3 explain the concept of cost estimation.
CO4 compute the job order cost for different type of shop floor.
CO5 calculate the machining time for various machining operations.

TEXT BOOKS:

1. Peter scalon, “Process planning, Design/Manufacture Interface”, Elsevier science technology Books, Dec 2002.
2. Sinha B.P, “Mechanical Estimating and Costing”, Tata-McGraw Hill publishing co, 1995.

REFERENCES:

1. Chitale A.V. and Gupta R.C., “Product Design and Manufacturing”, 2nd Edition, PHI, 2002.
2. Ostwalal P.F. and Munez J., “Manufacturing Processes and systems”, 9th Edition, John Wiley, 1998.
3. Russell R.S and Tailor B.W, “Operations Management”, 4th Edition, PHI, 2003.
4. Mikell P. Groover, “Automation, Production, Systems and Computer Integrated Manufacturing”, Pearson Education 2001.
5. K.C. Jain & L.N. Aggarwal, “Production Planning Control and Industrial Management”, Khanna Publishers 1990.

20154C73 **MECHATRONICS**

L	T	P	C
4	0	0	4

OBJECTIVE:

- To impart knowledge about the elements and techniques involved in Mechatronics systems which are very much essential to understand the emerging field of automation.

UNIT I INTRODUCTION 12

Introduction to Mechatronics – Systems – Concepts of Mechatronics approach – Need for Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics. Sensors and Transducers**:** Static and dynamic Characteristics of Sensor, Potentiometers – LVDT – Capacitance sensors – Strain gauges – Eddy current sensor – Hall effect sensor – Temperature sensors – Light sensors

UNIT II MICROPROCESSOR AND MICROCONTROLLER 9+6

Introduction – Architecture of 8085 – Pin Configuration – Addressing Modes –Instruction set, Timing diagram of 8085 – Concepts of 8051 microcontroller – Block diagram,.

UNIT III PROGRAMMABLE PERIPHERAL INTERFACE 9+6

Introduction – Architecture of 8255, Keyboard interfacing, LED display –interfacing, ADC and DAC interface, Temperature Control – Stepper Motor Control – Traffic Control interface.

UNIT IV PROGRAMMABLE LOGIC CONTROLLER 9+6

Introduction – Basic structure – Input and output processing – Programming – Mnemonics – Timers, counters and internal relays – Data handling – Selection of PLC.

UNIT V ACTUATORS AND MECHATRONIC SYSTEM DESIGN 9+6

Types of Stepper and Servo motors – Construction – Working Principle – Advantages and Disadvantages. Design process-stages of design process – Traditional and Mechatronics design concepts – Case studies of Mechatronics systems – Pick and place Robot – Engine Management system – Automatic car park barrier.

TOTAL : 45+30=75 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Discuss the interdisciplinary applications of Electronics, Electrical, Mechanical and Computer Systems for the Control of Mechanical, Electronic Systems and sensor technology.

CO2 Discuss the architecture of Microprocessor and Microcontroller, Pin Diagram, Addressing Modes of Microprocessor and Microcontroller.

CO3 Discuss Programmable Peripheral Interface, Architecture of 8255 PPI, and various device Interfacing

CO4 Explain the architecture, programming and application of programmable logic controllers to problems and challenges in the areas of Mechatronic engineering.

CO5 Discuss various Actuators and Mechatronics system using the knowledge and skills acquired through the course and also from the given case studies

TEXT BOOKS:

1. Bolton, “Mechatronics”, Prentice Hall, 2008
2. Ramesh S Gaonkar, “Microprocessor Architecture, Programming, and Applications with the 8085”, 5th Edition, Prentice Hall, 2008.

REFERENCES:

1. Bradley D.A, Dawson D, Buru N.C and Loader A.J, “Mechatronics”, Chapman and Hall, 1993.
2. Clarence W, de Silva, "Mechatronics" CRC Press, First Indian Re-print, 2013
3. Devadas Shetty and Richard A. Kolk, “Mechatronics Systems Design”, PWS publishing company, 2007.
4. Krishna Kant, “Microprocessors & Microcontrollers”, Prentice Hall of India, 2007.
5. Michael B.Histand and Davis G.Alciatore, “Introduction to Mechatronics and Measurement systems”, McGraw Hill International edition, 2007.

20154L77	SIMULATION AND ANALYSIS LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES:

- To give exposure to software tools needed to analyze engineering problems.
- To expose the students to different applications of simulation and analysis tools.

LIST OF EXPERIMENTS A. SIMULATION

1. MATLAB basics, Dealing with matrices, Graphing-Functions of one variable and two variables
2. Use of Matlab to solve simple problems in vibration
3. Mechanism Simulation using Multibody Dynamic software

B. ANALYSIS

1. Force and Stress analysis using link elements in Trusses, cables etc.
2. Stress and deflection analysis in beams with different support conditions.
3. Stress analysis of flat plates and simple shells.
4. Stress analysis of axi – symmetric components.
5. Thermal stress and heat transfer analysis of plates.
6. Thermal stress analysis of cylindrical shells.
7. Vibration analysis of spring-mass systems.
8. Model analysis of Beams.
9. Harmonic, transient and spectrum analysis of simple systems.

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 simulate the working principle of air conditioning system, hydraulic and pneumatic cylinder and cam follower mechanisms using MATLAB.

CO2 analyze the stresses and strains induced in plates, brackets and beams and heat transfer problems.

CO3 calculate the natural frequency and mode shape analysis of 2D components and beams.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. NO.	NAME OF THE EQUIPMENT	Qty.
1	Computer Work Station	15
2	Color Desk Jet Printer	01
3	Multibody Dynamic Software Suitable for Mechanism simulation and analysis	15 licenses
4	C / MATLAB	5 licenses

20154L78 **MECHATRONICS LABORATORY**

L	T	P	C
0	0	3	2

OBJECTIVE:

- To know the method of programming the microprocessor and also the design, modeling & analysis of basic electrical, hydraulic & pneumatic Systems which enable the students to understand the concept of mechatronics.

LIST OF EXPERIMENTS:

1. Assembly language programming of 8085 – Addition – Subtraction – Multiplication – Division – Sorting – Code Conversion.
2. Stepper motor interface.
3. Traffic light interface.
4. Speed control of DC motor.
5. Study of various types of transducers.
6. Study of hydraulic, pneumatic and electro-pneumatic circuits.
7. Modelling and analysis of basic hydraulic, pneumatic and electrical circuits using Software.
8. Study of PLC and its applications.
9. Study of image processing technique.

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Demonstrate the functioning of mechatronics system with various pneumatic, hydraulic and electrical systems.

CO2 Demonstrate the functioning of control systems with the help of PLC and microcontrollers.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl. No.	NAME OF THE EQUIPMENT	Qty.
1	Basic Pneumatic Trainer Kit with manual and electrical controls/ PLC Control each	1 No.
2	Basic Hydraulic Trainer Kit	1 No
3	Hydraulics and Pneumatics Systems Simulation Software	10 No
4	8051 - Microcontroller kit with stepper motor and drive circuit sets	2 No
5	Image processing system with hardware & software	1 No.

20154L79 **TECHNICALSEMINAR** **L T P C**

0 0 2 1

To enrich the communication skills of the student and presentations of technical topics of interest, this course is introduced. In this course, a student has to present three Technical papers or recent advances in engineering/technology that will be evaluated by a Committee constituted by the Head of the Department.

TOTAL: 30 PERIODS

20154C81 **PRINCIPLES OF MANAGEMENT**

L	T	P	C
3	0	0	3

OBJECTIVE:

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

UNIT II PLANNING 9

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT III ORGANISING 9

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

UNIT IV DIRECTING 9

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

UNIT V CONTROLLING 9

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

TOTAL: 45 PERIODS

OUTCOME:

- Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

TEXT BOOKS:

1. JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", 6th Edition, Pearson Education, 2004.
2. Stephen P. Robbins & Mary Coulter, "Management", Prentice Hall (India)Pvt. Ltd., Edition, 10^{th} 2009.

REFERENCES:

1. Harold Koontz & Heinz Weihrich, "Essentials of Management", Tata McGraw Hill, 1998.
2. Robert Kreitner & Mamata Mohapatra, "Management", Biztantra, 2008.

3. Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management", 7th Edition, Pearson Education, 2011.
4. Tripathy PC & Reddy PN, "Principles of Management", Tata Mcgraw Hill, 1999
5.

ELECTIVE – I (VI SEMESTER)

20154E66A **AUTOMOBILE ENGINEERING**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the construction and working principle of various parts of an automobile.
- To have the practice for assembling and dismantling of engine parts and transmission system

UNIT I VEHICLE STRUCTURE AND ENGINES 9

Types of automobiles vehicle construction and different layouts, chassis, frame and body, Vehicle aerodynamics (various resistances and moments involved), IC engines –components- functions and materials, variable valve timing (VVT).

UNIT II ENGINE AUXILIARY SYSTEMS 9

Electronically controlled gasoline injection system for SI engines, Electronically controlled diesel injection system (Unit injector system, Rotary distributor type and common rail direct injection system), Electronic ignition system (Transistorized coil ignition system, capacitive discharge ignition system), Turbo chargers (WGT, VGT), Engine emission control by three way catalytic converter system, Emission norms (Euro and BS).

UNIT III TRANSMISSION SYSTEMS 9

Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints, Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.

UNIT IV STEERING, BRAKES AND SUSPENSION SYSTEMS 9

Steering geometry and types of steering gear box- Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock Braking System (ABS), electronic brake force distribution (EBD) and Traction Control.

UNIT V ALTERNATIVE ENERGY SOURCES 9

Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles- Engine modifications required –Performance, Combustion and Emission Characteristics of SI and CI engines with these alternate fuels - Electric and Hybrid Vehicles, Fuel Cell Note: Practical Training in dismantling and assembling of Engine parts and Transmission Systems should be given to the students.

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

- CO1 recognize the various parts of the automobile and their functions and materials.
- CO2 discuss the engine auxiliary systems and engine emission control.
- CO3 distinguish the working of different types of transmission systems.
- CO4 explain the Steering, Brakes and Suspension Systems.
- CO5 predict possible alternate sources of energy for IC Engines.

TEXT BOOKS:

1. Jain K.K. and Asthana .R.B, “Automobile Engineering” Tata McGraw Hill Publishers, New Delhi, 2002.
2. Kirpal Singh, “Automobile Engineering”, Vol 1 & 2, Seventh Edition, Standard Publishers, New Delhi, 13th Edition 2014..

REFERENCES:

1. Ganesan V. “Internal Combustion Engines”, Third Edition, Tata McGraw-Hill, 2012.
2. Heinz Heisler, “Advanced Engine Technology,” SAE International Publications USA, 1998.
3. Joseph Heitner, “Automotive Mechanics,” Second Edition, East-West Press, 1999.
4. Martin W, Stockel and Martin T Stockle , “Automotive Mechanics Fundamentals,” The Good heart - Will Cox Company Inc, USA ,1978.
5. Newton ,Steeds and Garet, “Motor Vehicles”, Butterworth Publishers,1989.

20154E66B SAFETY IN ENGINEERING INDUSTIRES

L	T	P	C
3	0	0	3

OBJECTIVE

To promote safety in engineering industries for educating the employees and enforcing various labour legislation in order to eliminate the prevailing unsafe condition and correct the usage actions.

UNIT – I PRINCIPLES OF ACCIDENT PREVENTION **9**

Accident Prevention – Causes and Cost of Accident – Laws and regulations – Indian Factories Act governing health and safety of workers.

UNIT – II MACHINE GUARDING **9**

Machine guarding – need, basic requirements and benefits of machine guarding – types of guarding with applications.

UNIT – III

ELECTRICAL SAFETY

Electrical hazards – Shock protections methods – permit to work on electrical lines / installations – use of personal protective equipments.

UNIT – IV

SAFETY IN MATERIAL HANDLING

Material handling – manual and mechanical – material handling equipments – safe use and legal aspects.

UNIT – V

FIRE SAFETY

Fire – Extinguishing fire – Classification of fire – Types of fire extinguishers – Applications – Causes of fire.

REFERENCE:

1) National Safety council manual, Bombay
2) Factories Act 1948
3) Electrical Hazards – B. R. Kamath
4) Safety in the use of electricity, NSC, Bombay.

20154E66C **GAS DYNAMICS AND JET PROPULSION**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basic difference between incompressible and compressible flow.
- To understand the phenomenon of shock waves and its effect on flow. To gain some basic knowledge about jet propulsion and Rocket Propulsion.

(Use of Standard Gas Tables permitted)

UNIT I BASIC CONCEPTS AND ISENTROPIC FLOWS 9

Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts – Nozzle and Diffusers

UNIT II FLOW THROUGH DUCTS 9

Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties.

UNIT III NORMAL AND OBLIQUE SHOCKS 9

Governing equations – Variation of flow parameters across the normal and oblique shocks – Prandtl – Meyer relations – Applications.

UNIT IV JET PROPULSION 9

Theory of jet propulsion – Thrust equation – Thrust power and propulsive efficiency – Operating principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines.

UNIT V SPACE PROPULSION 9

Types of rocket engines – Propellants-feeding systems – Ignition and combustion – Theory of rocket propulsion – Performance study – Staging – Terminal and characteristic velocity – Applications – space flights.

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Apply the concept of compressible flows in variable area ducts.
CO2 Apply the concept of compressible flows in constant area ducts.
CO3 examine the effect of compression and expansion waves in compressible flow.
CO4 use the concept of gas dynamics in Jet Propulsion.
CO5 apply the concept of gas dynamics in Space Propulsion.

TEXT BOOKS:

1. Anderson, J.D., "Modern Compressible flow", 3rd Edition, McGraw Hill, 2012.
2. Yahya, S.M. "Fundamentals of Compressible Flow", New Age International (P) Limited, New Delhi, 2002.

REFERENCES:

1. Cohen. H., G.E.C. Rogers and Saravanamutto, "Gas Turbine Theory", Longman Group Ltd.,1980
2. Ganesan. V., "Gas Turbines", Tata McGraw Hill Publishing Co., New Delhi, 2010.
3. Shapiro. A.H.," Dynamics and Thermodynamics of Compressible fluid Flow", John wiley, New York, 1953.
4. Sutton. G.P., "Rocket Propulsion Elements", John wiley, New York,2010,.
5. Zucrow. N.J., "Principles of Jet Propulsion and Gas Turbines", John Wiley, New York, 1970.

20154E66D **FUNDAMENTALS OF NANOSCIENCE** **L T P C**
3 0 0 3

OBJECTIVE:
To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION 8
Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering- Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms- multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION 9
Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS 12
Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO2,MgO, ZrO2, NiO, nanoalumina, CaO, AgTiO2, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications.

UNIT IV CHARACTERIZATION TECHNIQUES 9
X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation.

UNIT V APPLICATIONS 7
NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery.

TOTAL : 45 PERIODS

OUTCOMES:
- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS :

1. A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, “Nanoscale Characterization of surfaces & Interfaces”, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

REFERENCES:

1. G Timp, “Nanotechnology”, AIP press/Springer, 1999.
2. Akhlesh Lakhtakia, “The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations”. Prentice-Hall of India (P) Ltd, New Delhi, 2007.

20154E74A **RENEWABLE SOURCES OF ENERGY**

L	T	P	C
3	0	0	3

OBJECTIVE:

- At the end of the course, the students are expected to identify the new methodologies / technologies for effective utilization of renewable energy sources.

UNIT I INTRODUCTION **9**

World Energy Use – Reserves of Energy Resources – Environmental Aspects of Energy Utilisation – Renewable Energy Scenario in Tamil nadu, India and around the World – Potentials - Achievements / Applications – Economics of renewable energy systems.

UNIT II SOLAR ENERGY **9**

Solar Radiation – Measurements of Solar Radiation - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation - Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

UNIT III WIND ENERGY **9**

Wind Data and Energy Estimation – Types of Wind Energy Systems – Performance – Site Selection – Details of Wind Turbine Generator – Safety and Environmental Aspects

UNIT IV BIO - ENERGY **9**

Biomass direct combustion – Biomass gasifiers – Biogas plants – Digesters – Ethanol production – Bio diesel – Cogeneration - Biomass Applications

UNIT V OTHER RENEWABLE ENERGY SOURCES **9**

Tidal energy – Wave Energy – Open and Closed OTEC Cycles – Small Hydro-Geothermal Energy – Hydrogen and Storage - Fuel Cell Systems – Hybrid Systems.

TOTAL : 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Discuss the importance and Economics of renewable Energy
CO2 Discuss the method of power generation from Solar Energy
CO3 Discuss the method of power generation from Wind Energy
CO4 Explain the method of power generation from Bio Energy
CO5 Explain the Tidal energy, Wave Energy, OTEC, Hydro energy, Geothermal Energy, Fuel Cells and Hybrid Systems.

TEXT BOOKS:

1. Rai. G.D., "Non Conventional Energy Sources", Khanna Publishers, New Delhi, 2011.
2. Twidell, J.W. & Weir, A., "Renewable Energy Sources", EFN Spon Ltd., UK, 2006.

REFERENCES:

1. Chetan Singh Solanki, Solar Photovoltaics, "Fundamentals, Technologies and Applications", PHI Learning Private Limited, New Delhi, 2015.
2. David M. Mousdale – "Introduction to Biofuels", CRC Press, Taylor & Francis Group, USA 2017
3. Freris. L.L., "Wind Energy Conversion Systems", Prentice Hall, UK, 1990.
4. Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future", Oxford University Press, U.K., 2012.
5. Johnson Gary, L. "Wind Energy Systems", Prentice Hall, New York, 1985

20154E74B **NON CONVENTIONAL MACHINING PROCESSES**

L	T	P	C
3	0	0	3

OBJECTIVE:

- To learn about various unconventional machining processes, the various process parameters and their influence on performance and their applications

UNIT I INTRODUCTION AND MECHANICAL ENERGY BASED PROCESSES 9

Unconventional machining Process – Need – classification – merits, demerits and applications. Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining - Ultrasonic Machining. (AJM, WJM, AWJM and USM). Working Principles – equipment used – Process parameters – MRR- Applications.

UNIT II THERMAL AND ELECTRICAL ENERGY BASED PROCESSES 9

Electric Discharge Machining (EDM) – Wire cut EDM – Working Principle-equipments-Process Parameters-Surface Finish and MRR- electrode / Tool – Power and control Circuits-Tool Wear – Dielectric – Flushing –– Applications. Laser Beam machining and drilling, (LBM), plasma, Arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques – Applications.

UNIT III CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES 9

Chemical machining and Electro-Chemical machining (CHM and ECM)- Etchants – Maskant - techniques of applying maskants - Process Parameters – Surface finish and MRR-Applications. Principles of ECM- equipments-Surface Roughness and MRR Electrical circuit-Process Parameters- ECG and ECH - Applications.

UNIT IV ADVANCED NANO FINISHING PROCESSES 9

Abrasive flow machining, chemo-mechanical polishing, magnetic abrasive finishing, magneto rheological finishing, magneto rheological abrasive flow finishing their working principles, equipments, effect of process parameters, applications, advantages and limitations.

UNIT V RECENT TRENDS IN NON-TRADITIONAL MACHINING PROCESSES 9

Recent developments in non-traditional machining processes, their working principles, equipments, effect of process parameters, applications, advantages and limitations. Comparison of non-traditional machining processes.

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Explain the need for unconventional machining processes and its classification

CO2 Compare various thermal energy and electrical energy based unconventional machining processes.

CO3 Summarize various chemical and electro-chemical energy based unconventional machining processes.

CO4 Explain various nano abrasives based unconventional machining processes.

CO5 Distinguish various recent trends based unconventional machining processes.

TEXT BOOKS:

1. Vijay.K. Jain "Advanced Machining Processes" Allied Publishers Pvt. Ltd., New Delhi, 2007
2. Pandey P.C. and Shan H.S. "Modern Machining Processes" Tata McGraw-Hill, New Delhi, 2007.

REFERENCES:

1. Benedict. G.F. "Nontraditional Manufacturing Processes", Marcel Dekker Inc., New York, 1987.
2. Mc Geough, "Advanced Methods of Machining", Chapman and Hall, London, 1998.
3. Paul De Garmo, J.T.Black, and Ronald. A.Kohser, "Material and Processes in Manufacturing" Prentice Hall of India Pvt. Ltd., 8thEdition, New Delhi , 2001.

20154E74C **OPERATIONS RESEARCH**

L	T	P	C
3	0	0	3

OBJECTIVE:

- To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

UNIT I LINEAR MODELS 15

The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.

UNIT II TRANSPORTATION MODELS AND NETWORK MODELS 8

Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route – Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks – Critical path scheduling – Sequencing models.

UNIT III INVENTORY MODELS 6

Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

UNIT IV QUEUEING MODELS 6

Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

UNIT V DECISION MODELS 10

Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life – Economic life– Single / Multi variable search technique – Dynamic Programming – Simple Problem.

TOTAL: 45 PERIODS

OUTCOME:

- Upon completion of this course, the students can able to use the optimization techniques for use engineering and Business problems

TEXT BOOK:

1. Hillier and Libeberman, "Operations Research", Holden Day, 2005
2. Taha H.A., "Operations Research", Sixth Edition, Prentice Hall of India, 2003.

REFERENCES:

1. Bazara M.J., Jarvis and Sherali H., "Linear Programming and Network Flows", John Wiley, 2009.
2. Budnick F.S., "Principles of Operations Research for Management", Richard D Irwin, 1990.
3. Philip D.T. and Ravindran A., "Operations Research", John Wiley, 1992.
4. Shennoy G.V. and Srivastava U.K., "Operation Research for Management", Wiley Eastern, 1994.
5. Tulsian and Pasdey V., "Quantitative Techniques", Pearson Asia, 2002.

20154E74D **TOTAL QUALITY MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVE:

- To facilitate the understanding of Quality Management principles and process.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention.

UNIT II TQM PRINCIPLES 9

Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS AND TECHNIQUES I 9

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV TQM TOOLS AND TECHNIQUES II 9

Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V QUALITY MANAGEMENT SYSTEM 9

Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation—Documentation—Internal Audits—Registration--**ENVIRONMENTAL MANAGEMENT SYSTEM:**

Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001—Benefits of EMS.

TOTAL: 45 PERIODS

OUTCOME:

- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

TEXT BOOK:

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Besterfield,Mary B.Sacre,Hemant Urdhwareshe and Rashmi Urdhwareshe, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.
2. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
3. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
4. ISO 9001-2015 standards

20154E76A	ROBOTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the functions of the basic components of a Robot.
- To study the use of various types of End of Effectors and Sensors
- To impart knowledge in Robot Kinematics and Programming
- To learn Robot safety issues and economics.

UNIT I FUNDAMENTALS OF ROBOT 9

Robot - Definition - Robot Anatomy - Co ordinate Systems, Work Envelope Types and Classification- Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load- Robot Parts and their Functions-Need for Robots-Different Applications.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS 9

Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT III SENSORS AND MACHINE VISION 9

Requirements of a sensor, Principles and Applications of the following types of sensors- Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors ,binary Sensors., Analog Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing Image Data-Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications-Inspection, Identification, Visual Serving and Navigation.

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING 9

Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems. Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs.

UNIT V IMPLEMENTATION AND ROBOT ECONOMICS 9

RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

- CO1 Explain the concepts of industrial robots, classification, specifications and coordinate systems. Also summarize the need and application of robots in different sectors.
- CO2 Illustrate the different types of robot drive systems as well as robot end effectors.
- CO3 Apply the different sensors and image processing techniques in robotics to improve the ability of robots.
- CO4 Develop robotic programs for different tasks and familiarize with the kinematics motions of robot.
- CO5 Examine the implementation of robots in various industrial sectors and interpolate the economic analysis of robots.

TEXT BOOKS:

1. Groover M.P., “Industrial Robotics -Technology Programming and Applications”, McGraw Hill, 2012.
2. Klafter R.D., Chmielewski T.A and Negin M., “Robotic Engineering - An Integrated Approach”,Prentice Hall, 2003.

REFERENCES:

1. Craig J.J., “Introduction to Robotics Mechanics and Control”, Pearson Education, 2008.
2. Deb S.R., “Robotics Technology and Flexible Automation” Tata McGraw Hill Book Co., 2013.
3. Fu.K.S.,Gonzalz R.C. and Lee C.S.G., “Robotics Control, Sensing, Vision and Intelligence”, McGraw Hill Book Co., 1987.
4. Janakiraman P.A., “Robotics and Image Processing”, Tata McGraw Hill, 1995.
5. Koren Y., “Robotics for Engineers", Mc Graw Hill Book Co., 1992.

20154E76B	DESIGN OF JIGS, FIXTURES AND PRESS TOOLS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the functions and design principles of Jigs, fixtures and press tools
- To gain proficiency in the development of required views of the final design.

UNIT I LOCATING AND CLAMPING PRINCIPLES: 9

Objectives of tool design- Function and advantages of Jigs and fixtures – Basic elements – principles of location – Locating methods and devices – Redundant Location – Principles of clamping – Mechanical actuation – pneumatic and hydraulic actuation Standard parts – Drill bushes and Jig buttons – Tolerances and materials used.

UNIT II JIGS AND FIXTURES 9

Design and development of jigs and fixtures for given component- Types of Jigs – Post, Turnover, Channel, latch, box, pot, angular post jigs – Indexing jigs – General principles of milling, Lathe, boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – Modular fixturing systems- Quick change fixtures.

UNIT III PRESS WORKING TERMINOLOGIES AND ELEMENTS OF CUTTING DIES 9

Press Working Terminologies - operations – Types of presses – press accessories – Computation of press capacity – Strip layout – Material Utilization – Shearing action – Clearances – Press Work Materials – Center of pressure- Design of various elements of dies – Die Block – Punch holder, Die set, guide plates – Stops – Strippers – Pilots – Selection of Standard parts – Design and preparation of four standard views of simple blanking, piercing, compound and progressive dies.

UNIT IV BENDING AND DRAWING DIES 9

Difference between bending and drawing – Blank development for above operations – Types of Bending dies – Press capacity – Spring back – knockouts – direct and indirect – pressure pads – Ejectors – Variables affecting Metal flow in drawing operations – draw die inserts – draw beads- ironing – Design and development of bending, forming, drawing, reverse redrawing and combination dies – Blank development for axisymmetric, rectangular and elliptic parts – Single and double action dies.

UNIT V FORMING TECHNIQUES AND EVALUATION 9

Bulging, Swaging, Embossing, coining, curling, hole flanging, shaving and sizing, assembly, fine Blanking dies – recent trends in tool design- computer Aids for sheet metal forming Analysis – basic introduction - tooling for numerically controlled machines- setup reduction for work holding – Single minute exchange of dies – Poka Yoke.

TOTAL: 45 PERIODS

Note: (Use of P S G Design Data Book is permitted in the University examination)

OUTCOMES:

Upon the completion of this course the students will be able to

CO1	Summarize the different methods of Locating Jigs and Fixtures and Clamping principles
CO2	Design and develop jigs and fixtures for given component
CO3	Discuss the press working terminologies and elements of cutting dies
CO4	Distinguish between Bending and Drawing dies.
CO5	Discuss the different types of forming techniques

TEXT BOOKS:

1. Joshi, P.H. "Jigs and Fixtures", Second Edition, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2010.
2. Joshi P.H "Press tools - Design and Construction", wheels publishing, 1996

REFERENCES:

1. ASTME Fundamentals of Tool Design Prentice Hall of India.
2. Design Data Hand Book, PSG College of Technology, Coimbatore.
3. Donaldson, Lecain and Goold "Tool Design", 5th Edition, Tata McGraw Hill, 2017.
4. Hoffman "Jigs and Fixture Design", Thomson Delmar Learning, Singapore, 2004.
5. Kempster, "Jigs and Fixture Design", Third Edition, Hoddes and Stoughton, 1974.
6. Venkataraman. K., "Design of Jigs Fixtures & Press Tools", Tata McGraw Hill, New Delhi, 2005.

20154E76C GENERAL ASPECTS OF ENERGY MANAGEMENT AND ENERGY AUDIT

L	T	P	C
3	0	0	3

UNIT 1: ENERGY SCENARIO

Introduction -Primary and Secondary Energy -Commercial Energy and Non commercial Energy-Renewable and Non Renewable Energy-Indian Energy Scenario-Energy Needs of Growing Economy-Long Term Energy Scenario for India-Energy Pricing in India-Energy Sector Reforms-Energy and Environment-Energy Security-Energy Conservation and its Importance-Energy Strategy for the Future.

UNIT II BASICS OF ENERGY AND ENERGY MANAGEMENT

Basics of energy: Definition-Various Forms of Energy-Electrical Energy Basics-Thermal Energy Basics-Units and Conversions.

Energy Management :Definition & Objectives of Energy Management -Energy Audit: Types and Methodology -Energy Audit Reporting Format -Understanding Energy Costs -Benchmarking and energy Performance -Matching Energy Usage to Requirement-Maximising System Efficiency -Fuel and Energy Substitution-Energy Audit Instruments.

UNIT III MATERIAL AND ENERGY BALANCE

Energy Balance: Basic Principles-The Sankey Diagram and its Use-Material Balances-Energy Balances-Method for Preparing Process Flow Chart-Facility as an Energy System How to Carryout Material and Energy (M & E) Balance. Case study.

UNIT IV PROJECT MANAGEMENT

Step in Project management-Project Definition and scope-Technical design-Financing-Contracting-Implementation-Project planning technique-Performance monitoring

UNIT V ENERGY MONITORING AND TARGETING

Energy monitoring: Definition-Elements of Monitoring & Targeting System-A Rationale for Monitoring, Targeting and Reporting -Data and Information Analysis –Relating-Energy Consumption and Production .

TEXT BOOK:

Guide book for National Certification Examination for Energy Management and Energy Auditors.

REFERENCES:

Energy Management Supply and Conservation, Butterworth Heinemann, 2002-Dr Clive Beggs
Energy Audit Report of National Productivity Council
Energy Management Hard Book, John Wiley and sons – Wayne C. Turner
www.bee-india.com

20154E76D **COMPOSITE MATERIALS**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the fundamentals of composite material strength and its mechanical behavior
- Understanding the analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.
- Thermo-mechanical behavior and study of residual stresses in Laminates during processing.
- Implementation of Classical Laminate Theory (CLT) to study and analysis for residual stresses in an isotropic layered structure such as electronic chips.

UNIT I INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS & MANUFACTURING 9

Definition –Need – General Characteristics, Applications. Fibers – Glass, Carbon, Ceramic and Aramid fibers. Matrices – Polymer, Graphite, Ceramic and Metal Matrices – Characteristics of fibers and matrices. Lamina Constitutive Equations: Lamina Assumptions – Macroscopic Viewpoint. Generalized Hooke's Law. Reduction to Homogeneous Orthotropic Lamina – Isotropic limit case, Orthotropic Stiffness matrix (Qij), Typical Commercial material properties, Rule of Mixtures. Generally Orthotropic Lamina –Transformation Matrix, Transformed Stiffness. Manufacturing: Bag Moulding Compression Moulding – Pultrusion – Filament Winding – Other Manufacturing Processes

UNIT II FLAT PLATE LAMINATE CONSTITUTE EQUATIONS 9

Definition of stress and Moment Resultants. Strain Displacement relations. Basic Assumptions of Laminated anisotropic plates. Laminate Constitutive Equations – Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates. Laminate Structural Moduli. Evaluation of Lamina Properties from Laminate Tests. Quasi-Isotropic Laminates. Determination of Lamina stresses within Laminates.

UNIT III LAMINA STRENGTH ANALYSIS 9

Introduction - Maximum Stress and Strain Criteria. Von-Misses Yield criterion for Isotropic Materials. Generalized Hill's Criterion for Anisotropic materials. Tsai-Hill's Failure Criterion for Composites. Tensor Polynomial (Tsai-Wu) Failure criterion. Prediction of laminate Failure

UNIT IV THERMAL ANALYSIS 9

Assumption of Constant C.T.E's. Modification of Hooke's Law. Modification of Laminate Constitutive Equations. Orthotropic Lamina C.T.E's. C.T.E's for special Laminate Configurations – Unidirectional, Off-axis, Symmetric Balanced Laminates, Zero C.T.E laminates, Thermally Quasi-Isotropic Laminates

UNIT V ANALYSIS OF LAMINATED FLAT PLATES 9

Equilibrium Equations of Motion. Energy Formulations. Static Bending Analysis. Buckling Analysis. Free Vibrations – Natural Frequencies

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Summarize the various types of Fibers, Equations and manufacturing methods for Composite materials
CO2 Derive Flat plate Laminate equations
CO3 Analyze Lamina strength

CO4 Analyze the thermal behavior of Composite laminates
CO5 Analyze Laminate flat plates

TEXT BOOKS:

1. Gibson, R.F., "Principles of Composite Material Mechanics", Second Edition, McGraw-Hill, CRC press in progress, 1994, -.
2. Hyer, M.W., “Stress Analysis of Fiber – Reinforced Composite Materials”, McGraw Hill, 1998

REFERENCES:

1. Agarwal, B.D., and Broutman L.J., “Analysis and Performance of Fiber Composites”, John Wiley and Sons, New York, 1990.
2. Halpin, J.C., “Primer on Composite Materials, Analysis”, Technomic Publishing Co., 1984.
3. Issac M. Daniel and Ori Ishai, “Engineering Mechanics of Composite Materials”, Oxford University Press-2006, First Indian Edition - 2007
4. Mallick, P.K., Fiber, ”Reinforced Composites: Materials, Manufacturing and Design”, Maneel Dekker Inc, 1993.
5. Mallick, P.K. and Newman, S., (edition), “Composite Materials Technology: Processes and Properties”, Hansen Publisher, Munish, 1990.

20154E82A	PRODUCTION PLANNING AND CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the various components and functions of production planning and control such as work study, product planning, process planning, production scheduling, Inventory Control.
- To know the recent trends like manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

UNIT I INTRODUCTION 9

Objectives and benefits of planning and control-Functions of production control-Types of production- job- batch and continuous-Product development and design-Marketing aspect - Functional aspects- Operational aspect-Durability and dependability aspect aesthetic aspect. Profit consideration- Standardization, Simplification & specialization- Break even analysis-Economics of a new design.

UNIT II WORK STUDY 9

Method study, basic procedure-Selection-Recording of process - Critical analysis, Development - Implementation - Micro motion and memo motion study – work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data - Predetermined motion time standards.

UNIT III PRODUCT PLANNING AND PROCESS PLANNING 9

Product planning-Extending the original product information-Value analysis-Problems in lack of product planning-Process planning and routing-Pre requisite information needed for process planning- Steps in process planning-Quantity determination in batch production-Machine capacity, balancing- Analysis of process capabilities in a multi product system.

UNIT IV PRODUCTION SCHEDULING 9

Production Control Systems-Loading and scheduling-Master Scheduling-Scheduling rules-Gantt charts-Perpetual loading-Basic scheduling problems - Line of balance – Flow production scheduling- Batch production scheduling-Product sequencing – Production Control systems- Periodic batch control-Material requirement planning kanban – Dispatching-Progress reporting and expediting- Manufacturing lead time-Techniques for aligning completion times and due dates.

UNIT V INVENTORY CONTROL AND RECENT TRENDS IN PPC 9

Inventory control-Purpose of holding stock-Effect of demand on inventories-Ordering procedures. Two bin system - Ordering cycle system-Determination of Economic order quantity and economic lot size- ABC analysis - Recorder procedure-Introduction to computer integrated production planning systems- elements of JUST IN TIME SYSTEMS-Fundamentals of MRP II and ERP.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to prepare production planning and control activities such as work study, product planning, production scheduling, Inventory Control.
- They can plan manufacturing requirements manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

TEXT BOOKS:

1. James. B. Dilworth, "Operations management – Design, Planning and Control for manufacturing and services" Mcgraw Hill International edition 1992.

2. Martand Telsang, “Industrial Engineering and Production Management”, First edition, S. Chand and Company, 2000.

REFERENCES:

1. Chary. S.N., “Theory and Problems in Production & Operations Management”, Tata McGraw Hill, 1995.
2. Elwood S.Buffa, and Rakesh K.Sarin, “Modern Production / Operations Management”, 8th Edition John Wiley and Sons, 2000.
3. Jain. K.C. & Aggarwal. L.N., “Production Planning Control and Industrial Management”, Khanna Publishers, 1990.
4. Kanishka Bedi, “Production and Operations management”, 2nd Edition, Oxford university press, 2007.
5. Melynk, Denzler, “ Operations management – A value driven approach” Irwin Mcgraw hill.
6. Norman Gaither, G. Frazier, “Operations Management” 9th Edition, Thomson learning IE, 2007
7. Samson Eilon, “Elements of Production Planning and Control”, Universal Book Corpn.1984
8. Upendra Kachru, “ Production and Operations Management – Text and cases” 1st Edition, Excel books 2007

20154E82B	COMPUTER INTEGRATED MANUFACTURING SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.

UNIT I INTRODUCTION 9

Brief introduction to CAD and CAM – Manufacturing Planning, Manufacturing control- Introduction to CAD/CAM – Concurrent Engineering-CIM concepts – Computerised elements of CIM system – Types of production - Manufacturing models and Metrics – Mathematical models of Production Performance – Simple problems – Manufacturing Control – Simple Problems – Basic Elements of an Automated system – Levels of Automation – Lean Production and Just-In-Time Production.

UNIT II PRODUCTION PLANNING AND CONTROL AND COMPUTERISED PROCESS PLANNING 9

Process planning – Computer Aided Process Planning (CAPP) – Logical steps in Computer Aided Process Planning – Aggregate Production Planning and the Master Production Schedule – Material Requirement planning – Capacity Planning- Control Systems-Shop Floor Control-Inventory Control – Brief on Manufacturing Resource Planning-II (MRP-II) & Enterprise Resource Planning (ERP) - Simple Problems.

UNIT III CELLULAR MANUFACTURING 9

Group Technology(GT), Part Families – Parts Classification and coding – Simple Problems in Opitz Part Coding system – Production flow Analysis – Cellular Manufacturing – Composite part concept – Machine cell design and layout – Quantitative analysis in Cellular Manufacturing – Rank Order Clustering Method - Arranging Machines in a GT cell – Hollier Method – Simple Problems.

UNIT IV FLEXIBLE MANUFACTURING SYSTEM (FMS) AND AUTOMATED GUIDED VEHICLE SYSTEM (AGVS) 9

Types of Flexibility - FMS – FMS Components – FMS Application & Benefits – FMS Planning and Control – Quantitative analysis in FMS – Simple Problems. Automated Guided Vehicle System (AGVS) – AGVS Application – Vehicle Guidance technology – Vehicle Management & Safety.

UNIT V INDUSTRIAL ROBOTICS 9

Robot Anatomy and Related Attributes – Classification of Robots- Robot Control systems – End Effectors – Sensors in Robotics – Robot Accuracy and Repeatability - Industrial Robot Applications – Robot Part Programming – Robot Accuracy and Repeatability – Simple Problems.

TOTAL : 45 PERIODS

OUTCOMES:

CO1 Explain the basic concepts of CAD, CAM and computer integrated manufacturing systems
CO2 Summarize the production planning and control and computerized process planning
CO3 Differentiate the different coding systems used in group technology
CO4 Explain the concepts of flexible manufacturing system (FMS) and automated guided vehicle (AGV) system

CO5 Classification of robots used in industrial applications

TEXT BOOKS:

1. Mikell.P.Groover "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall of India, 2008.
2. Radhakrishnan P, Subramanyan S.and Raju V., "CAD/CAM/CIM", 2nd Edition, New Age International (P) Ltd, New Delhi, 2000.

REFERENCES:

1. Gideon Halevi and Roland Weill, "Principles of Process Planning – A Logical Approach" Chapman & Hall, London, 1995.
2. Kant Vajpayee S, "Principles of Computer Integrated Manufacturing", Prentice Hall India.
3. Rao. P, N Tewari &T.K. Kundra, "Computer Aided Manufacturing", Tata McGraw Hill Publishing Company, 2000.

20154E82C	ENERGY EFFICIENCY IN THERMAL UTILITIES	L	T	P	C
		3	0	0	3

UNIT 1: FUELS AND COMBUSTION

9

Introduction to Fuels -Properties of Liquid Fuels -Properties of Coal -Properties of Gaseous Fuels -Properties of Agro Residues -Combustion -Combustion of Oil Combustion of Coal -Combustion of Gas -Draft System -Combustion Controls.

9

UNIT2: BOILERS

Introduction -Boiler Systems -Boiler Types and Classifications -Performance Evaluation of Boilers -Boiler Blowdown -Boiler Water Treatment -Energy Conservation Opportunities -Case Study.

9

UNIT3: STEAM SYSTEM

Introduction-Properties of Steam -Steam Distribution -Steam Pipe Sizing and Design-Proper Selection, Operation and Maintenance of Steam Traps -Performance Assessment Methods for Steam Traps-Energy Saving Opportunities.

9

UNIT4: FURNACES AND INSULATION

Types and Classification of Different Furnaces-Performance Evaluation of a Typical Furnace -General Fuel Economy Measures in Furnaces -Case Study -Purpose of Insulation -Types and Application -Calculation of Insulation Thickness Economic Thickness of Insulation(ETI) -Simplified Formula for Heat Loss Calculation.

9

UNIT 5: FBC BOILERS, COGENERATION AND WASTE HEAT RECOVERY

Introduction -Mechanism of Fluidised Bed Combustion -Types of Fluidised Bed Combustion Boilers -Retrofitting of FBC Systems to Conventional Boilers -Advantages of Fluidised Bed Combustion Boilers-Need for Cogeneration - Principle of Cogeneration -Technical Options for Cogeneration -Classification of Cogeneration Systems -Factors Influencing Cogeneration Choice -Case Study -Introduction -Classification and Application -Benefits of Waste Heat Recovery - Development of a Waste Heat Recovery System -Commercial Waste Heat Recovery Devices.

TOTAL: 45 PERIODS

TEXT BOOK:

Guide book for National Certification Examination for Energy Managers and Energy Auditors-Bureau of Energy Efficiency

REFERENCE BOOK :

1. Smith, CB Energy Management Principles, Pergamon Press, New York 1981
2. www.bee-india.com

20154E82D **PROFESSIONAL ETHICS IN ENGINEERING** **L T P C**
3 0 0 3

OBJECTIVE:

- To enable the students to create an awareness on Engineering Ethics and Human Values to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I HUMAN VALUES 10

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT V GLOBAL ISSUES 8

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.

TOTAL: 45 PERIODS

OUTCOME:

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

TEXT BOOKS:

1. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.
2. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.

REFERENCES:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and

Engineers", Oxford University Press, Oxford, 2001.
4. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd.,New Delhi, 2013.

Web sources:

1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

OPEN ELECTIVE–I

20150FE54A **DATABASE MANAGEMENT SYSTEMS**

L	T	P	C
3	0	0	3

OBJECTIVES:

-
- To learn the fundamentals of data models
- To learn conceptual modeling using ER diagrams.
- To study SQL queries and database programming
- To learn proper designing of relational database.
- To understand database security concepts
- To understand Information retrieval techniques

UNIT I DBMS AND CONCEPTUAL DATA MODELING 9

Purpose of Database System – Data independence - Data Models – Database System Architecture – Conceptual Data modeling: ER models - Enhanced-ER Model. Introduction to relational databases – Relational Model – Keys – ER-to-Relational Mapping. Modeling of a library management system.

UNIT II DATABASE QUERYING **11**

Relational Algebra – SQL: fundamentals – DDL – Specifying integrity constraints - DML – Basic retrieval queries in SQL - Complex SQL retrieval queries – nested queries – correlated queries – joins - aggregate functions. Creating a table, populating data, adding integrity constraints, querying tables with simple and complex queries.

UNIT III DATABASE PROGRAMMING **9**

Database programming with function calls, stored procedures - views – triggers. Embedded SQL. ODBC connectivity with front end tools. Implementation using ODBC/JDBC and SQL/PSM, implementing functions, views, and triggers in MySQL / Oracle.

UNIT IV SUSPENSION AND BRAKES SYSTEMS **9**

Functional Dependencies – Design guidelines – Normal Forms: first, second, third – Boyce/Codd Normal Form – Normalization algorithms. Design of a banking database system / university database system.

UNIT V ALTERNATIVE ENERGY SOURCES **9**

Database security issues – Discretionary access control – role based access – Encryption and public key infrastructures – challenges. Information Retrieval: IR Concepts, Retrieval Models, Queries in IR systems.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

-
- understand relational data model, evolve conceptual model of a given problem, its mapping to relational model and Normalization
- query the relational database and write programs with database connectivity
- understand the concepts of database security and information retrieval systems
-

TEXTBOOKS:

Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Sixth Edition , Pearson, 2011.

2. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Sixth Edition, Tata McGraw Hill, 2011

REFERENCES:

C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.

2. Raghu Ramakrishnan, ―Database Management Systems‖, Fourth Edition, McGraw-Hill College Publications, 2015.

20150FE54B **CLOUD COMPUTING**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn about the concept of cloud and utility computing.
- To have knowledge on the various issues in cloud computing.
- To be familiar with the lead players in cloud.
- To appreciate the emergence of cloud as the next generation computing paradigm.

UNIT I INTRODUCTION TO CLOUD COMPUTING 9

Introduction to Cloud Computing – Roots of Cloud Computing – Desired Features of Cloud Computing – Challenges and Risks – Benefits and Disadvantages of Cloud Computing.

UNIT II VIRTUALIZATION **9**

Introduction to Virtualization Technology – Load Balancing and Virtualization – Understanding Hypervisor – Seven Layers of Virtualization – Types of Virtualization – Server, Desktop, Application Virtualization.

UNIT III CLOUD ARCHITECTURE, SERVICES AND STORAGE **9**

NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds - laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage.

UNIT IV RESOURCE MANAGEMENT AND SECURITY IN CLOUD **9**

Inter Cloud Resource Management – Resource Provisioning Methods – Security Overview – Cloud Security Challenges – Data Security –Application Security – Virtual Machine Security.

UNIT V CASE STUDIES **9**

Google App Engine(GAE) – GAE Architecture – Functional Modules of GAE – Amazon Web Services(AWS) – GAE Applications – Cloud Software Environments – Eucalyptus – Open Nebula – Open Stack.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Articulate the main concepts, key technologies, strengths and limitations of cloud computing.
- Learn the key and enabling technologies that help in the development of cloud.
- Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.
- Explain the core issues of cloud computing such as resource management and security.
- Be able to install and use current cloud technologies.
- Choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.

TEXTBOOKS:

1. Buyya R., Broberg J., Goscinski A., “Cloud Computing: Principles and Paradigm”, First Edition, John Wiley & Sons, 2011.
2. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
3. Rittinghouse, John W., and James F. Ransome, “Cloud Computing: Implementation, Management, And Security”, CRC Press, 2017.

20152FE54A **BASICS OF BIOMEDICAL INSTRUMENTATION**

L	T	P	C
3	0	0	3

OBJECTIVES:

-
- To study about the different bio potential and its propagation
- To understand the different types of electrodes and its placement for various recording
- To study the design of bio amplifier for various physiological recording
- To learn the different measurement techniques for non-physiological parameters.
- To familiarize the different biochemical measurements.
-

UNIT I BIO POTENTIAL GENERATION AND ELECTRODES TYPES 9

Origin of bio potential and its propagation. Types of electrodes - surface, needle and micro electrodes and their equivalent circuits. Recording problems - measurement with two electrodes

UNIT II BIOSIGNAL CHARACTERISTICS AND ELECTRODECONFIGURATIONS **9**

Biosignals characteristics – frequency and amplitude ranges. ECG – Einthoven"s triangle, standard 12 lead system. EEG – 10-20 electrode system, unipolar, bipolar and average mode. EMG– unipolar and bipolar mode.

UNIT III SIGNAL CONDITIONING CIRCUITS **9**

Need for bio-amplifier - differential bio-amplifier, Impedance matching circuit, isolation amplifiers, Power line interference, Right leg driven ECG amplifier, Band pass filtering

UNIT IV MEASUREMENT OF NON-ELECTRICALPARAMETERS **10**

Temperature, respiration rate and pulse rate measurements. Blood Pressure: indirect methods - Auscultatory method, direct methods: electronic manometer, Systolic, diastolic pressure, Blood flow and cardiac output measurement: Indicator dilution, and dye dilution method, ultrasound blood flow measurement.

UNIT V BIO-CHEMICAL MEASUREMENT **8**

Blood gas analyzers and Non-Invasive monitoring, colorimeter, Sodium Potassium Analyser, spectrophotometer, blood cell counter, auto analyzer (simplified schematic description).

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

-
- To Learn the different bio potential and its propagation.
- CO2: To get Familiarize the different electrode placement for various physiological recording
- CO3: Students will be able design bio amplifier for various physiological recording
- CO4: Students will understand various technique non electrical physiogical measurements

CO5: Understand the different biochemical measurements

TEXTBOOKS:

1. Leslie Cromwell, "Biomedical Instrumentation and measurement", Prentice hall of India, New Delhi, 2007.
2. John G. Webster, "Medical Instrumentation Application and Design", John Wiley and sons, New York, 2004. (Units I, II & V)

REFERENCES:

1. Myer Kutz, "Standard Handbook of Biomedical Engineering and Design", McGraw Hill Publisher, 2003.
2. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi, 2003.(Units II & IV)
3. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson Education, 2004.

20153FE54A

INDUSTRIAL NANOTECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To elucidate on advantages of nanotechnology based applications in each industry
- To provide instances of contemporary industrial applications of nanotechnology
- To provide an overview of future technological advancements and increasing role of nanotechnology in each industry

UNIT I NANO ELECTRONICS 9

Advantages of nano electrical and electronic devices –Electronic circuit chips – Lasers - Micro and NanoElectromechanical systems – Sensors, Actuators, Optical switches,- Data memory – Lighting and Displays – Batteries - Fuel cells and Photo-voltaic cells – Electric double layer capacitors – Lead-free solder – Nanoparticle coatings for electrical products.

UNIT II BIONANOTECHNOLOGY **9**

Nanoparticles in bone substitutes and dentistry – Implants and Prosthesis – Nanorobotics in Surgery –Nanosensors in Diagnosis– Neuro-electronic Interfaces– Therapeutic applications.

UNIT III TRANSMISSION SYSTEMS **9**

Nanocatalyts – Smart materials – Heterogenous nanostructures and composites – Nanostructures for Molecular recognition (Quantum dots, Nanorods, Nanotubes) – Molecular Encapsulation and its applications – Nanoporous zeolites – Self-assembled Nanoreactors.

UNIT IV SUSPENSION AND BRAKES SYSTEMS **9**

Nanotechnology in Agriculture -Precision farming, Smart delivery system – Insecticides using nanotechnology – Potential of nano-fertilizers - Nanotechnology in Food industry

UNIT V ALTERNATIVE ENERGY SOURCES **9**

Nanofibre production - Electrospinning – Controlling morphologies of nanofibers – Tissue engineering application– Polymer nanofibers - Nylon-6 nanocomposites from polymerization - Nano-filled polypropylene fibers - Nano finishing in textiles (UV resistant, antibacterial, hydrophilic, self-cleaning, flame retardant finishes) – Modern textiles Cosmetics – Formulation of Gels, Shampoos, Hair-conditioners

TOTAL : 45 PERIODS

REFERENCES:

Neelina H. Malsch (Ed.),Biomedical Nanotechnology, CRC Press (2005)
2. Udo H. Brinker, Jean-Luc Mieusset (Eds.), Molecular Encapsulation: Organic Reactions in Constrained Systems,Wiley Publishers (2010).
3. Jennifer Kuzma and Peter VerHage, Nanotechnology in agriculture and food production, Woodrow Wilson International Center, (2006).

4. Lynn J. Frewer, Willehm Norde, R. H. Fischer and W. H. Kampers, Nanotechnology in the Agri-food sector, Wiley-VCH Verlag, (2011).
5. P. J. Brown and K. Stevens, Nanofibers and Nanotechnology in Textiles, Woodhead Publishing Limited, Cambridge, (2007).
6. Y-W. Mai,Polymer Nano composites, Woodhead publishing, (2006).
7. W.N. Chang,Nanofibres fabrication, performance and applications, Nova Science Publishers Inc, (2009)

20153FE54B **ENERGY CONSERVATION AND MANAGEMENT**

L	T	P	C
3	0	0	3

OBJECTIVES:

Understand and analyse the energy data of industries
 Carryout energy accounting and balancing
 Conduct energy audit and suggest methodologies for energy savings and
 Utilise the available resources in optimal ways

•

UNIT I INTRODUCTION 9

Energy - Power – Past & Present scenario of World; National Energy consumption Data – Environmental aspects associated with energy utilization – Energy Auditing: Need, Types, Methodology and Barriers. Role of Energy Managers. Instruments for energy auditing.

UNIT II ELECTRICAL SYSTEMS **9**

Components of EB billing – HT and LT supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors - Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED Lighting and scope of Encon in Illumination.

UNIT III THERMAL SYSTEMS **9**

Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency computation and encon measures. Steam: Distribution &U sage: Steam Traps, Condensate Recovery, Flash Steam Utilization, Insulators & Refractories

UNIT IV ENERGY CONSERVATION IN MAJOR UTILITIES **9**

Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. sets

UNIT V ECONOMICS **9**

Energy Economics – Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing –ESCO concept

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- **to analyse the energy data of industries.**
- Can carryout energy accounting and balancing
- Can suggest methodologies for energy savings
-

TEXTBOOKS:

Energy Manager Training Manual (4 Volumes) available at www.energymanager training.com,a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India, 2004.

REFERENCES:

Witte. L.C., P.S. Schmidt, D.R. Brown, "Industrial Energy Management and Utilisation" Hemisphere Publ, Washington, 1988.
2. Callaghn, P.W. "Design and Management for Energy Conservation", Pergamon Press, Oxford, 1981.
3. Dryden. I.G.C., "The Efficient Use of Energy" Butterworths, London, 1982
4. Turner. W.C., "Energy Management Hand book", Wiley, New York, 1982.
5. Murphy. W.R. and G. Mc KAY, "Energy Management", Butterworths, London 1987.

20154FE54A

RENEWABLE ENERGY SOURCES

L	T	P	C
3	**0**	**0**	**3**

OBJECTIVES:

- To get exposure on solar radiation and its environmental impact to power.
- To know about the various collectors used for storing solar energy.
- To know about the various applications in solar energy.
- To learn about the wind energy and biomass and its economic aspects.
- To know about geothermal energy with other energy sources.

UNIT I PRINCIPLES OF SOLAR RADIATION 10

Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

UNIT II SOLAR ENERGY COLLECTION 8

Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT III SOLAR ENERGY STORAGE AND APPLICATIONS 7

Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

UNIT IV WIND ENERGY 10

Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria BIO-MASS: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engine operation and economic aspects.

UNIT V GEOTHERMAL ENERGY 9

Resources, types of wells, methods of harnessing the energy, potential in India. OCEAN ENERGY: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics. DIRECT ENERGY CONVERSION: Need for DEC, Carnot cycle, limitations, principles of DEC.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Understanding the physics of solar radiation.
- Ability to classify the solar energy collectors and methodologies of storing solar energy.

- Knowledge in applying solar energy in a useful way.
- Knowledge in wind energy and biomass with its economic aspects.

  Knowledge in capturing and applying other forms of energy sources like wind, biogas and geothermal energies.

TEXTBOOKS:

1. Rai G.D. , “Non-Conventional Energy Sources”, Khanna Publishers, 2011
2. Twidell & Wier, “Renewable Energy Resources”, CRC Press (Taylor & Francis), 2011

REFERENCES:

1. Tiwari and Ghosal, “Renewable energy resources”, Narosa Publishing House, 2007
2. Ramesh R & Kumar K.U , “Renewable Energy Technologies”,Narosa Publishing House, 2004
3. Mittal K M , “Non-Conventional Energy Systems”, Wheeler Publishing Co. Ltd, New Delhi, 2003
4. Kothari D.P, Singhal ., K.C., “Renewable energy sources and emerging technologies”, P.H.I, New Delhi, 2010

20154FE54B **AUTOMOTIVE SYSTEMS**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the construction and working principle of various parts of an automobile.
- To have the practice for assembling and dismantling of engine parts and transmission system

UNIT I AUTOMOTIVE ENGINE AUXILIARY SYSTEMS 9

Automotive engines- External combustion engines –Internal combustion engines -classification of engines- SI Engines- CI Engines- two stroke engines -four stroke engines- construction and working principles - IC engine components- functions and materials -valve timing –port timing diagram- Injection system -Unit injector system- Rotary distributor type - Electronically controlled injection system for SI engines-CI engines-Ignition system - Electronic ignition system -Transistorized ignition system, capacitive discharge ignition system.

UNIT II VEHICLE FRAMES AND STEERING SYSTEM **9**

Vehicle construction and different Chassis layouts –classifications of chassis- types of frames-frameless chassis construction –articulated vehicles- vehicle body - Vehicle aerodynamics-various resistances and its effects - steering system –conventional –sophisticated vehicle- and types of steering gear box-Power Steering- Steering geometry-condition for true rolling motion-Ackermann's- Devi's steering system - types of stub axle – Types of rear axles.

UNIT III TRANSMISSION SYSTEMS **9**

Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints –-Hotchkiss Drive and Torque Tube Drive- rear axle- Differential-wheels and tyres.

UNIT IV SUSPENSION AND BRAKES SYSTEMS **9**

Suspension Systems- conventional Suspension Systems -independent Suspension Systems –leaf spring – coil spring –taper-lite - eligo,s spring Types of brakes -Pneumatic and Hydraulic Braking Systems, Antilock Braking System (ABS), electronic brake force distribution (EBD) and Traction Control. Derive the equation of Forces acting while applying a brakes on plain surface - inclined road-gradient .

UNIT V ALTERNATIVE ENERGY SOURCES **9**

Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles- Engine modifications required –Performance, Combustion and Emission Characteristics of SI and CI engines with these alternate fuels - Electric and Hybrid Vehicles, Fuel Cell. Turbo chargers -Engine emission control by three way catalytic converter system.
Note: Practical Training in dismantling and assembling of Engine parts and Transmission Systems should be given to the students.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Upon completion of this course, the students will be able to identify the different components in automobile engineering.
- Have clear understanding on different auxiliary and transmission systems usual.

TEXTBOOKS:

Ganesan V. “Internal Combustion Engines”, Third Edition, Tata McGraw-Hill, 2007.

2. Jain K.K. and Asthana .R.B, “Automobile Engineering” Tata McGraw Hill Publishers, New Delhi, 2002.

3. Kirpal Singh, “Automobile Engineering”, Vol 1 & 2, Seventh Edition, Standard Publishers, New Delhi, 1997.

REFERENCES:

Heinz Heisler, “Advanced Engine Technology,” SAE International Publications USA, 1998.

2. Joseph Heitner, “Automotive Mechanics,” Second Edition, East-West Press, 1999.

3. Martin W, Stockel and Martin T Stockle , “Automotive Mechanics Fundamentals,” The Good heart –Will Cox Company Inc, USA ,1978.

4. Newton ,Steeds and Garet, “Motor Vehicles”, Butterworth Publishers,1989.

20155FE54A **AIR POLLUTION AND CONTROL ENGINEERING**

L	T	P	C
3	0	0	3

OBJECTIVES:

-
- To impart knowledge on the principle and design of control of Indoor/ particulate/ gaseous air pollutant and its emerging trends.
-

UNIT I NTRODUCTION 7

Structure and composition of Atmosphere – Definition, Scope and Scales of Air Pollution – Sources and classification of air pollutants and their effect on human health, vegetation, animals, property, aesthetic value and visibility- Ambient Air Quality and Emission standards.

UNIT II METEOROLOGY **6**

Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns- Atmospheric Diffusion Theories – Dispersion models, Plume rise.

UNIT III CONTROL OF PARTICULATE CONTAMINANTS 11

Factors affecting Selection of Control Equipment – Gas Particle Interaction – Working principle - Gravity Separators, Centrifugal separators Fabric filters, Particulate Scrubbers, Electrostatic Precipitators.

UNIT IV CONTROL OF GASEOUS CONTAMINANTS **11**

Factors affecting Selection of Control Equipment – Working principle - absorption, Adsorption, condensation, Incineration, Bio filters – Process control and Monitoring.

UNIT V INDOOR AIR QUALITY MANAGEMENT **10**

Sources, types and control of indoor air pollutants, sick building syndrome and Building related illness- Sources and Effects of Noise Pollution – Measurement – Standards –Control and Preventive measures.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

-
- basic concepts of air quality management
- Ability to identify, formulate and solve air and noise pollution problems
- Ability to design stacks and particulate air pollution control devices to meet applicable standards.
- Ability to select control equipments.
- Ability to ensure quality, control and preventive measures.
-

TEXTBOOKS:

Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, “Air Pollution Control Engineering”, Tokyo, springer science + science media LLC,2004.
2. Noel de Nevers, “Air Pollution Control Engineering”, Waveland press,Inc 2017.
3. Anjaneyulu. Y, “Air Pollution and Control Technologies‟, Allied Publishers (P) Ltd., India 2002.

REFERENCES:

1. David H.F. Liu, Bela G. Liptak, “Air Pollution”, Lweis Publishers, 2000.
2. Arthur C. Stern, “Air Pollution (Vol.I – Vol.VIII)”, Academic Press, 2006.
3. Wayne T.Davis, “Air Pollution Engineering Manual”, John Wiley & Sons, Inc, 2000.
4. M.N Rao and HVN Rao, “Air Pollution”, Tata Mcgraw Hill Publishing Company limited,2007.
5. C.S.Rao, “Environmental Pollution Control Engineering”, New Age International(P) Limited Publishers,2006.

20155FE54B **GEOGRAPHIC INFORMATION SYSTEM**

L	T	P	C
3	0	0	3

OBJECTIVES:

-
- To introduce the fundamentals and components of Geographic Information System
- To provide details of spatial data structures and input, management and output
- processes.

UNIT I FUNDAMENTALS OF GIS 9

Introduction to GIS - Basic spatial concepts - Coordinate Systems - GIS and Information Systems – Definitions – History of GIS - Components of a GIS – Hardware, Software, Data, People, Methods – Proprietary and open source Software - Types of data – Spatial, Attribute data- types of attributes – scales/ levels of measurements.

UNIT II SPATIAL DATA MODELS **9**

Database Structures – Relational, Object Oriented – ER diagram - spatial data models – Raster Data Structures – Raster Data Compression - Vector Data Structures - Raster vs Vector Models-TIN and GRID data models - OGC standards - Data Quality.

UNIT III DATA INPUT AND TOPOLOGY **9**

Scanner - Raster Data Input – Raster Data File Formats – Vector Data Input –Digitiser –Topology - Adjacency, connectivity and containment – Topological Consistency rules – Attribute Data linking – ODBC – GPS - Concept GPS based mapping.

UNIT IV DATA ANALYSIS **9**

Vector Data Analysis tools - Data Analysis tools - Network Analysis - Digital Education models - 3D data collection and utilisation.

UNIT V APPLICATIONS **9**

GIS Applicant - Natural Resource Management - Engineering - Navigation - Vehicle tracking and fleet management - Marketing and Business applications - Case studies.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

-
- Have basic idea about the fundamentals of GIS.
- Understand the types of data models.
- Get knowledge about data input and topology.
- Gain knowledge on data quality and standards.
- Understand data management functions and data output
-

TEXTBOOKS:

Kang - Tsung Chang, Introduction to Geographic Information Systems, McGraw Hill Publishing, 2nd Edition, 2011. 2. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, “An Introduction Geographical Information Systems, Pearson Education, 2nd Edition,2007.

REFERENCES:

Lo.C.P., Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems, Prentice-Hall India Publishers, 2006

OPEN ELECTIVEII

20150FE74A INTRODUCTION TO C PROGRAMMING L T P C 3 0 0 3 OBJECTIVES

• To develop C Programs using basic programming constructs • To develop C programs using arrays and strings • To develop applications in C using functions and structures

UNIT I INTRODUCTION 9

Structure of C program – Basics: Data Types – Constants –Variables - Keywords – Operators: Precedence and Associativity - Expressions - Input/Output statements, Assignment statements – Decision-making statements - Switch statement - Looping statements – Pre-processor directives - Compilation process – Exercise Programs: Check whether the required amount can be withdrawn based on the available amount – Menu-driven program to find the area of different shapes – Find the sum of even numbers Text Book: ReemaThareja (Chapters 2,3)

UNIT II ARRAYS 9

Introduction to Arrays – One dimensional arrays: Declaration – Initialization - Accessing elements – Operations: Traversal, Insertion, Deletion, Searching - Two dimensional arrays: Declaration – Initialization - Accessing elements – Operations: Read – Print – Sum – Transpose – Exercise Programs: Print the number of positive and negative values present in the array – Sort the numbers using bubble sort - Find whether the given is matrix is diagonal or not. Text Book: ReemaThareja (Chapters 5)

UNIT III STRINGS 9

Introduction to Strings - Reading and writing a string - String operations (without using built-in string functions): Length – Compare – Concatenate – Copy – Reverse – Substring – Insertion – Indexing – Deletion – Replacement – Array of strings – Introduction to Pointers – Pointer operators – Pointer arithmetic - Exercise programs: To find the frequency of a character in a string - To find the number of vowels, consonants and white spaces in a given text - Sorting the names. Text Book: ReemaThareja (Chapters 6 & 7)

UNIT IV FUNCTIONS 9

Introduction to Functions – Types: User-defined and built-in functions - Function prototype - Function definition - Function call - Parameter passing: Pass by value - Pass by reference - Built-in functions (string functions) – Recursive functions – Exercise programs: Calculate the total amount of power consumed by ‘n’ devices (passing an array to a function) – Menu-driven program to count the numbers which are divisible by 3, 5 and by both (passing an array to a function) – Replace the punctuations from a given sentence by the space character (passing an array to a function) Text Book: ReemaThareja (Chapters 4)

UNIT V STRUCTURES 9

Introduction to structures – Declaration – Initialization – Accessing the members – Nested Structures – Array of Structures – Structures and functions – Passing an entire structure – Exercise programs: Compute the age of a person using structure and functions (passing a structure to a function) – Compute the number of days an employee came late to the office by considering his arrival time for 30 days (Use array of structures and functions) Text Book: ReemaThareja (Chapters 8)

TOTAL:45 PERIODS

OUTCOMES

Upon completion of this course, the students will be able to

• Develop simple applications using basic constructs

• Develop applications using arrays and strings
• Develop applications using functions and structures

TEXT BOOK

1. ReemaThareja, “Programming in C”, Oxford University Press, Second Edition, 2016

REFERENCES:

1. Kernighan, B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2006
2. Paul Deitel and Harvey Deitel, “C How to Program”, Seventh edition, Pearson Publication
3. Juneja, B. L and Anita Seth, “Programming in C”, CENGAGE Learning India pvt. Ltd., 2011
4. PradipDey, Manas Ghosh, “Fundamentals of Computing and Programming in C”, First Edition, Oxford University Press, 2009

20150FE74B DATA STRUCTURES AND ALGORITHMS L T P C
3 0 0 3

OBJECTIVES:

- To understand the various algorithm design and analysis techniques
- To learn linear data structures – lists, stacks, and queues
- To learn different sorting and searching algorithms
- To understand Tree and Graph data structures

UNIT I ALGORITHM ANALYSIS, LIST ADT 11

Algorithms: Notation - analysis – running time calculations. Abstract Data Types (ADTs): List ADT – array-based implementation – linked list implementation – singly linked lists- applications of lists: Polynomial Manipulation. Implementation of List ADT using an array and using a linked list in C.

UNIT II STACKS AND QUEUES 7

Stack ADT - Applications - Evaluating arithmetic expressions- Conversion of Infix to Postfix- Recursion. Queue ADT – Priority Queue - applications of queues. Implementation of Stack ADT and palindrome checking using C. Implementation of Queue operations using arrays in C.

UNIT III SEARCHING AND SORTING ALGORITHMS 10

Divide and conquer methodology - Searching: Linear Search - Binary Search. Sorting: Insertion sort – Merge sort – Quick sort – Heap sort. Analysis of searching and sorting techniques. Implementation of linear search, binary search, insertion sort, merge sort and quick sort algorithms in C.

UNIT IV TREES 9

Tree ADT – tree traversals - Binary Tree ADT – expression trees – binary search tree ADT – applications of trees.Heap – applications of heap. Implementation of Binary search tree and its operations, tree traversal methods, finding height of the tree using C. Implementation of heap and heap sorting using arrays in C.

UNIT V GRAPHS 8

Definition – Representation of Graph – Breadth-first traversal - Depth-first traversal – Dynamic programming Technique – Warshall's and Floyd's algorithm – Greedy method - Dijkstra's algorithm – applications of graphs. Implementation of graph, graph traversal methods, finding shortest path using Dijkstra's algorithm in C

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students should be able to:

- Implement linear data structures and solve problems using them
- Implement and apply trees and graphs to solve problems.
- Implement the various searching and sorting algorithms.

TEXT BOOKS:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2^{nd} Edition, Pearson Education,1997.
2. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", 2^{nd} Edition, Pearson Education, 1988.

REFERENCES:

1. Aho, Hopcroft and Ullman, “Data Structures and Algorithms”, Pearson Education,1983.
2. S.Sridhar, “Design and Analysis of Algorithms”, First Edition, Oxford University Press. 2014
3. Byron Gottfried, Jitender Chhabra, “Programming with C” (Schaum's Outlines Series),Mcgraw Hill Higher Ed., III Edition, 2010
4. YashvantKanetkar, “Data Structures Through C”, BPB publications, II edition, 2003

20152FE74A **ROBOTICS** **L T P C**
3 0 0 3

OBJECTIVES:
 To understand the functions of the basic components of a Robot. To study the use of various types of End of Effectors and Sensors To impart knowledge in Robot Kinematics and Programming To learn Robot safety issues and economics.

UNIT I FUNDAMENTALS OF ROBOT **6**
Robot - Definition - Robot Anatomy - Co ordinate Systems, Work Envelope Types and Classification- Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load- Robot Parts and their Functions-Need for Robots-Different Applications.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS **9**
Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT III SENSORS AND MACHINE VISION **12**
Requirements of a sensor, Principles and Applications of the following types of sensors- Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors ,binary Sensors., Analog Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing Image Data- Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications- Inspection, Identification, Visual Serving and Navigation.

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING **13**
Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems. Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs.

UNIT V IMPLEMENTATION AND ROBOT ECONOMICS **5**
RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

TOTAL: 45 PERIODS OUTCOME:
 Upon completion of this course, the students can able to apply the basic engineering knowledge for the design of robotics

TEXT BOOKS: 1. Klafter R.D., ChmielewskiT.A and Negin M., “Robotic Engineering - An Integrated Approach”, Prentice Hall, 2003. 2. GrooverM.P., “Industrial Robotics -Technology Programming and Applications”, McGraw Hill, 2001.

20152FE74B ELECTRONIC DEVICES L T P C 3 0 0 3

OBJECTIVES:

The student should be made to:

- Introduce the concept of diodes, Bipolar Junction Transistors and FET
- Study the various model parameters of Transistors
- Learn the concept of special semiconductor devices, Power & Display devices
- Impart the knowledge of various configurations, characteristics and applications.

UNIT I SEMICONDUCTOR DIODE 9

PN junction diode, Current equations, Energy Band diagram, Diffusion and drift current densities, forward and reverse bias characteristics, Transition and Diffusion Capacitances, Switching Characteristics, Breakdown in PN Junction Diodes.

UNIT II BIPOLAR JUNCTION TRANSISTORS 9

NPN -PNP -Operations-Early effect-Current equations – Input and Output characteristics of CE, CB, CC - Hybrid -p model - h-parameter model, Ebers Moll Model- GummelPoonmodel, Multi Emitter Transistor.

UNIT III FIELD EFFECT TRANSISTORS 9

JFETs – Drain and Transfer characteristics,-Current equations-Pinch off voltage and its significance- MOSFET- Characteristics- Threshold voltage -Channel length modulation, DMOSFET, E-MOSFET- Characteristics – Comparison of MOSFET with JFET.

UNIT IV SPECIAL SEMICONDUCTOR DEVICES 9

Metal-Semiconductor Junction - MESFET, FINFET, PINFET, CNTFET, DUAL GATE MOSFET, Point Contact Diode, p-i-n Diode, Avalanche Photodiode, Schottky barrier diodeZener diode-Varactor diode – Tunnel diode- Gallium Arsenide device, LASER diode, LDR.

UNIT V POWER DEVICES AND DISPLAY DEVICES 9

UJT, Thyristor - SCR, Diac, Triac, Power BJT- Power MOSFET- DMOS-VMOS. LED, LCD, Opto Coupler, Solar cell, CCD.

TOTAL: 45 PERIODS

OUTCOMES:

After this course, the student should be able to:

- Analyze the characteristics of semiconductor diodes.
- Analyze and solve problems of Transistor circuits using model parameters.
- Identify and characterize diodes and various types of transistors.
- Analyze the characteristics of special semiconductor devices.
- Analyze the characteristics of Power and Display devices.

TEXT BOOKS:

1. Millman and Halkias, “Electronic Devices and Circuits”, 4th Edition, McGraw Hill, 2015.

2. Mohammad Rashid, “Electronic Devices and Circuits”, Cengage Learning Pvt. Ltd, 2015.
3. Salivahanan. S, Suresh Kumar. N, “Electronic Devices and circuits”, 4TH Edition, McGraw Hill, 2016.

REFERENCES:

1. Donald A Neaman, “Semiconductor Physics and Devices”, 4th Edition, McGraw Hill, 2012.
2. Robert L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory” Pearson Prentice Hall, 11thEdition, 2014.
3. Bhattacharya and Sharma, “Solid State Electronic Devices”, 2ndEdition, Oxford University Press, 2014.
4. R.S.Sedha, “A Textbook of Electronic Devices and Circuits”, 2ndEdition, S.Chand Publications, 2008.
5. David A. Bell, “Electronic Devices and Circuits”, 5thEdition, Oxford University Press, 2008.

20153FE74B INTRODUCTION TO RENEWABLE ENERGY SYSTEMS L T P C

3 0 0 3

OBJECTIVES:

To Provide knowledge

- About the stand alone and grid connected renewable energy systems.
- Design of power converters for renewable energy applications.
- Wind electrical generators and solar energy systems.
- Power converters used for renewable energy systems.

UNIT I INTRODUCTION 9

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems.

UNIT II ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION

Reference theory fundamentals-principle of operation and analysis: IG and PMSG 9

UNIT III POWER CONVERTERS 9

Solar: Block diagram of solar photo voltaic system -Principle of operation: line commutated converters (inversion-mode) - Boost and buck-boost converters- selection of inverter, battery sizing, array sizing Wind: Three phase AC voltage controllers

UNIT IV ANALYSIS OF WIND AND PV SYSTEMS 9

Stand alone operation of fixed and variability speed wind energy conversion systems and solar system-Grid connection Issues -Grid integrated PMSG, SCIG Based WECS, grid Integrated solar system

UNIT V HYBRID RENEWABLE ENERGY SYSTEMS 9

Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind-PV Maximum Power Point Tracking (MPPT).

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.
- Ability to handle the engineering aspects of electrical energy generation and utilization.
- Ability to understand the stand alone and grid connected renewable energy systems.
- Ability to design of power converters for renewable energy applications.
- Ability to acquire knowledge on wind electrical generators and solar energy systems.
- Ability to design power converters used for hybrid renewable energy systems.

TEXT BOOK:

1. S. N. Bhadra, D.Kastha, S.Banerjee, “Wind Electrical Systems”, Oxford University Press, 2005.
2. B.H.Khan Non-conventional Energy sources Tata McGraw-hill Publishing Company, New Delhi,2009.

REFERENCES:

1. Rashid .M. H “power electronics Hand book”, Academic press, 2001.
2. Ion Boldea, “Variability speed generators”, Taylor & Francis group, 2006.
3. Rai. G.D, “Non conventional energy sources”, Khanna publishes, 1993.
4. Gray, L. Johnson, “Wind energy system”, prentice hall linc, 1995.

5. Andrzej M. Trzynnadlowski, „Introduction to Modern Power Electronics", Second edition, wiley India Pvt. Ltd, 2012.

20155FE74B **WASTE WATER TREATMENT** **L T P C**
3 0 0 3

OBJECTIVES

- To make the student conversant with the water treatment methods including adsorption and oxidation process.
- To provide basic under standings about the requirements of water, its preliminary treatment.

UNIT I WATER QUALITY AND PRELIMINARY TREATMENT 9

Water Quality-physical- chemical and biological parameters of water- water quality requirement - potable water standards -wastewater effluent standards -water quality indices. Water purification systems in natural systems- physical processes-chemical processes and biological processes- primary, secondary and tertiary treatment-Unit operations-unit processes. Mixing, clarification - sedimentation; Types; aeration and gas transfer – coagulation and flocculation, coagulation processes - stability of colloids - destabilization of colloids- transport of colloidal particles, clariflocculation.

UNIT II INDUSTRIAL WATER TREATMENT 9

Filtration – size and shape characteristics of filtering media – sand filters hydraulics of filtration – design considerations – radial, upflow, highrate and multimedia filters, pressure filter. Water softening – lime soda, zeolite and demineralization processes – industrial water treatment for boilers.

UNIT III CONVENTIONAL TREATMENT METHODS 9

Taste and odour control – adsorption – activated carbon treatment – removal of color – iron and manganese removal – aeration, oxidation, ion exchange and other methods – effects of fluorides – fluoridation and defluoridation –desalination - corrosion prevention and control – factors influencing corrosion – Langelier index – corrosion control measures.

UNIT IV WASTEWATER TREATMENT 9

Wastewater treatment – pre and primary treatment – equalization neutralization – screening and grid removal – sedimentation – oil separation gas stripping of volatile organics – biological oxidation – lagoons and stabilization basins – aerated lagoons – activated sludge process – trickling filtration – anaerobic decomposition.

UNIT V ADSORPTION AND OXIDATION PROCESSES 9

Chemical process – adsorption – theory of adsorption – ion exchange process – chemical oxidation – advanced oxidation process – sludge handling and disposal – miscellaneous treatment processes.

TOTAL: 45 PERIODS

OUTCOMES

- Will have knowledge about adsorption and oxidation process.
- Will gain idea about various methods available for water treatment.
- Will appreciate the necessity of water and acquire knowledge of preliminary treatment.

TEXTBOOKS:

1. Metcalf and Eddy, “Wastewater Engineering”, 4th ed., McGraw Hill Higher Edu., 2002.
2. W. Wesley Eckenfelder, Jr., “Industrial Water Pollution Control”, 2nd Edn., McGraw Hill Inc., 1989.

REFERENCES

1. S.P. Mahajan, “Pollution control in process industries”, 27^{th} Ed. Tata McGraw Hill Publishing Company Ltd., 2012.
2. M. Lancaster, “Green Chemistry: An Introductory Text”, 2^{nd} edition, RSC publishing, 2010.
3. C.S. Rao, “Environmental Pollution Control Engineering”, New Age International, 2007.

I - VIII SEMESTER CURRICULUM AND SYLLABI

B.TECH (FT) MECHANICAL [Regulation 2019]

SEMESTER I

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	19147S11	Communicative English	4	0	0	4
2.	19148S12	Engineering Mathematics - I	4	0	0	4
3.	19149S13	Engineering Physics	3	0	0	3
4.	19149S14	Engineering Chemistry	3	0	0	3
5.	19154S15	Engineering Graphics	2	0	4	4
6.	19150S16	Problem Solving andPython Programming	3	0	0	3
PRACTICAL						
7.	19150L17	Problem Solving and Python Programming Laboratory	0	0	4	2
8.	19149L18	Physics and ChemistryLaboratory	0	0	4	2
9.	191VEA19	Value Education				-
TOTAL			**19**	**2**	**12**	**25**

SKILL DEVELOPMENT

SEMESTER II

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	19147S21	Technical English	4	0	0	4
2.	19148S22	Engineering Mathematics II	4	0	0	4
3	19149S23C	Material Science	3	0	0	3
4.	19149S24A	Environmental Science And Engineering	3	0	0	3
5.	19153S25D	Basic Electrical, Electronics And Instrumentation Engineering	3	0	0	3
6.	19154S26D	Engineering Mechanics	3	2	0	4
PRACTICAL						
7.	19154L27	Engineering Practices Lab . (All Branches)	0	0	3	2
8.	19153L28D	Basic Electrical, Electronics and Instrumentation Engineering Lab	0	0	3	2
9.	191ICA29	Fundamentals of Indian constitution and Economy				-
TOTAL			**20**	**2**	**6**	**25**

SKILL DEVELOPMENT

SEMESTER III

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	19148S31C	Transforms and Partial Differential Equations	4	0	0	4
2.	19154C32	Engineering Thermodynamics	3	2	0	4
3.	19154C33	Fluid Mechanics and Machinery	4	0	0	4
4.	19154C34	Production Technology - I	3	0	0	3
5.	19154S35	Electrical Drives and Controls	3	0	0	3
PRACTICAL						
6.	19154L36	Production Technology Laboratory - I	0	0	3	2
7.	19154L37	Computer Aided Machine Drawing	0	0	3	2
8.	19154L38	Electrical Engineering Laboratory	0	0	3	2
9.	19154L39	Interpersonal Skills / Listening & Speaking	0	0	2	1
TOTAL			**17**	2	**11**	**25**

SKILL DEVELOPMENT

SEMESTER IV

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	19148S41D	Statistics and Numerical Methods	4	0	0	4
2.	19154C42	Theory of Machines-I	3	0	0	3
3.	19154C43	Production Technology – II	3	0	0	3
4.	19154C44	Engineering Metallurgy	3	0	0	3
5.	19154C45	Strength of Materials for Mechanical Engineers	3	0	0	3
6.	19154C46	Thermal Engineering- I	3	0	0	3
Practical						
7.	19154L47	Production Technology Laboratory - II	0	0	3	2
8.	19154L48	Strength of Materials and Fluid Mechanics and Machinery Laboratory	0	0	3	2
9.	19154L49	Advanced Reading and Writing	0	0	2	1
Research Skill Based (RSB) Course						
10.	19154CRS	Research Led Seminar				1
TOTAL			**19**	**0**	**8**	**25**

EMPLOYABILITY

ENTREPRENUEURSHIP

SKILL DEVELOPMENT

SEMESTER V

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	19154C51	Thermal Engineering- II	3	0	0	3
2.	19154C52	Design of Machine Elements	3	0	0	3
3.	19154C53	Metrology and Measurements	3	0	0	3
4.	191_ _OE54_	Open Elective I	3	0	0	3
5.	19154C55	Theory of Machines-II	3	2	0	4
PRACTICAL						
6.	19154L56	Theory of Machines Laboratory	0	0	3	2
7.	19154L57	Thermal Engineering Laboratory	0	0	3	2
8.	19154L58	Metrology and Measurements Laboratory	0	0	3	2
Research Skill Based (RSB) Course						
9.	19154CRM	Research Methodology				3
TOTAL			**16**	**6**	**9**	**25**

EMPLOYABILITY

ENTREPRENUEURSHIP

SKILL DEVELOPMENT

SEMESTER VI

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	19154C61	Design of Transmission Systems	3	0	0	3
2.	19154C62	Computer Aided Design And Manufacturing	3	0	0	3
3.	19154C63	Heat and Mass Transfer	3	2	0	4
4.	19154C64	Finite Element Analysis	3	0	0	3
5.	19154C65	Hydraulics And Pneumatics	3	0	0	3
6.	19154E66_	Elective - I	3	0	0	3
PRACTICAL						
7.	19154L67	CAD / CAM Laboratory	0	0	3	2
8.	19154L68	Design and Fabrication Project	0	0	3	2
9.	19154L69	Professional Communication	0	0	2	1
Research Skill Based (RSB) Course						
10	19154CBR	Participation in Bounded Research				1
TOTAL			**18**	**2**	**8**	**25**

EMPLOYABILITY

ENTREPRENUEURSHIP

SKILL DEVELOPMENT ENT

SEMESTER VII

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	19154C71	Power Plant Engineering	3	0	0	3
2.	19154C72	Process Planning and Cost Estimation	3	0	0	3
3.	19154C73	Mechatronics	3	0	0	3
4.	191_ _ OE74_	Open ElectiveII	3	0	0	3
5.	19154E75_	Elective II	3	0	0	3
6.	19154E76_	Elective III	3	0	0	3
PRACTICAL						
7.	19154L77	Simulation and Analysis Laboratory	0	0	3	2
8.	19154L78	Mechatronics Laboratory	0	0	3	2
9.	19154L79	Technical Seminar	0	0	2	1
Research Skill Based (RSB) Course						
10.	19154CSR	Design /SOCIO Technical Project				3
TOTAL			**20**	**2**	**8**	26

EMPLOYABILITY

ENTREPRENUEURSHIP

SKILL DEVELOPMENT

SEMESTER VIII

S.No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	19154S81	Principles of Management	3	0	0	3
2.	19154E82_	Elective– IV	3	0	0	3
PRACTICAL						
3.	19154P83	Project Work	0	0	20	10
4	19154PEE	Programme Exit Examination				2
TOTAL			**6**	**0**	**20**	**18**
TOTAL CREDITS						**194**

ENTREPRENUEURSHIP

.ELECTIVE – I (VI SEMESTER)

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	19154E66A	Automobile Engineering	3	0	0	3
2.	19154E66B	Safety in Engineering industries	3	0	0	3
3.	19154E66C	Gas Dynamics and Jet Propulsion	3	0	0	3
4.	19154E66D	Fundamentals of Nano Science	3	0	0	3

EMPLOYABILITY

ELECTIVE – II (VII SEMESTER)

	COURSE CODE	COURSE TITLE	L	T	P	C
1.	19154E75A	Renewable Sources of Energy	3	0	0	3
2.	19154E75B	Nonconventional Machining Processes	3	0	0	3
3.	19154E75C	Operations Research	3	0	0	3
4.	19154E75D	Total Quality Management	3	0	0	3

EMPLOYABILITY

ENTREPRENUEURSHIP

ELECTIVE – III (VII SEMESTER)

SI. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	19154E76A	Robotics	3	0	0	3
2.	19154E76B	Design of Jigs, Fixtures and Press Tools	3	0	0	3
3.	19154E76C	General Aspects of Energy Management and Energy audit	3	0	0	3
4.	19154E76D	Composite Materials	3	0	0	3

EMPLOYABILITY

ENTREPRENUEURSHIP

ELECTIVE – IV (VIII SEMESTER)

SI. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	19154E82A	Production Planning and Control	3	0	0	3
2.	19154E82B	Computer Integrated Manufacturing Systems	3	0	0	3
3.	19154E82C	Energy Efficiency in Thermal Utilities	3	0	0	3
4.	19154E82D	Professional Ethics in Engineering	3	0	0	3

EMPLOYABILITY

ENTREPRENUEURSHIP

SKILL DEVELOPMENT

OPEN ELECTIVE– I

Sl. No	DEPT	COURSE CODE	COURSE TITLE	L	T	P	C
1.	CSE	19150OE54A	Data Base management systems	3	0	0	3
2.		19150OE54B	Cloud computing	3	0	0	3
3.	ECE	19152OE54A	Basics Of Bio Medical Instrumentation	3	0	0	3
4.		19152OE54B	Sensors And Transducers	3	0	0	3
5.	EEE	19153OE54A	Industrial Nano Technology	3	0	0	3
6.		19153OE54B	Energy Conservation and Management	3	0	0	3
7.	CIVIL	19155OE54A	Air Pollution And Control Engineering	3	0	0	3
8.		19155OE54B	Geographic Information Systems	3	0	0	3

OPEN ELECTIVE– II

Sl. No	DEPT	COURSE CODE	COURSE TITLE	L	T	P	C
1	CSE	19150OE74A	Introduction to C programming	3	0	0	3
2.		19150OE74B	Data structures and algorithms	3	0	0	3
3.	ECE	19152OE74A	Robotics	3	0	0	3
4.		19150OE74B	Electronic devices	3	0	0	3
5.	EEE	19153OE74A	Basic circuit theory	3	0	0	3
6.		19153OE74B	Introduction to renewable energy systems	3	0	0	3
7.	CIVIL	19155OE74A	Green building design	3	0	0	3
8.		19155OE74B	Waste water treatment	3	0	0	3

EMPLOYABILITY

ENTREPRENUEURSHIP

SKILL DEVELOPMENT

CGPA CREDITS

Semester	Core	Elective	Open elective	Practical	Seminar	Exit exam	Project	RSD course	Total
I	24	-	-	04	-	-	-	-	28
II	24	-	-	04	-	-	-	-	28
III	18	-	-	07	-	-	-	-	25
IV	19	-	-	05	-	-	-	01	25
V	13	-	03	06	-	-	-	03	25
VI	16	03	-	05	-	-	-	2	26
VII	09	06	03	04	01	-	-	04	27
VIII	03	03	-	-	-	02	15	-	23
TOTAL									207

NON-CGPA CREDITS

Semester	Add on course	Total
I	01	**01**
II	01	**01**
III	-	**-**
IV	-	**-**
V	-	**-**
VI	-	**-**
VII	-	**-**
VIII	-	**-**
Co curricular Activities	In-plant Training , Industrial Visit , Seminars & Conferences	**03**
TOTAL NON-CGPA CREDITS		**05**

TOTAL CREDITS	
CGPA CREDITS	**207**
NON-CGPA CREDITS	**05**
TOTAL	**212**

191VEA19 VALUE EDUCATION

	L	T	P	C
	0	**0**	**0**	**1**

UNIT – I

Concept of Human Values, Value Education Towards Personal Development

Aim of education and value education; Evolution of value oriented education; Concept of Human values; types of values; Components of value education.

Personal Development :

Self analysis and introspection; sensitization towards gender equality, physically challenged, intellectually challenged. Respect to - age, experience, maturity, family members, neighbours, co-workers.

Character Formation Towards Positive Personality:

Truthfulness, Constructivity, Sacrifice, Sincerity, Self Control, Altruism, Tolerance, Scientific Vision.

UNIT – II

Value Education Towards National and Global Development National and International Values:

Constitutional or national values - Democracy, socialism, secularism, equality, justice, liberty, freedom and fraternity.

Social Values - Pity and probity, self control, universal brotherhood.
Professional Values - Knowledge thirst, sincerity in profession, regularity, punctuality and faith.
Religious Values - Tolerance, wisdom, character.
Aesthetic values - Love and appreciation of literature and fine arts and respect for the same.
National Integration and international understanding.

UNIT – III Impact of Global Development on Ethics and Values

Conflict of cross-cultural influences, mass media, cross-border education, materialistic values, professional challenges and compromise.

Modern Challenges of Adolescent Emotions and behavior; Sex and spirituality: Comparision and competition; positive and negative thoughts.

Adolescent Emotions, arrogance, anger, sexual instability, selfishness, defiance.

UNIT - IV Theraupatic Measures

Control of the mind through
a. Simplified physical exercise
b. Meditation – Objectives, types, effect on body, mind and soul
c. Yoga – Objectives, Types, Asanas

d. Activities:
- (i) Moralisation of Desires
- (ii) Neutralisation of Anger
- (iii)Eradication of Worries
- (iv) Benefits of Blessings

UNIT; V Human Rights

1. Concept of Human Rights – Indian and International Perspectives
    a. Evolution of Human Rights
    b. Definitions under Indian and International documents

2. Broad classification of Human Rights and Relevant Constitutional Provisions.
    a. Right to Life, Liberty and Dignity
    b. Right to Equality
    c. Right against Exploitation
    d. Cultural and Educational Rights
    e. Economic Rights
    f. Political Rights
    g. Social Rights

3. Human Rights of Women and Children
    a. Social Practice and Constitutional Safeguards
        (i) Female Foeticide and Infanticide
        (ii) Physical assault and harassment
        (iii) Domestic violence
        (iv) Conditions of Working Women

4. Institutions for Implementation
    a. Human Rights Commission
    b. Judiciary

5. Violations and Redressel
    a. Violation by State
    b. Violation by Individuals
    c. Nuclear Weapons and terrorism
    d. Safeguards.

191ICA29 FUNDAMENTALS OF INDIAN CONSTITUTION AND ECONOMY L P T C

1 0 0 1

UNIT-I: THE MAKING OF INDIAN CONSTITUTION

The Constituent Assembly: Organization- Character- Work-Salient feature of the constitution- Writtern and detailed constitution- Socialism- Secularism- Democracy and Republic.

UNIT-II: FUNDAMENTAL RIGHTS AND FUNDAMENTAL DUTIES OF THE CITIZENS

Right of equality- Right of freedom-Right against exploitation-Right to freedom of religion- Cultural and Educational rights-Right to constitutional remedies- Fundamental duties.

UNIT-III: DIRECTIVE PRINCIPLES OF STATE POLICY

Socialistic principles- Gandhian principles- Liberal and general principles-Differences between Fundamental Rights and Directive principles

UNIT-IV: THE UNION EXECUTIVE, UNION PARLIAMENT AND SUPREME COURT

Powers and Positions of the president- Qualification-Method of election of president and Vice President- Prime minister- Rajya sabha- Lok sabha- The Supreme Court- High Court- Functions and Positions of Supreme Court and High Court.

UNIT V: STATE COUNCIL- ELECTION SYSTEM AND PARLIMENTARY DEMOCRACY IN INDIA

State Council of Ministers- Chief Minister- Election Systems in India- Main Features-Election Commission – Features of Indian Democracy.

REFERENCES:

1. Palekar. S.A., Indian constitution government and politics, ABD Publications , India
2.Aiyer, Alladi Krishnaswami, Constitution and Fundamental rights 1955
3. Markandan. K.C., Directive Principles in the Indian Constitution 1966.
4. Kashyap, Subash C., Our Parliament , National Book Trust , New Delhi 1989.

		L	T	P	C
19154L39	INTERPERSONAL SKILLS/LISTENING & SPEAKING	0	0	2	1

OBJECTIVES: The Course will enable learners to:

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- improve general and academic listening skills
- Make effective presentations.

UNIT I

Listening as a key skill- its importance- speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification Improving pronunciation - pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

UNIT II

Listen to a process information- give information, as part of a simple explanation - conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

UNIT III

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk - greet - respond to greetings - describe health and symptoms - invite and offer - accept - decline - take leave - listen for and follow the gist- listen for detail

UNIT IV

Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and lectures conversational speech listening to and participating in conversations - persuade.

UNIT V

Formal and informal talk - listen to follow and respond to explanations, directions and instructions in academic and business contexts - strategies for presentations and interactive communication - group/pair presentations - negotiate disagreement in group work.

TOTAL : 30 PERIODS

OUTCOMES: At the end of the course Learners will be able to:

- Listen and respond appropriately.
- Participate in group discussions
- Make effective presentations
- Participate confidently and appropriately in conversations both formal and informal

TEXT BOOKS:

1. Brooks,Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press, Oxford: 2011.

2. Richards,C. Jack. & David Bholke. Speak Now Level 3. Oxford University Press, Oxford: 2010

REFERENCES

1. Bhatnagar, Nitin and MamtaBhatnagar. Communicative English for Engineers and Professionals. Pearson: New Delhi, 2010.
2. Hughes, Glyn and Josephine Moate. Practical English Classroom. Oxford University Press: Oxford, 2014.
3. Ladousse, Gillian Porter. Role Play. Oxford University Press: Oxford, 2014
4. Richards C. Jack. Person to Person (Starter). Oxford University Press: Oxford, 2006.
5. Vargo, Mari. Speak Now Level 4. Oxford University Press: Oxford, 2013.

1. ” Tata McGraw-Hill Publishers, 2007

19154L47 PRODUCTION TECHNOLOGY LABORATORY – II

L	T	P	C
0	0	3	2

OBJECTIVE:

- To Study and acquire knowledge on various basic machining operations in special purpose machines and its applications in real life manufacture of components in the industry

LIST OF EXPERIMENTS:

1. Contour milling using vertical milling machine
2. Spur gear cutting in milling machine
3.
4. Helical Gear Cutting in milling machine
5. Gear generation in hobbing machine
6. Gear generation in gear shaping machine
7. Plain Surface grinding
8. Cylindrical grinding
9. Tool angle grinding with tool and Cutter Grinder
10. Measurement of cutting forces in Milling / Turning Process
11. CNC Part Programming

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 use different machine tools to manufacturing gears
CO2 Ability to use different machine tools to manufacturing gears.
CO3 Ability to use different machine tools for finishing operations
CO4 Ability to manufacture tools using cutter grinder
CO5 Develop CNC part programming

TOTAL: 45

PERIODS LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Turret and Capstan Lathes	1 No each
2	Horizontal Milling Machine	2 No
3	Vertical Milling Machine	1 No
4	Surface Grinding Machine	1 No.
5	Cylinderical Grinding Machine	1 No.
6	Radial Drilling Machine	1 No.
7	lathe Tool Dynamometer	1 No
8	Milling Tool Dynamometer	1 No
9	Gear Hobbing Machine	1 No
10	Tool Makers Microscope	1 No
11	CNC Lathe	1 No
12	CNC Milling machine	1 No
13	Gear Shaping machine	1 No
14	Centerless grinding machine	1 No
15	Tool and cutter grinder	1 No

19154L48	STRENGTH OF MATERIALS AND FLUID MECHANICS AND MACHINERY LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES:

- To study the mechanical properties of materials when subjected to different types of loading.
- To verify the principles studied in Fluid Mechanics theory by performing experiments in lab.

STRENGTH OF MATERIALS **23**

LIST OF EXPERIMENTS

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels.
10. Tempering- Improvement Mechanical properties Comparison
    (i) Unhardened specimen
    (ii) Quenched Specimen and
    (iii) Quenched and tempered specimen.
11. Microscopic Examination of
    (i) Hardened samples and
    (ii) Hardened and tempered samples.

OUTCOME:

- Ability to perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Universal Tensile Testing machine with double 1 shear attachment – 40 Ton Capacity	1
2	Torsion Testing Machine (60 NM Capacity)	1
3	Impact Testing Machine (300 J Capacity)	1
4	Brinell Hardness Testing Machine	1
5	Rockwell Hardness Testing Machine	1
6	Spring Testing Machine for tensile and compressive loads (2500 N)	1
7	Metallurgical Microscopes	3
8	Muffle Furnace (800 C)	1

FLUID MECHANICS AND MACHINES LABORATORY **22**

LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.

7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course, the students will be able to:

- Perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.
- Use the measurement equipments for flow measurement.
- Perform test on different fluid machinery.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. NO.	NAME OF THE EQUIPMENT	Qty.
1	Orifice meter setup	1
2	Venturi meter setup	1
3	Rotameter setup	1
4	Pipe Flow analysis setup	1
5	Centrifugal pump/submergible pump setup	1
6	Reciprocating pump setup	1
7	Gear pump setup	1
8	Pelton wheel setup	1
9	Francis turbine setup	1
10	Kaplan turbine setup	1

19154L 49	ADVANCED READING AND WRITING	L	T	P	C
		0	0	2	1

OBJECTIVES:
- Strengthen the reading skills of students of engineering.
- Enhance their writing skills with specific reference to technical writing.
- Develop students' critical thinking skills.
- Provide more opportunities to develop their project and proposal writing skills.

UNIT I

Reading - Strategies for effective reading-Use glosses and footnotes to aid reading comprehension-Read and recognize different text types-Predicting content using photos and title Writing-Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence –Write a descriptive paragraph

UNIT II

Reading-Read for details-Use of graphic organizers to review and aid comprehension Writing-State reasons and examples to support ideas in writing- Write a paragraph with reasons and examples- Write an opinion paragraph

UNIT III

Reading- Understanding pronoun reference and use of connectors in a passage- speed reading techniques-Writing- Elements of a good essay-Types of essays- descriptive-narrative- issue-based-argumentative-analytical.

UNIT IV

Reading- Genre and Organization of Ideas- Writing- Email writing- resumes – Job application- project writing-writing convincing proposals.

UNIT V

Reading- Critical reading and thinking- understanding how the text positions the reader- identify
Writing- Statement of Purpose- letter of recommendation- Vision statement

TOTAL: 30 PERIODS

OUTCOMES: At the end of the course Learners will be able to:
- Write different types of essays.
- Write winning job applications.
- Read and evaluate texts critically.
- Display critical thinking in various professional contexts.

TEXT BOOKS:

1. Debra Daise, CharlNorloff, and Paul Carne Reading and Writing (Level 4) Oxford University Press: Oxford, 2011
2. Gramer F. Margot and Colin S. Ward Reading and Writing (Level 3) Oxford University Press: Oxford, 2011

REFERENCES

1. Davis, Jason and Rhonda LIss.Effective Academic Writing (Level 3) Oxford University Press: Oxford, 2006
2. E. Suresh Kumar and et al. Enriching Speaking and Writing Skills. Second Edition. Orient Black swan: Hyderabad, 2012
3. Withrow, Jeans and et al. Inspired to Write. Readings and Tasks to develop writing skills. Cambridge University Press: Cambridge, 2004
4. Goatly, Andrew. Critical Reading and Writing. Routledge: United States of America, 2000
5. Petelin, Roslyn and Marsh Durham. The Professional Writing Guide: Knowing Well and Knowing Why. Business & Professional Publishing: Australia, 2004

19154C52 **DESIGN OF MACHINE ELEMENTS**

L	T	P	C
3	2	0	4

OBJECTIVES

- To familiarize the various steps involved in the Design Process
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data
- To learn to use catalogues and standard machine components
- (Use of P S G Design Data Book is permitted)

UNIT I STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS 9+6

Introduction to the design process - factors influencing machine design, selection of materials based on mechanical properties - Preferred numbers, fits and tolerances – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – curved beams – crane hook and 'C' frame- Factor of safety - theories of failure – Design based on strength and stiffness – stress concentration – Design for variable loading.

UNIT II SHAFTS AND COUPLINGS 9+6

Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys, keyways and splines - Rigid and flexible couplings.

UNIT III TEMPORARY AND PERMANENT JOINTS 9+6

Threaded fastners - Bolted joints including eccentric loading, Knuckle joints, Cotter joints – Welded joints, riveted joints for structures - theory of bonded joints.

UNIT IV ENERGY STORING ELEMENTS AND ENGINE COMPONENTS 9+6

Various types of springs, optimization of helical springs - rubber springs - Flywheels considering stresses in rims and arms for engines and punching machines- Connecting Rods and crank shafts.

UNIT V BEARINGS 9+6

Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfeld Number, Raimondi and Boyd graphs, -- Selection of Rolling Contact bearings.

TOTAL: 45+30= 75 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Explain the influence of steady and variable stresses in machine component design.
CO2 Apply the concepts of design to shafts, keys and couplings.
CO3 Apply the concepts of design to temporary and permanent joints.
CO4 Apply the concepts of design to energy absorbing members, connecting rod and crank shaft.
CO5 Apply the concepts of design to bearings.

TEXT BOOKS:

1. Bhandari V, "Design of Machine Elements", 4th Edition, Tata McGraw-Hill Book Co, 2016.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 9th Edition, Tata McGraw-Hill, 2011.

REFERENCES:

1. Alfred Hall, Halowenko, A and Laughlin, H., “Machine Design”, Tata McGraw-Hill BookCo.(Schaum’s Outline), 2010
2. Ansel Ugural, “Mechanical Design – An Integral Approach", 1st Edition, Tata McGraw-Hill Book Co, 2003.
3. P.C. Gope, “Machine Design – Fundamental and Application”, PHI learning private ltd, New Delhi, 2012.
4. R.B. Patel, “Design of Machine Elements”, MacMillan Publishers India P Ltd., Tech-Max Educational resources, 2011.
5. Robert C. Juvinall and Kurt M Marshek, “Fundamentals of Machine Design”, 4th Edition, Wiley, 2005
6. Sundararajamoorthy T. V. Shanmugam .N, “Machine Design”, Anuradha Publications, Chennai, 2015.

19154C53	METROLOGY AND MEASUREMENTS	L	T	P	C
		4	0	0	4

OBJECTIVES:

- To provide knowledge on various Metrological equipments available to measure the dimension of the components.
- To provide knowledge on the correct procedure to be adopted to measure the dimension of the components.

UNIT I BASICS OF METROLOGY 12

Introduction to Metrology – Need – Elements – Work piece, Instruments – Persons – Environment – their effect on Precision and Accuracy – Errors – Errors in Measurements – Types – Control – Types of standards.

UNIT II LINEAR AND ANGULAR MEASUREMENTS 12

Linear Measuring Instruments – Evolution – Types – Classification – Limit gauges – gauge design – terminology – procedure – concepts of interchange ability and selective assembly – Angular measuring instruments – Types – Bevel protractor clinometers angle gauges, spirit levels sine bar – Angle alignment telescope – Autocollimator – Applications.

UNIT III ADVANCES IN METROLOGY 12

Basic concept of lasers Advantages of lasers – laser Interferometers – types – DC and AC Lasers interferometer – Applications – Straightness – Alignment. Basic concept of CMM – Types of CMM

– Constructional features – Probes – Accessories – Software – Applications – Basic concepts of Machine Vision System – Element – Applications.

UNIT IV FORM MEASUREMENT 12

Principles and Methods of straightness – Flatness measurement – Thread measurement, gear measurement, surface finish measurement, Roundness measurement – Applications.

UNIT V MEASUREMENT OF POWER, FLOW AND TEMPERATURE 12

Force, torque, power - mechanical , Pneumatic, Hydraulic and Electrical type. Flow measurement: Venturimeter, Orifice meter, rotameter, pitot tube – Temperature: bimetallic strip, thermocouples, electrical resistance thermometer – Reliability and Calibration – Readability and Reliability.

TOTAL : 60 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Describe the concepts of measurements to apply in various metrological instruments

CO2 Outline the principles of linear and angular measurement tools used for industrial Applications

CO3 Explain the procedure for conducting computer aided inspection

CO4 Demonstrate the techniques of form measurement used for industrial components

CO5 Discuss various measuring techniques of mechanical properties in industrial applications

TEXT BOOKS:

1. Gupta. I.C., "Engineering Metrology", Dhanpatrai Publications, 2005.
2. Jain R.K. "Engineering Metrology", Khanna Publishers, 2009.

REFERENCES:

1. Alan S. Morris, "The essence of Measurement", Prentice Hall of India 1996.
2. Beckwith, Marangoni, Lienhard, "Mechanical Measurements", Pearson Education , 2014.
3. Charles Reginald Shotbolt, "Metrology for Engineers", 5th edition, Cengage Learning EMEA,1990.
4. Donald Peckman, "Industrial Instrumentation", Wiley Eastern, 2004.
5. Raghavendra ,Krishnamurthy "Engineering Metrology & Measurements", Oxford Univ. Press, 2013.

19154L57 **THERMAL ENGINEERING LABORATORY**

L	T	P	C
0	0	3	2

OBJECTIVES:

- To study the value timing-V diagram and performance of IC Engines
- To Study the characteristics of fuels/Lubricates used in IC Engines
- To study the Performance of steam generator/ turbine
- To study the heat transfer phenomena predict the relevant coefficient using implementation
- To study the performance of refrigeration cycle / components

LIST OF EXPERIMENTS

I.C. ENGINE LAB

1. Valve Timing and Port Timing diagrams.
2. Actual p-v diagrams of IC engines.
3. Performance Test on 4 – stroke Diesel Engine.
4. Heat Balance Test on 4 – stroke Diesel Engine.
5. Morse Test on Multi-cylinder Petrol Engine.
6. Retardation Test on a Diesel Engine.
7. Determination of Flash Point and Fire Point of various fuels / lubricants.

STEAM LAB

1. Study on Steam Generators and Turbines.
2. Performance and Energy Balance Test on a Steam Generator.
3. Performance and Energy Balance Test on Steam Turbine.

HEAT TRANSFER LAB:

1. Thermal conductivity measurement using guarded plate apparatus.
2. Thermal conductivity measurement of pipe insulation using lagged pipe apparatus.
3. Determination of heat transfer coefficient under natural convection from a vertical cylinder.
4. Determination of heat transfer coefficient under forced convection from a tube.
5. Determination of Thermal conductivity of composite wall.
6. Determination of Thermal conductivity of insulating powder.
7. Heat transfer from pin-fin apparatus (natural & forced convection modes)
8. Determination of Stefan – Boltzmann constant.
9. Determination of emissivity of a grey surface.
10. Effectiveness of Parallel / counter flow heat exchanger.

REFRIGERATION AND AIR CONDITIONING LAB

1. Determination of COP of a refrigeration system
2. Experiments on Psychrometric processes
3. Performance test on a reciprocating air compressor
4. Performance test in a HC Refrigeration System
5. Performance test in a fluidized Bed Cooling Tower

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 conduct tests on heat conduction apparatus and evaluate thermal conductivity of materials.

CO2 conduct tests on natural and forced convective heat transfer apparatus and evaluate heat transfer coefficient.

CO3 conduct tests on radiative heat transfer apparatus and evaluate Stefan Boltzmann constant and emissivity.
CO4 conduct tests to evaluate the performance of parallel/counter flow heat exchanger apparatus and reciprocating air compressor.
CO5 conduct tests to evaluate the performance of refrigeration and airconditioning test rigs.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

	NAME OF THE EQUIPMENT	**Qty.**
1	I.C Engine – 2 stroke and 4 stroke model	1 set
2	Apparatus for Flash and Fire Point	1 No.
3	4-stroke Diesel Engine with mechanical loading.	1 No
4	4-stroke Diesel Engine with hydraulic loading.	1 No.
5	4-stroke Diesel Engine with electrical loading.	1 No.
6	Multi-cylinder Petrol Engine	1 No.
7	Single cylinder Petrol Engine	1 No.
8	Data Acquisition system with any one of the above engines	1 No.
9	Steam Boiler with turbine setup	1 No.

S.No.	**NAME OF THE EQUIPMENT**	**Qty.**
1	Guarded plate apparatus	1 No.
2	Lagged pipe apparatus	1 No.
3	Natural convection-vertical cylinder apparatus	1 No.
4	Forced convection inside tube apparatus	1 No.
5	Composite wall apparatus	1 No.
6	Thermal conductivity of insulating powder apparatus	1 No.
7	Pin-fin apparatus	1 No.
8	Stefan-Boltzmann apparatus	1 No.
9	Emissivity measurement apparatus	1 No.
10	Parallel/counter flow heat exchanger apparatus	1 No.
11	Single/two stage reciprocating air compressor	1 No.
12	Refrigeration test rig	1 No.
13	Air-conditioning test rig	1 No.

19154L58	METROLOGY AND MEASUREMENTS LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVE:

- To familiar with different measurement equipments and use of this industry for quality inspection.

LIST OF EXPERIMENTS

1. Calibration and use of measuring instruments – Vernier caliper, micrometer, Vernier height gauge – using gauge blocks
2. Calibration and use of measuring instruments – depth micrometer, bore gauge, telescopic gauge
3. Measurement of linear dimensions using Comparators
4. Measurement of angles using bevel protractor and sine bar
5. Measurement of screw thread parameters – Screw thread Micrometers and Three wire method '(floating carriage micrometer)
6. Measurement of gear parameters – disc micrometers, gear tooth vernier caliper
7. Measurement of features in a prismatic component using Coordinate Measuring Machine (CMM)
8. Programming of CNC Coordinate Measuring Machines for repeated measurements of identical components
9. Non-contact (Optical) measurement using Toolmaker's microscope / Profile projector and Video measurement system
10. Measurement of Surface finish in components manufactured using various processes (turning, milling, grinding, etc.,) using stylus based instruments.
11. Machine tool metrology – Level tests using precision level; Testing of straightness of a machine tool guide way using Autocollimator, spindle tests.
12. Measurement of force, torque and temperature

TOTAL: 45 PERIODS

OUTCOMES

Upon the completion of this course the students will be able to

CO1 Measure the gear tooth dimensions, angle using sine bar, straightness and flatness, thread parameters, temperature using thermocouple, force, displacement, torque and vibration.

CO2 Calibrate the vernier, micrometer and slip gauges and setting up the comparator for the inspection.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Micrometer	5
2	Vernier Caliper	5
3	Vernier Height Gauge	2
4	Vernier depth Gauge	2
5	Slip Gauge Set	1
6	Gear Tooth Vernier	1
7	Sine Bar	1
8	Floating Carriage Micrometer	1
9	Profile Projector / Tool Makers Microscope	1
10	Parallel / counter flow heat exchanger apparatus	1
11	Mechanical / Electrical / Pneumatic Comparator	1
12	Autocollimator	1
13	Temperature Measuring Setup	1

14	Force Measuring Setup	1
15	Torque Measuring Setup	1
16	Coordinate measuring machine	1
17	Surface finish measuring equipment	1
18	Bore gauge	1
19	Telescope gauge	1

19154C61 **DESIGN OF TRANSMISSION SYSTEMS**

L	T	P	C
3	2	0	4

OBJECTIVES:

- To gain knowledge on the principles and procedure for the design of Mechanical power Transmission components.
- To understand the standard procedure available for Design of Transmission of Mechanical elements
- To learn to use standard data and catalogues (Use of P S G Design Data Book permitted)

UNIT I DESIGN OF FLEXIBLE ELEMENTS 9+6

Design of Flat belts and pulleys - Selection of V belts and pulleys – Selection of hoisting wire ropes and pulleys – Design of Transmission chains and Sprockets.

UNIT II SPUR GEARS AND PARALLEL AXIS HELICAL GEARS 9+6

Speed ratios and number of teeth-Force analysis -Tooth stresses - Dynamic effects – Fatigue strength - Factor of safety - Gear materials – Design of straight tooth spur & helical gears based on strength and wear considerations – Pressure angle in the normal and transverse plane-Equivalent number of teeth-forces for helical gears.

UNIT III BEVEL, WORM AND CROSS HELICAL GEARS 9+6

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears. Worm Gear: Merits and demerits-terminology. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the worm gear pair. Cross helical: Terminology-helix angles-Estimating the size of the pair of cross helical gears.

UNIT IV GEAR BOXES 9+6

Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box - Design of multi speed gear box for machine tool applications - Constant mesh gear box - Speed reducer unit. – Variable speed gear box, Fluid Couplings, Torque Converters for automotive applications.

UNIT V CAMS, CLUTCHES AND BRAKES 9+6

Cam Design: Types-pressure angle and under cutting base circle determination-forces and surface stresses. Design of plate clutches –axial clutches-cone clutches-internal expanding rim clutches-Electromagnetic clutches. Band and Block brakes - external shoe brakes – Internal expanding shoe brake.

TOTAL : 45+30=75 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 apply the concepts of design to belts, chains and rope drives.
CO2 apply the concepts of design to spur, helical gears.
CO3 apply the concepts of design to worm and bevel gears.
CO4 apply the concepts of design to gear boxes .
CO5 apply the concepts of design to cams, brakes and clutches

TEXT BOOKS:

1. Bhandari V, "Design of Machine Elements", 4th Edition, Tata McGraw-Hill Book Co, 2016.

2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 8^{th} Edition, Tata McGraw-Hill, 2008.

REFERENCES:

1. Merhyle F. Spotts, Terry E. Shoup and Lee E. Hornberger, "Design of Machine Elements" 8^{th} Edition, Printice Hall, 2003.
2. Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.
3. Prabhu. T.J., "Design of Transmission Elements", Mani Offset, Chennai, 2000.
4. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine Design", 4^{th} Edition, Wiley, 2005
5. Sundararajamoorthy T. V, Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.

19154C62 **COMPUTER AIDED DESIGN AND MANUFACTURING** **L T P C**

3 2 0 4

OBJECTIVES:

- To provide an overview of how computers are being used in mechanical component design
- To understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.

UNIT I INTRODUCTION 9+6

Product cycle- Design process- sequential and concurrent engineering- Computer aided design – CAD system architecture- Computer graphics – co-ordinate systems- 2D and 3D transformations-homogeneous coordinates - Line drawing -Clipping- viewing transformation-Brief introduction to CAD and CAM – Manufacturing Planning, Manufacturing control- Introduction to CAD/CAM – CAD/CAM concepts —Types of production - Manufacturing models and Metrics – Mathematical models of Production Performance

UNIT II GEOMETRIC MODELING 9+6

Representation of curves- Hermite curve- Bezier curve- B-spline curves-rational curves-Techniques for surface modeling – surface patch- Coons and bicubic patches- Bezier and B-spline surfaces. Solid modeling techniques- CSG andB-rep

UNIT III CAD STANDARDS 9+6

Standards for computer graphics- Graphical Kernel System (GKS) - standards for exchange images- Open Graphics Library (OpenGL) - Data exchange standards - IGES, STEP, CALS etc. - communication standards.

UNIT IV FUNDAMENTAL OF CNC AND PART PROGRAMING 9+6

Introduction to NC systems and CNC - Machine axis and Co-ordinate system- CNC machine tools-Principle of operation CNC- Construction features including structure- Drives and CNC controllers- 2D and 3D machining on CNC- Introduction of Part Programming, types - Detailed Manual part programming on Lathe & Milling machines using G codes and M codes- Cutting Cycles, Loops, Sub program and Macros- Introduction of CAM package.

UNIT V CELLULAR MANUFACTURING AND FLEXIBLE MANUFACTURING SYSTEM (FMS) 9+6

Group Technology(GT),Part Families–Parts Classification and coding–Simple Problems in Opitz Part Coding system–Production flow Analysis–Cellular Manufacturing–Composite part concept–Types of Flexibility - FMS – FMS Components – FMS Application & Benefits – FMS Planning and Control– Quantitative analysis in FMS

TOTAL : 45+30=75 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1	Explain the 2D and 3D transformations, clipping algorithm, Manufacturing models and Metrics
CO2	Explain the fundamentals of parametric curves, surfaces and Solids
CO3	Summarize the different types of Standard systems used in CAD
CO4	Apply NC & CNC programming concepts to develop part programme for Lathe & Milling Machines
CO5	Summarize the different types of techniques used in Cellular Manufacturing and FMS

TEXT BOOKS:

1. Ibrahim Zeid “Mastering CAD CAM” Tata McGraw-Hill PublishingCo.2007
2. Mikell.P.Groover “Automation, Production Systems and Computer Integrated Manufacturing”, Prentice Hall of India, 2008.
3. Radhakrishnan P, SubramanyanS.andRaju V., “CAD/CAM/CIM”, 2nd Edition, New Age International (P) Ltd, New Delhi,2000.

REFERENCES:

1. Chris McMahon and Jimmie Browne “CAD/CAM Principles", "Practice and Manufacturing management “ Second Edition, Pearson Education, 1999.
2. Donald Hearn and M. Pauline Baker “Computer Graphics”’. Prentice Hall, Inc,1992.
3. Foley, Wan Dam, Feiner and Hughes - "Computer graphics principles & practice" Pearson Education -2003
4. William M Neumann and Robert F.Sproul “Principles of Computer Graphics”, McGraw Hill Book Co. Singapore, 1989.

19154C64 **FINITE ELEMENT ANALYSIS**

L	T	P	C
3	2	0	4

OBJECTIVES:

- To introduce the concepts of Mathematical Modeling of Engineering Problems.
- To appreciate the use of FEM to a range of Engineering Problems.

UNIT I INTRODUCTION 9+6

Historical Background – Mathematical Modeling of field problems in Engineering – Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems– Weighted Residual Methods – Variational Formulation of Boundary Value Problems – Ritz Technique – Basic concepts of the Finite Element Method.

UNIT II ONE-DIMENSIONAL PROBLEMS 9+6

One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher order Elements – Derivation of Shape functions and Stiffness matrices and force vectors- Assembly of Matrices - Solution of problems from solid mechanics and heat transfer. Longitudinal vibration frequencies and mode shapes. Fourth Order Beam Equation –Transverse deflections and Natural frequencies of beams.

UNIT III TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS 9+6

Second Order 2D Equations involving Scalar Variable Functions – Variational formulation –Finite Element formulation – Triangular elements – Shape functions and element matrices and vectors. Application to Field Problems - Thermal problems – Torsion of Non circular shafts –Quadrilateral elements – Higher Order Elements.

UNIT IV TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS 9+6

Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Body forces and temperature effects – Stress calculations - Plate and shell elements.

UNIT V ISOPARAMETRIC FORMULATION 9+6

Natural co-ordinate systems – Isoparametric elements – Shape functions for iso parametric elements – One and two dimensions – Serendipity elements – Numerical integration and application to plane stress problems - Matrix solution techniques – Solutions Techniques to Dynamic problems – Introduction to Analysis Software.

TOTAL : 45+30=75 PERIODS

OUTCOMES

CO1 Summarize the basics of finite element formulation.
CO2 Apply finite element formulations to solve one dimensional Problems.
CO3 Apply finite element formulations to solve two dimensional scalar Problems.
CO4 Apply finite element method to solve two dimensional Vector problems.
CO5 Apply finite element method to solve problems on iso parametric element and dynamic Problems.

TEXT BOOKS:

1. Reddy. J.N., "An Introduction to the Finite Element Method", 3rd Edition, Tata McGraw-Hill, 2005
2. Seshu, P, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., New Delhi, 2007.

REFERENCES:

1. Bhatti Asghar M, "Fundamental Finite Element Analysis and Applications", John Wiley & Sons, 2005 (Indian Reprint 2013)*
2. Chandrupatla & Belagundu, "Introduction to Finite Elements in Engineering", 3rd Edition, Prentice Hall College Div, 1990
3. Logan, D.L., "A first course in Finite Element Method", Thomson Asia Pvt. Ltd., 2002
4. Rao, S.S., "The Finite Element Method in Engineering", 3rd Edition, Butterworth Heinemann, 2004
5. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, "Concepts and Applications of Finite Element Analysis", 4th Edition, Wiley Student Edition, 2002.

19154C65 **HYDRAULICS AND PNEUMATICS**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide student with knowledge on the application of fluid power in process, construction and manufacturing Industries.
- To provide students with an understanding of the fluids and components utilized in modern industrial fluid power system.
- To develop a measurable degree of competence in the design, construction and operation of fluid power circuits.

UNIT I FLUID POWER PRINICIPLES AND HYDRAULIC PUMPS 9

Introduction to Fluid power – Advantages and Applications – Fluid power systems – Types offluids - Properties of fluids and selection – Basics of Hydraulics – Pascal's Law – Principles of flow - Friction loss – Work, Power and Torque Problems, Sources of Hydraulic power : Pumping Theory – Pump Classification – Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criteria of Linear and Rotary – Fixed and Variable displacement pumps – Problems.

UNIT II HYDRAULIC ACTUATORS AND CONTROL COMPONENTS 9

Hydraulic Actuators: Cylinders – Types and construction, Application, Hydraulic cushioning – Hydraulic motors - Control Components : Direction Control, Flow control and pressure control valves – Types, Construction and Operation – Servo and Proportional valves – Applications – Accessories : Reservoirs, Pressure Switches – Applications – Fluid Power ANSI Symbols – Problems.

UNIT III HYDRAULIC CIRCUITS AND SYSTEMS 9

Accumulators, Intensifiers, Industrial hydraulic circuits – Regenerative, Pump Unloading, Double-Pump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-Safe, Speed Control, Hydrostatic transmission, Electro hydraulic circuits, Mechanical hydraulic servo systems.

UNIT IV PNEUMATIC AND ELECTRO PNEUMATIC SYSTEMS 9

Properties of air – Perfect Gas Laws – Compressor – Filters, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust Valves, Pneumatic actuators, Design of Pneumatic circuit – Cascade method – Electro Pneumatic System – Elements – Ladder diagram – Problems, Introduction to fluidics and pneumatic logic circuits.

UNIT V TROUBLE SHOOTING AND APPLICATIONS 9

Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic systems, Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and Forklift applications. Design of Pneumatic circuits for Pick and Place applications and tool handling in CNC Machine tools – Low cost Automation – Hydraulic and Pneumatic power packs.

TOTAL:45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Explain the Fluid power and operation of different types of pumps.

CO2 Summarize the features and functions of Hydraulic motors, actuators and Flow control valves

CO3 Explain the different types of Hydraulic circuits and systems

CO4 Explain the working of different pneumatic circuits and systems

CO5 Summarize the various trouble shooting methods and applications of hydraulic and pneumatic systems.

TEXT BOOKS:

1. Anthony Esposito, "Fluid Power with Applications", Pearson Education 2005.
2. Majumdar S.R., "Oil Hydraulics Systems- Principles and Maintenance", Tata McGraw-Hill, 2001.

REFERENCES:

1. Anthony Lal, "Oil hydraulics in the service of industry", Allied publishers, 1982.
2. Dudelyt, A. Pease and John T. Pippenger, "Basic Fluid Power", Prentice Hall, 1987.
3. Majumdar S.R., "Pneumatic systems – Principles and maintenance", Tata McGraw Hill, 1995
4. Michael J, Prinches and Ashby J. G, "Power Hydraulics", Prentice Hall, 1989.
5. Shanmugasundaram.K, "Hydraulic and Pneumatic controls", Chand & Co, 2006.

19154L67	CAD / CAM LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES:

- To gain practical experience in handling 2D drafting and 3D modelling software systems.
- To study the features of CNC Machine Tool.
- To expose students to modern control systems (Fanuc, Siemens etc.,)
- To know the application of various CNC machines like CNC lathe, CNC Vertical Machining centre, CNC EDM and CNC wire-cut and studying of Rapid prototyping.

LIST OF EXPERIMENTS

1. 3D GEOMETRIC MODELLING **23 PERIODS**

List of Experiments

1. Introduction of 3D Modelling software

Creation of 3D assembly model of following machine elements using 3D Modelling software

2. Flange Coupling
3. Plummer Block
4. Screw Jack
5. Lathe Tailstock
6. Universal Joint
7. Machine Vice
8. Stuffing box
9. Crosshead
10. Safety Valves
11. Non-return valves
12. Connecting rod
13. Piston
14. Crankshaft

* Students may also be trained in manual drawing of some of the above components

2. Manual Part Programming. **22 PERIODS**

(i) Part Programming - CNC Machining Centre a) Linear Cutting.
b) Circular cutting.
c) Cutter Radius Compensation. d) Canned Cycle Operations.
(ii) Part Programming - CNC Turning Centre a) Straight, Taper and Radius Turning.
b) Thread Cutting.
c) Rough and Finish Turning Cycle. d) Drilling and Tapping Cycle.

3. Computer Aided Part Programming

e) CL Data and Post process generation using CAM packages.
f) Application of CAPP in Machining and Turning Centre.

TOTAL: 45 PERIODS

OUTCOMES

CO1 Draw 3D and Assembly drawing using CAD software
CO2 Demonstrate manual part programming with G and M codes using CAM

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	Description of Equipment	Qty
HARDWARE		
1.	Computer Server	1
2.	Computer nodes or systems (High end CPU with atleast 1 GB main memory) networked to the server	30
3.	A3 size plotter	1
4.	Laser Printer	1
5.	CNC Lathe	1
6.	CNC milling machine	1
SOFTWARE		
7.	Any High end integrated modeling and manufacturing CAD / CAM software	15 licenses
8.	CAM Software for machining centre and turning centre (CNC Programming and tool path simulation for FANUC / Sinumeric and Heidenhain controller)	15 licenses
9.	Licensed operating system	Adequate
10.	Support for CAPP	Adequate

19154L68 **DESIGN AND FABRICATION PROJECT**

L	T	P	C
0	0	3	2

OBJECTIVE:

- The main objective is to give an opportunity to the student to get hands on training in the fabrication of one or more components of a complete working model, which is designed by them.

GUIDELINE FOR REVIEW AND EVALUATION

The students may be grouped into 2 to 4 and work under a project supervisor. The device/ system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL : 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 design and Fabricate the machine element or the mechanical product.

CO2 demonstrate the working model of the machine element or the mechanical product.

19154L69 **PROFESSIONAL COMMUNICATION**

L	T	P	C
0	0	2	1

OBJECTIVES: The course aims to:

- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employable Graduates
- Develop their confidence and help them attend interviews successfully.

UNIT I

Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs

UNIT II

Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice–– presenting the visuals effectively – 5 minute presentations

UNIT III

Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic -– questioning and clarifying –GD strategies- activities to improve GD skills

UNIT IV

Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews

UNIT V

Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long- term career plan-making career changes

TOTAL : 30 PERIODS

OUTCOMES: At the end of the course Learners will be able to:

- Make effective presentations
- Participate confidently in Group Discussions.
- Attend job interviews and be successful in them.
- Develop adequate Soft Skills required for the workplace

Recommended Software

1. Globearena
2.Win English

REFERENCES:

1. Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015
3. Interact English Lab Manual for Undergraduate Students,. OrientBalckSwan: Hyderabad, 2016.
4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
5. S. Hariharanetal. Soft Skills. MJP Publishers: Chennai, 2010.

19154C71 **POWER PLANT ENGINEERING**

L	T	P	C
4	0	0	4

OBJECTIVE:

- Providing an overview of Power Plants and detailing the role of Mechanical Engineers in their operation and maintenance.

UNIT I COAL BASED THERMAL POWER PLANTS 15

Rankine cycle - improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.

UNIT II DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS 15

Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimisation. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.

UNIT III NUCLEAR POWER PLANTS 15

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : Boili*ng Water Reactor* (BWR), P*ressurized Water Reactor* (PWR), CANada Deuterium- Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

UNIT IV POWER FROM RENEWABLE ENERGY 15

Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, *Solar* Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.

UNIT V ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS 15

Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

TOTAL : 60 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Explain the layout, construction and working of the components inside a thermal power plant.

CO2 Explain the layout, construction and working of the components inside a Diesel, Gas and Combined cycle power plants.

CO3 Explain the layout, construction and working of the components inside nuclear power plants.

CO4 Explain the layout, construction and working of the components inside Renewable energy power plants.

CO5 Explain the applications of power plants while extend their knowledge to power plant economics and environmental hazards and estimate the costs of electrical energy production.

TEXT BOOK:

1. Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008.

REFERENCES:

1. El-Wakil. M.M., "Power Plant Technology", Tata McGraw – Hill Publishing Company Ltd., 2010.
2. Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.
3. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, "Power Plant Engineering", Second Edition, Standard Handbook of McGraw – Hill, 1998.

19154C72	PROCESS PLANNING AND COST ESTIMATION	L	T	P	C
		3	2	0	4

OBJECTIVE:

- To introduce the process planning concepts to make cost estimation for various products after process planning

UNIT I INTRODUCTION TO PROCESS PLANNING 9+6

Introduction- methods of process planning-Drawing interpretation-Material evaluation – steps in process selection-.Production equipment and tooling selection

UNIT II PROCESS PLANNING ACTIVITIES 9+6

Process parameters calculation for various production processes-Selection jigs and fixtures election of quality assurance methods - Set of documents for process planning-Economics of process planning- case studies

UNIT III INTRODUCTION TO COST ESTIMATION 9+6

Importance of costing and estimation –methods of costing-elements of cost estimation –Types of estimates – Estimating procedure- Estimation labor cost, material cost- allocation of over head charges- Calculation of depreciation cost

UNIT IV PRODUCTION COST ESTIMATION 9+6

Estimation of Different Types of Jobs - Estimation of Forging Shop, Estimation of Welding Shop, Estimation of Foundry Shop

UNIT V MACHINING TIME CALCULATION 9+6

Estimation of Machining Time - Importance of Machine Time Calculation- Calculation of Machining Time for Different Lathe Operations ,Drilling and Boring - Machining Time Calculation for Milling, Shaping and Planning -Machining Time Calculation for Grinding.

TOTAL: 45+30=75 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 select the process, equipment and tools for various industrial products.
CO2 prepare process planning activity chart.
CO3 explain the concept of cost estimation.
CO4 compute the job order cost for different type of shop floor.
CO5 calculate the machining time for various machining operations.

TEXT BOOKS:

1. Peter scalon, “Process planning, Design/Manufacture Interface”, Elsevier science technology Books, Dec 2002.
2. Sinha B.P, “Mechanical Estimating and Costing”, Tata-McGraw Hill publishing co, 1995.

REFERENCES:

1. Chitale A.V. and Gupta R.C., “Product Design and Manufacturing”, 2nd Edition, PHI, 2002.
2. Ostwalal P.F. and Munez J., “Manufacturing Processes and systems”, 9th Edition, John Wiley, 1998.
3. Russell R.S and Tailor B.W, “Operations Management”, 4th Edition, PHI, 2003.
4. Mikell P. Groover, “Automation, Production, Systems and Computer Integrated Manufacturing”, Pearson Education 2001.
5. K.C. Jain & L.N. Aggarwal, “Production Planning Control and Industrial Management”, Khanna Publishers 1990.

19154C73	MECHATRONICS	L	T	P	C
		4	0	0	4

OBJECTIVE:

- To impart knowledge about the elements and techniques involved in Mechatronics systems which are very much essential to understand the emerging field of automation.

UNIT I INTRODUCTION 12

Introduction to Mechatronics – Systems – Concepts of Mechatronics approach – Need for Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics. Sensors and Transducers**:** Static and dynamic Characteristics of Sensor, Potentiometers – LVDT – Capacitance sensors – Strain gauges – Eddy current sensor – Hall effect sensor – Temperature sensors – Light sensors

UNIT II MICROPROCESSOR AND MICROCONTROLLER 9+6

Introduction – Architecture of 8085 – Pin Configuration – Addressing Modes –Instruction set, Timing diagram of 8085 – Concepts of 8051 microcontroller – Block diagram,.

UNIT III PROGRAMMABLE PERIPHERAL INTERFACE 9+6

Introduction – Architecture of 8255, Keyboard interfacing, LED display –interfacing, ADC and DAC interface, Temperature Control – Stepper Motor Control – Traffic Control interface.

UNIT IV PROGRAMMABLE LOGIC CONTROLLER 9+6

Introduction – Basic structure – Input and output processing – Programming – Mnemonics – Timers, counters and internal relays – Data handling – Selection of PLC.

UNIT V ACTUATORS AND MECHATRONIC SYSTEM DESIGN 9+6

Types of Stepper and Servo motors – Construction – Working Principle – Advantages and Disadvantages. Design process-stages of design process – Traditional and Mechatronics design concepts – Case studies of Mechatronics systems – Pick and place Robot – Engine Management system – Automatic car park barrier.

TOTAL : 45+30=75 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Discuss the interdisciplinary applications of Electronics, Electrical, Mechanical and Computer Systems for the Control of Mechanical, Electronic Systems and sensor technology.

CO2 Discuss the architecture of Microprocessor and Microcontroller, Pin Diagram, Addressing Modes of Microprocessor and Microcontroller.

CO3 Discuss Programmable Peripheral Interface, Architecture of 8255 PPI, and various device Interfacing

CO4 Explain the architecture, programming and application of programmable logic controllers to problems and challenges in the areas of Mechatronic engineering.

CO5 Discuss various Actuators and Mechatronics system using the knowledge and skills acquired through the course and also from the given case studies

TEXT BOOKS:

1. Bolton, “Mechatronics”, Prentice Hall, 2008
2. Ramesh S Gaonkar, “Microprocessor Architecture, Programming, and Applications with the 8085”, 5th Edition, Prentice Hall, 2008.

REFERENCES:

1. Bradley D.A, Dawson D, Buru N.C and Loader A.J, "Mechatronics", Chapman and Hall, 1993.
2. Clarence W, de Silva, "Mechatronics" CRC Press, First Indian Re-print, 2013
3. Devadas Shetty and Richard A. Kolk, "Mechatronics Systems Design", PWS publishing company, 2007.
4. Krishna Kant, "Microprocessors & Microcontrollers", Prentice Hall of India, 2007.
5. Michael B.Histand and Davis G.Alciatore, "Introduction to Mechatronics and Measurement systems", McGraw Hill International edition, 2007.

19154L77	SIMULATION AND ANALYSIS LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES:

- To give exposure to software tools needed to analyze engineering problems.
- To expose the students to different applications of simulation and analysis tools.

LIST OF EXPERIMENTS A. SIMULATION

1. MATLAB basics, Dealing with matrices, Graphing-Functions of one variable and two variables
2. Use of Matlab to solve simple problems in vibration
3. Mechanism Simulation using Multibody Dynamic software

B. ANALYSIS

1. Force and Stress analysis using link elements in Trusses, cables etc.
2. Stress and deflection analysis in beams with different support conditions.
3. Stress analysis of flat plates and simple shells.
4. Stress analysis of axi – symmetric components.
5. Thermal stress and heat transfer analysis of plates.
6. Thermal stress analysis of cylindrical shells.
7. Vibration analysis of spring-mass systems.
8. Model analysis of Beams.
9. Harmonic, transient and spectrum analysis of simple systems.

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 simulate the working principle of air conditioning system, hydraulic and pneumatic cylinder and cam follower mechanisms using MATLAB.

CO2 analyze the stresses and strains induced in plates, brackets and beams and heat transfer problems.

CO3 calculate the natural frequency and mode shape analysis of 2D components and beams.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. NO.	NAME OF THE EQUIPMENT	Qty.
1	Computer Work Station	15
2	Color Desk Jet Printer	01
3	Multibody Dynamic Software Suitable for Mechanism simulation and analysis	15 licenses
4	C / MATLAB	5 licenses

19154L78 **MECHATRONICS LABORATORY**

L	T	P	C
0	0	3	2

OBJECTIVE:

- To know the method of programming the microprocessor and also the design, modeling & analysis of basic electrical, hydraulic & pneumatic Systems which enable the students to understand the concept of mechatronics.

LIST OF EXPERIMENTS:

1. Assembly language programming of 8085 – Addition – Subtraction – Multiplication – Division – Sorting – Code Conversion.
2. Stepper motor interface.
3. Traffic light interface.
4. Speed control of DC motor.
5. Study of various types of transducers.
6. Study of hydraulic, pneumatic and electro-pneumatic circuits.
7. Modelling and analysis of basic hydraulic, pneumatic and electrical circuits using Software.
8. Study of PLC and its applications.
9. Study of image processing technique.

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Demonstrate the functioning of mechatronics system with various pneumatic, hydraulic and electrical systems.

CO2 Demonstrate the functioning of control systems with the help of PLC and microcontrollers.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl. No.	NAME OF THE EQUIPMENT	Qty.
1	Basic Pneumatic Trainer Kit with manual and electrical controls/ PLC Control each	1 No.
2	Basic Hydraulic Trainer Kit	1 No
3	Hydraulics and Pneumatics Systems Simulation Software	10 No
4	8051 - Microcontroller kit with stepper motor and drive circuit sets	2 No
5	Image processing system with hardware & software	1 No.

19154L79 **TECHNICALSEMINAR** **L T P C**

0 0 2 1

To enrich the communication skills of the student and presentations of technical topics of interest, this course is introduced. In this course, a student has to present three Technical papers or recent advances in engineering/technology that will be evaluated by a Committee constituted by the Head of the Department.

TOTAL: 30 PERIODS

19154C81 **PRINCIPLES OF MANAGEMENT**

L	T	P	C
3	0	0	3

OBJECTIVE:

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

UNIT II PLANNING 9

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT III ORGANISING 9

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

UNIT IV DIRECTING 9

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

UNIT V CONTROLLING 9

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

TOTAL: 45 PERIODS

OUTCOME:

- Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

TEXT BOOKS:

1. JAF Stoner, Freeman R.E and Daniel R Gilbert “Management”, 6th Edition, Pearson Education, 2004.
2. Stephen P. Robbins & Mary Coulter, “Management”, Prentice Hall (India)Pvt. Ltd., Edition, 10th 2009.

REFERENCES:

1. Harold Koontz & Heinz Weihrich, “Essentials of Management”, Tata McGraw Hill, 1998.
2. Robert Kreitner & Mamata Mohapatra, “Management”, Biztantra, 2008.

3. Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management", 7th Edition, Pearson Education, 2011.
4. Tripathy PC & Reddy PN, "Principles of Management", Tata Mcgraw Hill, 1999
5.

ELECTIVE – I (VI SEMESTER)

19154E66A **AUTOMOBILE ENGINEERING**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the construction and working principle of various parts of an automobile.
- To have the practice for assembling and dismantling of engine parts and transmission system

UNIT I VEHICLE STRUCTURE AND ENGINES **9**

Types of automobiles vehicle construction and different layouts, chassis, frame and body, Vehicle aerodynamics (various resistances and moments involved), IC engines –components-functions and materials, variable valve timing (VVT).

UNIT II ENGINE AUXILIARY SYSTEMS **9**

Electronically controlled gasoline injection system for SI engines, Electronically controlled diesel injection system (Unit injector system, Rotary distributor type and common rail direct injection system), Electronic ignition system (Transistorized coil ignition system, capacitive discharge ignition system), Turbo chargers (WGT, VGT), Engine emission control by three way catalytic converter system, Emission norms (Euro and BS).

UNIT III TRANSMISSION SYSTEMS **9**

Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints, Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.

UNIT IV STEERING, BRAKES AND SUSPENSION SYSTEMS **9**

Steering geometry and types of steering gear box- Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock Braking System (ABS), electronic brake force distribution (EBD) and Traction Control.

UNIT V ALTERNATIVE ENERGY SOURCES **9**

Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles- Engine modifications required –Performance, Combustion and Emission Characteristics of SI and CI engines with these alternate fuels - Electric and Hybrid Vehicles, Fuel Cell Note: Practical Training in dismantling and assembling of Engine parts and Transmission Systems should be given to the students.

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 recognize the various parts of the automobile and their functions and materials.
CO2 discuss the engine auxiliary systems and engine emission control.
CO3 distinguish the working of different types of transmission systems.
CO4 explain the Steering, Brakes and Suspension Systems.
CO5 predict possible alternate sources of energy for IC Engines.

TEXT BOOKS:

1. Jain K.K. and Asthana .R.B, “Automobile Engineering” Tata McGraw Hill Publishers, New Delhi, 2002.
2. Kirpal Singh, “Automobile Engineering”, Vol 1 & 2, Seventh Edition, Standard Publishers, New Delhi, 13th Edition 2014..

REFERENCES:

1. Ganesan V. “Internal Combustion Engines”, Third Edition, Tata McGraw-Hill, 2012.
2. Heinz Heisler, “Advanced Engine Technology,” SAE International Publications USA, 1998.
3. Joseph Heitner, “Automotive Mechanics,” Second Edition, East-West Press, 1999.
4. Martin W, Stockel and Martin T Stockle , “Automotive Mechanics Fundamentals,” The Good heart - Will Cox Company Inc, USA ,1978.
5. Newton ,Steeds and Garet, “Motor Vehicles”, Butterworth Publishers,1989.

19154E66B SAFETY IN ENGINEERING INDUSTIRES

L	T	P	C
3	0	0	3

OBJECTIVE

To promote safety in engineering industries for educating the employees and enforcing various labour legislation in order to eliminate the prevailing unsafe condition and correct the usage actions.

UNIT – I PRINCIPLES OF ACCIDENT PREVENTION 9

Accident Prevention – Causes and Cost of Accident – Laws and regulations – Indian Factories Act governing health and safety of workers.

UNIT – II MACHINE GUARDING 9

Machine guarding – need, basic requirements and benefits of machine guarding – types of guarding with applications.

UNIT – III

ELECTRICAL SAFETY

Electrical hazards – Shock protections methods – permit to work on electrical lines / installations – use of personal protective equipments.

UNIT – IV

SAFETY IN MATERIAL HANDLING

Material handling – manual and mechanical – material handling equipments – safe use and legal aspects.

UNIT – V

FIRE SAFETY

Fire – Extinguishing fire – Classification of fire – Types of fire extinguishers – Applications – Causes of fire.

REFERENCE:

1) National Safety council manual, Bombay
2) Factories Act 1948
3) Electrical Hazards – B. R. Kamath
4) Safety in the use of electricity, NSC, Bombay.

19154E66C **GAS DYNAMICS AND JET PROPULSION**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basic difference between incompressible and compressible flow.
- To understand the phenomenon of shock waves and its effect on flow. To gain some basic knowledge about jet propulsion and Rocket Propulsion.

(Use of Standard Gas Tables permitted)

UNIT I BASIC CONCEPTS AND ISENTROPIC FLOWS **9**

Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts – Nozzle and Diffusers

UNIT II FLOW THROUGH DUCTS **9**

Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties.

UNIT III NORMAL AND OBLIQUE SHOCKS **9**

Governing equations – Variation of flow parameters across the normal and oblique shocks – Prandtl – Meyer relations – Applications.

UNIT IV JET PROPULSION **9**

Theory of jet propulsion – Thrust equation – Thrust power and propulsive efficiency – Operating principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines.

UNIT V SPACE PROPULSION **9**

Types of rocket engines – Propellants-feeding systems – Ignition and combustion – Theory of rocket propulsion – Performance study – Staging – Terminal and characteristic velocity – Applications – space flights.

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Apply the concept of compressible flows in variable area ducts.
CO2 Apply the concept of compressible flows in constant area ducts.
CO3 examine the effect of compression and expansion waves in compressible flow.
CO4 use the concept of gas dynamics in Jet Propulsion.
CO5 apply the concept of gas dynamics in Space Propulsion.

TEXT BOOKS:

1. Anderson, J.D., "Modern Compressible flow", 3rd Edition, McGraw Hill, 2012.
2. Yahya, S.M. "Fundamentals of Compressible Flow", New Age International (P) Limited, New Delhi, 2002.

REFERENCES:

1. Cohen. H., G.E.C. Rogers and Saravanamutto, "Gas Turbine Theory", Longman Group Ltd.,1980
2. Ganesan. V., "Gas Turbines", Tata McGraw Hill Publishing Co., New Delhi, 2010.
3. Shapiro. A.H.," Dynamics and Thermodynamics of Compressible fluid Flow", John wiley, New York, 1953.
4. Sutton. G.P., "Rocket Propulsion Elements", John wiley, New York,2010,.
5. Zucrow. N.J., "Principles of Jet Propulsion and Gas Turbines", John Wiley, New York, 1970.

19154E66D **FUNDAMENTALS OF NANOSCIENCE** **L T P C**
3 0 0 3

OBJECTIVE:
To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION **8**
Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering- Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms- multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION **9**
Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS **12**
Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO_2,MgO, ZrO_2, NiO, nanoalumina, CaO, $AgTiO_2$, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications.

UNIT IV CHARACTERIZATION TECHNIQUES **9**
X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation.

UNIT V APPLICATIONS **7**
NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery.

TOTAL : 45 PERIODS

OUTCOMES:
- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS :

1. A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, “Nanoscale Characterization of surfaces & Interfaces”, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

REFERENCES:

1. G Timp, “Nanotechnology”, AIP press/Springer, 1999.
2. Akhlesh Lakhtakia, “The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations”. Prentice-Hall of India (P) Ltd, New Delhi, 2007.

19154E74A **RENEWABLE SOURCES OF ENERGY**

L	T	P	C
3	0	0	3

OBJECTIVE:

- At the end of the course, the students are expected to identify the new methodologies / technologies for effective utilization of renewable energy sources.

UNIT I INTRODUCTION **9**

World Energy Use – Reserves of Energy Resources – Environmental Aspects of Energy Utilisation – Renewable Energy Scenario in Tamil nadu, India and around the World – Potentials - Achievements / Applications – Economics of renewable energy systems.

UNIT II SOLAR ENERGY **9**

Solar Radiation – Measurements of Solar Radiation - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation - Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

UNIT III WIND ENERGY **9**

Wind Data and Energy Estimation – Types of Wind Energy Systems – Performance – Site Selection – Details of Wind Turbine Generator – Safety and Environmental Aspects

UNIT IV BIO - ENERGY **9**

Biomass direct combustion – Biomass gasifiers – Biogas plants – Digesters – Ethanol production – Bio diesel – Cogeneration - Biomass Applications

UNIT V OTHER RENEWABLE ENERGY SOURCES **9**

Tidal energy – Wave Energy – Open and Closed OTEC Cycles – Small Hydro-Geothermal Energy – Hydrogen and Storage - Fuel Cell Systems – Hybrid Systems.

TOTAL : 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Discuss the importance and Economics of renewable Energy
CO2 Discuss the method of power generation from Solar Energy
CO3 Discuss the method of power generation from Wind Energy
CO4 Explain the method of power generation from Bio Energy
CO5 Explain the Tidal energy, Wave Energy, OTEC, Hydro energy, Geothermal Energy, Fuel Cells and Hybrid Systems.

TEXT BOOKS:

1. Rai. G.D., "Non Conventional Energy Sources", Khanna Publishers, New Delhi, 2011.
2. Twidell, J.W. & Weir, A., "Renewable Energy Sources", EFN Spon Ltd., UK, 2006.

REFERENCES:

1. Chetan Singh Solanki, Solar Photovoltaics, "Fundamentals, Technologies and Applications", PHI Learning Private Limited, New Delhi, 2015.
2. David M. Mousdale – "Introduction to Biofuels", CRC Press, Taylor & Francis Group, USA 2017
3. Freris. L.L., "Wind Energy Conversion Systems", Prentice Hall, UK, 1990.
4. Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future", Oxford University Press, U.K., 2012.
5. Johnson Gary, L. "Wind Energy Systems", Prentice Hall, New York, 1985

19154E74B	NON CONVENTIONAL MACHINING PROCESSES	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To learn about various unconventional machining processes, the various process parameters and their influence on performance and their applications

UNIT I INTRODUCTION AND MECHANICAL ENERGY BASED PROCESSES 9

Unconventional machining Process – Need – classification – merits, demerits and applications. Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining - Ultrasonic Machining. (AJM, WJM, AWJM and USM). Working Principles – equipment used – Process parameters – MRR- Applications.

UNIT II THERMAL AND ELECTRICAL ENERGY BASED PROCESSES 9

Electric Discharge Machining (EDM) – Wire cut EDM – Working Principle-equipments-Process Parameters-Surface Finish and MRR- electrode / Tool – Power and control Circuits-Tool Wear – Dielectric – Flushing –– Applications. Laser Beam machining and drilling, (LBM), plasma, Arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques – Applications.

UNIT III CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES 9

Chemical machining and Electro-Chemical machining (CHM and ECM)- Etchants – Maskant - techniques of applying maskants - Process Parameters – Surface finish and MRR-Applications. Principles of ECM- equipments-Surface Roughness and MRR Electrical circuit-Process Parameters- ECG and ECH - Applications.

UNIT IV ADVANCED NANO FINISHING PROCESSES 9

Abrasive flow machining, chemo-mechanical polishing, magnetic abrasive finishing, magneto rheological finishing, magneto rheological abrasive flow finishing their working principles, equipments, effect of process parameters, applications, advantages and limitations.

UNIT V RECENT TRENDS IN NON-TRADITIONAL MACHINING PROCESSES 9

Recent developments in non-traditional machining processes, their working principles, equipments, effect of process parameters, applications, advantages and limitations. Comparison of non-traditional machining processes.

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Explain the need for unconventional machining processes and its classification

CO2 Compare various thermal energy and electrical energy based unconventional machining processes.

CO3 Summarize various chemical and electro-chemical energy based unconventional machining processes.

CO4 Explain various nano abrasives based unconventional machining processes.

CO5 Distinguish various recent trends based unconventional machining processes.

TEXT BOOKS:

1. Vijay.K. Jain “Advanced Machining Processes” Allied Publishers Pvt. Ltd., New Delhi, 2007
2. Pandey P.C. and Shan H.S. “Modern Machining Processes” Tata McGraw-Hill, New Delhi, 2007.

REFERENCES:

1. Benedict. G.F. “Nontraditional Manufacturing Processes”, Marcel Dekker Inc., New York, 1987.
2. Mc Geough, “Advanced Methods of Machining”, Chapman and Hall, London, 1998.
3. Paul De Garmo, J.T.Black, and Ronald. A.Kohser, “Material and Processes in Manufacturing” Prentice Hall of India Pvt. Ltd., 8thEdition, New Delhi , 2001.

19154E74C **OPERATIONS RESEARCH**

L	T	P	C
3	0	0	3

OBJECTIVE:

- To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

UNIT I LINEAR MODELS **15**

The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.

UNIT II TRANSPORTATION MODELS AND NETWORK MODELS **8**

Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route – Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks – Critical path scheduling – Sequencing models.

UNIT III INVENTORY MODELS **6**

Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

UNIT IV QUEUEING MODELS **6**

Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

UNIT V DECISION MODELS **10**

Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life – Economic life– Single / Multi variable search technique – Dynamic Programming – Simple Problem.

TOTAL: 45 PERIODS

OUTCOME:

- Upon completion of this course, the students can able to use the optimization techniques for use engineering and Business problems

TEXT BOOK:

1. Hillier and Libeberman, “Operations Research”, Holden Day, 2005
2. Taha H.A., “Operations Research”, Sixth Edition, Prentice Hall of India, 2003.

REFERENCES:

1. Bazara M.J., Jarvis and Sherali H., “Linear Programming and Network Flows”, John Wiley, 2009.
2. Budnick F.S., “Principles of Operations Research for Management”, Richard D Irwin, 1990.
3. Philip D.T. and Ravindran A., “Operations Research”, John Wiley, 1992.
4. Shennoy G.V. and Srivastava U.K., “Operation Research for Management”, Wiley Eastern, 1994.
5. Tulsian and Pasdey V., “Quantitative Techniques”, Pearson Asia, 2002.

19154E74D **TOTAL QUALITY MANAGEMENT** **L T P C 3 0 0 3**

OBJECTIVE:

- To facilitate the understanding of Quality Management principles and process.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention.

UNIT II TQM PRINCIPLES 9

Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS AND TECHNIQUES I 9

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV TQM TOOLS AND TECHNIQUES II 9

Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V QUALITY MANAGEMENT SYSTEM 9

Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation—Documentation—Internal Audits—Registration--**ENVIRONMENTAL MANAGEMENT SYSTEM:**

Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001—Benefits of EMS.

TOTAL: 45 PERIODS

OUTCOME:

- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

TEXT BOOK:

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Besterfield,Mary B.Sacre,Hemant Urdhwareshe and Rashmi Urdhwareshe, “Total Quality Management”, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8^{th} Edition, First Indian Edition, Cengage Learning, 2012.
2. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
3. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
4. ISO 9001-2015 standards

19154E76A	ROBOTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the functions of the basic components of a Robot.
- To study the use of various types of End of Effectors and Sensors
- To impart knowledge in Robot Kinematics and Programming
- To learn Robot safety issues and economics.

UNIT I FUNDAMENTALS OF ROBOT 9

Robot - Definition - Robot Anatomy - Co ordinate Systems, Work Envelope Types and Classification- Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load- Robot Parts and their Functions-Need for Robots-Different Applications.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS 9

Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT III SENSORS AND MACHINE VISION 9

Requirements of a sensor, Principles and Applications of the following types of sensors- Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors ,binary Sensors., Analog Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing Image Data- Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications- Inspection, Identification, Visual Serving and Navigation.

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING 9

Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems. Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs.

UNIT V IMPLEMENTATION AND ROBOT ECONOMICS 9

RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Explain the concepts of industrial robots, classification, specifications and coordinate systems. Also summarize the need and application of robots in different sectors.

CO2 Illustrate the different types of robot drive systems as well as robot end effectors.

CO3 Apply the different sensors and image processing techniques in robotics to improve the ability of robots.

CO4 Develop robotic programs for different tasks and familiarize with the kinematics motions of robot.

CO5 Examine the implementation of robots in various industrial sectors and interpolate the economic analysis of robots.

TEXT BOOKS:

1. Groover M.P., “Industrial Robotics -Technology Programming and Applications”, McGraw Hill, 2012.
2. Klafter R.D., Chmielewski T.A and Negin M., “Robotic Engineering - An Integrated Approach”,Prentice Hall, 2003.

REFERENCES:

1. Craig J.J., “Introduction to Robotics Mechanics and Control”, Pearson Education, 2008.
2. Deb S.R., “Robotics Technology and Flexible Automation” Tata McGraw Hill Book Co., 2013.
3. Fu.K.S.,Gonzalz R.C. and Lee C.S.G., “Robotics Control, Sensing, Vision and Intelligence”, McGraw Hill Book Co., 1987.
4. Janakiraman P.A., “Robotics and Image Processing”, Tata McGraw Hill, 1995.
5. Koren Y., “Robotics for Engineers", Mc Graw Hill Book Co., 1992.

19154E76B	DESIGN OF JIGS, FIXTURES AND PRESS TOOLS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the functions and design principles of Jigs, fixtures and press tools
- To gain proficiency in the development of required views of the final design.

UNIT I LOCATING AND CLAMPING PRINCIPLES: 9

Objectives of tool design- Function and advantages of Jigs and fixtures – Basic elements – principles of location – Locating methods and devices – Redundant Location – Principles of clamping – Mechanical actuation – pneumatic and hydraulic actuation Standard parts – Drill bushes and Jig buttons – Tolerances and materials used.

UNIT II JIGS AND FIXTURES 9

Design and development of jigs and fixtures for given component- Types of Jigs – Post, Turnover, Channel, latch, box, pot, angular post jigs – Indexing jigs – General principles of milling, Lathe, boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – Modular fixturing systems- Quick change fixtures.

UNIT III PRESS WORKING TERMINOLOGIES AND ELEMENTS OF CUTTING DIES 9

Press Working Terminologies - operations – Types of presses – press accessories – Computation of press capacity – Strip layout – Material Utilization – Shearing action – Clearances – Press Work Materials – Center of pressure- Design of various elements of dies – Die Block – Punch holder, Die set, guide plates – Stops – Strippers – Pilots – Selection of Standard parts – Design and preparation of four standard views of simple blanking, piercing, compound and progressive dies.

UNIT IV BENDING AND DRAWING DIES 9

Difference between bending and drawing – Blank development for above operations – Types of Bending dies – Press capacity – Spring back – knockouts – direct and indirect – pressure pads – Ejectors – Variables affecting Metal flow in drawing operations – draw die inserts – draw beads- ironing – Design and development of bending, forming, drawing, reverse redrawing and combination dies – Blank development for axisymmetric, rectangular and elliptic parts – Single and double action dies.

UNIT V FORMING TECHNIQUES AND EVALUATION 9

Bulging, Swaging, Embossing, coining, curling, hole flanging, shaving and sizing, assembly, fine Blanking dies – recent trends in tool design- computer Aids for sheet metal forming Analysis – basic introduction - tooling for numerically controlled machines- setup reduction for work holding – Single minute exchange of dies – Poka Yoke.

TOTAL: 45 PERIODS

Note: (Use of P S G Design Data Book is permitted in the University examination)

OUTCOMES:

Upon the completion of this course the students will be able to

CO1	Summarize the different methods of Locating Jigs and Fixtures and Clamping principles
CO2	Design and develop jigs and fixtures for given component
CO3	Discuss the press working terminologies and elements of cutting dies
CO4	Distinguish between Bending and Drawing dies.
CO5	Discuss the different types of forming techniques

TEXT BOOKS:

1. Joshi, P.H. “Jigs and Fixtures”, Second Edition, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2010.
2. Joshi P.H “Press tools - Design and Construction”, wheels publishing, 1996

REFERENCES:

1. ASTME Fundamentals of Tool Design Prentice Hall of India.
2. Design Data Hand Book, PSG College of Technology, Coimbatore.
3. Donaldson, Lecain and Goold “Tool Design”, 5th Edition, Tata McGraw Hill, 2017.
4. Hoffman “Jigs and Fixture Design”, Thomson Delmar Learning, Singapore, 2004.
5. Kempster, “Jigs and Fixture Design”, Third Edition, Hoddes and Stoughton, 1974.
6. Venkataraman. K., “Design of Jigs Fixtures & Press Tools”, Tata McGraw Hill, New Delhi, 2005.

19154E76C GENERAL ASPECTS OF ENERGY MANAGEMENT AND ENERGY AUDIT

L	T	P	C
3	0	0	3

UNIT 1: ENERGY SCENARIO

Introduction -Primary and Secondary Energy -Commercial Energy and Non commercial Energy-Renewable and Non Renewable Energy-Indian Energy Scenario-Energy Needs of Growing Economy-Long Term Energy Scenario for India-Energy Pricing in India-Energy Sector Reforms-Energy and Environment-Energy Security-Energy Conservation and its Importance-Energy Strategy for the Future.

UNIT II BASICS OF ENERGY AND ENERGY MANAGEMENT

Basics of energy: Definition-Various Forms of Energy-Electrical Energy Basics-Thermal Energy Basics-Units and Conversions.

Energy Management :Definition & Objectives of Energy Management -Energy Audit: Types and Methodology -Energy Audit Reporting Format -Understanding Energy Costs -Benchmarking and energy Performance -Matching Energy Usage to Requirement-Maximising System Efficiency -Fuel and Energy Substitution-Energy Audit Instruments.

UNIT III MATERIAL AND ENERGY BALANCE

Energy Balance: Basic Principles-The Sankey Diagram and its Use-Material Balances-Energy Balances-Method for Preparing Process Flow Chart-Facility as an Energy System How to Carryout Material and Energy (M & E) Balance. Case study.

UNIT IV PROJECT MANAGEMENT

Step in Project management-Project Definition and scope-Technical design-Financing-Contracting-Implementation-Project planning technique-Performance monitoring

UNIT V ENERGY MONITORING AND TARGETING

Energy monitoring: Definition-Elements of Monitoring & Targeting System-A Rationale for Monitoring, Targeting and Reporting -Data and Information Analysis –Relating-Energy Consumption and Production .

TEXT BOOK:

Guide book for National Certification Examination for Energy Management and Energy Auditors.

REFERENCES:

Energy Management Supply and Conservation, Butterworth Heinemann, 2002-Dr Clive Beggs
Energy Audit Report of National Productivity Council
Energy Management Hard Book, John Wiley and sons – Wayne C. Turner
www.bee-india.com

19154E76D **COMPOSITE MATERIALS**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the fundamentals of composite material strength and its mechanical behavior
- Understanding the analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.
- Thermo-mechanical behavior and study of residual stresses in Laminates during processing.
- Implementation of Classical Laminate Theory (CLT) to study and analysis for residual stresses in an isotropic layered structure such as electronic chips.

UNIT I INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS & MANUFACTURING 9

Definition –Need – General Characteristics, Applications. Fibers – Glass, Carbon, Ceramic and Aramid fibers. Matrices – Polymer, Graphite, Ceramic and Metal Matrices – Characteristics of fibers and matrices. Lamina Constitutive Equations: Lamina Assumptions – Macroscopic Viewpoint. Generalized Hooke's Law. Reduction to Homogeneous Orthotropic Lamina – Isotropic limit case, Orthotropic Stiffness matrix (Qij), Typical Commercial material properties, Rule of Mixtures. Generally Orthotropic Lamina –Transformation Matrix, Transformed Stiffness. Manufacturing: Bag Moulding Compression Moulding – Pultrusion – Filament Winding – Other Manufacturing Processes

UNIT II FLAT PLATE LAMINATE CONSTITUTE EQUATIONS 9

Definition of stress and Moment Resultants. Strain Displacement relations. Basic Assumptions of Laminated anisotropic plates. Laminate Constitutive Equations – Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates. Laminate Structural Moduli. Evaluation of Lamina Properties from Laminate Tests. Quasi-Isotropic Laminates. Determination of Lamina stresses within Laminates.

UNIT III LAMINA STRENGTH ANALYSIS 9

Introduction - Maximum Stress and Strain Criteria. Von-Misses Yield criterion for Isotropic Materials. Generalized Hill's Criterion for Anisotropic materials. Tsai-Hill's Failure Criterion for Composites. Tensor Polynomial (Tsai-Wu) Failure criterion. Prediction of laminate Failure

UNIT IV THERMAL ANALYSIS 9

Assumption of Constant C.T.E's. Modification of Hooke's Law. Modification of Laminate Constitutive Equations. Orthotropic Lamina C.T.E's. C.T.E's for special Laminate Configurations – Unidirectional, Off-axis, Symmetric Balanced Laminates, Zero C.T.E laminates, Thermally Quasi-Isotropic Laminates

UNIT V ANALYSIS OF LAMINATED FLAT PLATES 9

Equilibrium Equations of Motion. Energy Formulations. Static Bending Analysis. Buckling Analysis. Free Vibrations – Natural Frequencies

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Summarize the various types of Fibers, Equations and manufacturing methods for Composite materials

CO2 Derive Flat plate Laminate equations

CO3 Analyze Lamina strength

CO4 Analyze the thermal behavior of Composite laminates
CO5 Analyze Laminate flat plates

TEXT BOOKS:

1. Gibson, R.F., "Principles of Composite Material Mechanics", Second Edition, McGraw-Hill, CRC press in progress, 1994, -.
2. Hyer, M.W., “Stress Analysis of Fiber – Reinforced Composite Materials”, McGraw Hill, 1998

REFERENCES:

1. Agarwal, B.D., and Broutman L.J., “Analysis and Performance of Fiber Composites”, John Wiley and Sons, New York, 1990.
2. Halpin, J.C., “Primer on Composite Materials, Analysis”, Technomic Publishing Co., 1984.
3. Issac M. Daniel and Ori Ishai, “Engineering Mechanics of Composite Materials”, Oxford University Press-2006, First Indian Edition - 2007
4. Mallick, P.K., Fiber, ”Reinforced Composites: Materials, Manufacturing and Design”, Maneel Dekker Inc, 1993.
5. Mallick, P.K. and Newman, S., (edition), “Composite Materials Technology: Processes and Properties”, Hansen Publisher, Munish, 1990.

19154E82A	PRODUCTION PLANNING AND CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the various components and functions of production planning and control such as work study, product planning, process planning, production scheduling, Inventory Control.
- To know the recent trends like manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

UNIT I INTRODUCTION 9

Objectives and benefits of planning and control-Functions of production control-Types of production- job- batch and continuous-Product development and design-Marketing aspect - Functional aspects- Operational aspect-Durability and dependability aspect aesthetic aspect. Profit consideration- Standardization, Simplification & specialization- Break even analysis-Economics of a new design.

UNIT II WORK STUDY 9

Method study, basic procedure-Selection-Recording of process - Critical analysis, Development - Implementation - Micro motion and memo motion study – work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data - Predetermined motion time standards.

UNIT III PRODUCT PLANNING AND PROCESS PLANNING 9

Product planning-Extending the original product information-Value analysis-Problems in lack of product planning-Process planning and routing-Pre requisite information needed for process planning- Steps in process planning-Quantity determination in batch production-Machine capacity, balancing- Analysis of process capabilities in a multi product system.

UNIT IV PRODUCTION SCHEDULING 9

Production Control Systems-Loading and scheduling-Master Scheduling-Scheduling rules-Gantt charts-Perpetual loading-Basic scheduling problems - Line of balance – Flow production scheduling- Batch production scheduling-Product sequencing – Production Control systems- Periodic batch control-Material requirement planning kanban – Dispatching-Progress reporting and expediting- Manufacturing lead time-Techniques for aligning completion times and due dates.

UNIT V INVENTORY CONTROL AND RECENT TRENDS IN PPC 9

Inventory control-Purpose of holding stock-Effect of demand on inventories-Ordering procedures. Two bin system - Ordering cycle system-Determination of Economic order quantity and economic lot size- ABC analysis - Recorder procedure-Introduction to computer integrated production planning systems- elements of JUST IN TIME SYSTEMS-Fundamentals of MRP II and ERP.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to prepare production planning and control activities such as work study, product planning, production scheduling, Inventory Control.
- They can plan manufacturing requirements manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

TEXT BOOKS:

1. James. B. Dilworth, "Operations management – Design, Planning and Control for manufacturing and services" Mcgraw Hill International edition 1992.

2. Martand Telsang, “Industrial Engineering and Production Management”, First edition, S. Chand and Company, 2000.

REFERENCES:

1. Chary. S.N., “Theory and Problems in Production & Operations Management”, Tata McGraw Hill, 1995.
2. Elwood S.Buffa, and Rakesh K.Sarin, “Modern Production / Operations Management”, 8th Edition John Wiley and Sons, 2000.
3. Jain. K.C. & Aggarwal. L.N., “Production Planning Control and Industrial Management”, Khanna Publishers, 1990.
4. Kanishka Bedi, “Production and Operations management”, 2nd Edition, Oxford university press, 2007.
5. Melynk, Denzler, “ Operations management – A value driven approach” Irwin Mcgraw hill.
6. Norman Gaither, G. Frazier, “Operations Management” 9th Edition, Thomson learning IE, 2007
7. Samson Eilon, “Elements of Production Planning and Control”, Universal Book Corpn.1984
8. Upendra Kachru, “ Production and Operations Management – Text and cases” 1st Edition, Excel books 2007

		L	T	P	C
19154E82B	**COMPUTER INTEGRATED MANUFACTURING SYSTEMS**				
		3	**0**	**0**	**3**

OBJECTIVE:

- To understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.

UNIT I INTRODUCTION 9

Brief introduction to CAD and CAM – Manufacturing Planning, Manufacturing control- Introduction to CAD/CAM – Concurrent Engineering-CIM concepts – Computerised elements of CIM system – Types of production - Manufacturing models and Metrics – Mathematical models of Production Performance – Simple problems – Manufacturing Control – Simple Problems – Basic Elements of an Automated system – Levels of Automation – Lean Production and Just-In-Time Production.

UNIT II PRODUCTION PLANNING AND CONTROL AND COMPUTERISED PROCESS PLANNING 9

Process planning – Computer Aided Process Planning (CAPP) – Logical steps in Computer Aided Process Planning – Aggregate Production Planning and the Master Production Schedule – Material Requirement planning – Capacity Planning- Control Systems-Shop Floor Control-Inventory Control – Brief on Manufacturing Resource Planning-II (MRP-II) & Enterprise Resource Planning (ERP) - Simple Problems.

UNIT III CELLULAR MANUFACTURING 9

Group Technology(GT), Part Families – Parts Classification and coding – Simple Problems in Opitz Part Coding system – Production flow Analysis – Cellular Manufacturing – Composite part concept – Machine cell design and layout – Quantitative analysis in Cellular Manufacturing – Rank Order Clustering Method - Arranging Machines in a GT cell – Hollier Method – Simple Problems.

UNIT IV FLEXIBLE MANUFACTURING SYSTEM (FMS) AND AUTOMATED GUIDED VEHICLE SYSTEM (AGVS) 9

Types of Flexibility - FMS – FMS Components – FMS Application & Benefits – FMS Planning and Control – Quantitative analysis in FMS – Simple Problems. Automated Guided Vehicle System (AGVS) – AGVS Application – Vehicle Guidance technology – Vehicle Management & Safety.

UNIT V INDUSTRIAL ROBOTICS 9

Robot Anatomy and Related Attributes – Classification of Robots- Robot Control systems – End Effectors – Sensors in Robotics – Robot Accuracy and Repeatability - Industrial Robot Applications – Robot Part Programming – Robot Accuracy and Repeatability – Simple Problems.

TOTAL : 45 PERIODS

OUTCOMES:

CO1 Explain the basic concepts of CAD, CAM and computer integrated manufacturing systems
CO2 Summarize the production planning and control and computerized process planning
CO3 Differentiate the different coding systems used in group technology
CO4 Explain the concepts of flexible manufacturing system (FMS) and automated guided vehicle (AGV) system
CO5 Classification of robots used in industrial applications

TEXT BOOKS:

1. Mikell.P.Groover "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall of India, 2008.
2. Radhakrishnan P, Subramanyan S.and Raju V., "CAD/CAM/CIM", 2nd Edition, New Age International (P) Ltd, New Delhi, 2000.

REFERENCES:

1. Gideon Halevi and Roland Weill, "Principles of Process Planning – A Logical Approach" Chapman & Hall, London, 1995.
2. Kant Vajpayee S, "Principles of Computer Integrated Manufacturing", Prentice Hall India.
3. Rao. P, N Tewari &T.K. Kundra, "Computer Aided Manufacturing", Tata McGraw Hill Publishing Company, 2000.

19154E82C	ENERGY EFFICIENCY IN THERMAL UTILITIES	L	T	P	C
		3	0	0	3

UNIT 1: FUELS AND COMBUSTION

9

Introduction to Fuels -Properties of Liquid Fuels -Properties of Coal -Properties of Gaseous Fuels -Properties of Agro Residues -Combustion -Combustion of Oil Combustion of Coal -Combustion of Gas -Draft System -Combustion Controls.

9

UNIT2: BOILERS

Introduction -Boiler Systems -Boiler Types and Classifications -Performance Evaluation of Boilers -Boiler Blowdown -Boiler Water Treatment -Energy Conservation Opportunities -Case Study.

9

UNIT3: STEAM SYSTEM

Introduction-Properties of Steam -Steam Distribution -Steam Pipe Sizing and Design-Proper Selection, Operation and Maintenance of Steam Traps -Performance Assessment Methods for Steam Traps-Energy Saving Opportunities.

9

UNIT4: FURNACES AND INSULATION

Types and Classification of Different Furnaces-Performance Evaluation of a Typical Furnace -General Fuel Economy Measures in Furnaces -Case Study -Purpose of Insulation -Types and Application -Calculation of Insulation Thickness Economic Thickness of Insulation(ETI) -Simplified Formula for Heat Loss Calculation.

9

UNIT 5: FBC BOILERS, COGENERATION AND WASTE HEAT RECOVERY

Introduction -Mechanism of Fluidised Bed Combustion -Types of Fluidised Bed Combustion Boilers -Retrofitting of FBC Systems to Conventional Boilers -Advantages of Fluidised Bed Combustion Boilers-Need for Cogeneration - Principle of Cogeneration -Technical Options for Cogeneration -Classification of Cogeneration Systems -Factors Influencing Cogeneration Choice -Case Study -Introduction -Classification and Application -Benefits of Waste Heat Recovery - Development of a Waste Heat Recovery System -Commercial Waste Heat Recovery Devices.

TOTAL: 45 PERIODS

TEXT BOOK:

Guide book for National Certification Examination for Energy Managers and Energy Auditors-Bureau of Energy Efficiency

REFERENCE BOOK :

1. Smith, CB Energy Management Principles, Pergamon Press, New York 1981
2. www.bee-india.com

19154E82D **PROFESSIONAL ETHICS IN ENGINEERING** **L T P C**
3 0 0 3

OBJECTIVE:

- To enable the students to create an awareness on Engineering Ethics and Human Values to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I HUMAN VALUES **10**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS **9**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION **9**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS **9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT V GLOBAL ISSUES **8**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.

TOTAL: 45 PERIODS

OUTCOME:

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

TEXT BOOKS:

1. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.
2. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.

REFERENCES:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and

Engineers", Oxford University Press, Oxford, 2001.
4. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd.,New Delhi, 2013.

Web sources:

1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

OPEN ELECTIVE–I

19150FE54A **DATABASE MANAGEMENT SYSTEMS**

L	T	P	C
3	0	0	3

OBJECTIVES:

-
- To learn the fundamentals of data models
- To learn conceptual modeling using ER diagrams.
- To study SQL queries and database programming
- To learn proper designing of relational database.
- To understand database security concepts
- To understand Information retrieval techniques

UNIT I DBMS AND CONCEPTUAL DATA MODELING 9

Purpose of Database System – Data independence - Data Models – Database System Architecture – Conceptual Data modeling: ER models - Enhanced-ER Model. Introduction to relational databases – Relational Model – Keys – ER-to-Relational Mapping. Modeling of a library management system.

UNIT II DATABASE QUERYING **11**

Relational Algebra – SQL: fundamentals – DDL – Specifying integrity constraints - DML – Basic retrieval queries in SQL - Complex SQL retrieval queries – nested queries – correlated queries – joins - aggregate functions. Creating a table, populating data, adding integrity constraints, querying tables with simple and complex queries.

UNIT III DATABASE PROGRAMMING **9**

Database programming with function calls, stored procedures - views – triggers. Embedded SQL. ODBC connectivity with front end tools. Implementation using ODBC/JDBC and SQL/PSM, implementing functions, views, and triggers in MySQL / Oracle.

UNIT IV SUSPENSION AND BRAKES SYSTEMS **9**

Functional Dependencies – Design guidelines – Normal Forms: first, second, third – Boyce/Codd Normal Form – Normalization algorithms. Design of a banking database system / university database system.

UNIT V ALTERNATIVE ENERGY SOURCES **9**

Database security issues – Discretionary access control – role based access – Encryption and public key infrastructures – challenges. Information Retrieval: IR Concepts, Retrieval Models, Queries in IR systems.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

-
- understand relational data model, evolve conceptual model of a given problem, its mapping to relational model and Normalization
- query the relational database and write programs with database connectivity
- understand the concepts of database security and information retrieval systems
-

TEXTBOOKS:

Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Sixth Edition , Pearson, 2011.

2. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Sixth Edition, Tata McGraw Hill, 2011

REFERENCES:

C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.

2. Raghu Ramakrishnan, ―Database Management Systems‖, Fourth Edition, McGraw-Hill College Publications, 2015.

19150FE54B **CLOUD COMPUTING**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn about the concept of cloud and utility computing.
- To have knowledge on the various issues in cloud computing.
- To be familiar with the lead players in cloud.
- To appreciate the emergence of cloud as the next generation computing paradigm.

UNIT I INTRODUCTION TO CLOUD COMPUTING 9

Introduction to Cloud Computing – Roots of Cloud Computing – Desired Features of Cloud Computing – Challenges and Risks – Benefits and Disadvantages of Cloud Computing.

UNIT II VIRTUALIZATION **9**

Introduction to Virtualization Technology – Load Balancing and Virtualization – Understanding Hypervisor – Seven Layers of Virtualization – Types of Virtualization – Server, Desktop, Application Virtualization.

UNIT III CLOUD ARCHITECTURE, SERVICES AND STORAGE **9**

NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds - laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage.

UNIT IV RESOURCE MANAGEMENT AND SECURITY IN CLOUD **9**

Inter Cloud Resource Management – Resource Provisioning Methods – Security Overview – Cloud Security Challenges – Data Security –Application Security – Virtual Machine Security.

UNIT V CASE STUDIES **9**

Google App Engine(GAE) – GAE Architecture – Functional Modules of GAE – Amazon Web Services(AWS) – GAE Applications – Cloud Software Environments – Eucalyptus – Open Nebula – Open Stack.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Articulate the main concepts, key technologies, strengths and limitations of cloud computing.
- Learn the key and enabling technologies that help in the development of cloud.
- Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.
- Explain the core issues of cloud computing such as resource management and security.
- Be able to install and use current cloud technologies.
- Choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.

TEXTBOOKS:

1. Buyya R., Broberg J., Goscinski A., “Cloud Computing: Principles and Paradigm”, First Edition, John Wiley & Sons, 2011.
2. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
3. Rittinghouse, John W., and James F. Ransome, “Cloud Computing: Implementation, Management, And Security”, CRC Press, 2017.

19152FE54A **BASICS OF BIOMEDICAL INSTRUMENTATION**

L	T	P	C
3	0	0	3

OBJECTIVES:

-
- To study about the different bio potential and its propagation
- To understand the different types of electrodes and its placement for various recording
- To study the design of bio amplifier for various physiological recording
- To learn the different measurement techniques for non-physiological parameters.
- To familiarize the different biochemical measurements.
-

UNIT I BIO POTENTIAL GENERATION AND ELECTRODES TYPES 9

Origin of bio potential and its propagation. Types of electrodes - surface, needle and micro electrodes and their equivalent circuits. Recording problems - measurement with two electrodes

UNIT II BIOSIGNAL CHARACTERISTICS AND ELECTRODECONFIGURATIONS **9**

Biosignals characteristics – frequency and amplitude ranges. ECG – Einthoven‟s triangle, standard 12 lead system. EEG – 10-20 electrode system, unipolar, bipolar and average mode. EMG– unipolar and bipolar mode.

UNIT III SIGNAL CONDITIONING CIRCUITS **9**

Need for bio-amplifier - differential bio-amplifier, Impedance matching circuit, isolation amplifiers, Power line interference, Right leg driven ECG amplifier, Band pass filtering

UNIT IV MEASUREMENT OF NON-ELECTRICALPARAMETERS **10**

Temperature, respiration rate and pulse rate measurements. Blood Pressure: indirect methods - Auscultatory method, direct methods: electronic manometer, Systolic, diastolic pressure, Blood flow and cardiac output measurement: Indicator dilution, and dye dilution method, ultrasound blood flow measurement.

UNIT V BIO-CHEMICAL MEASUREMENT **8**

Blood gas analyzers and Non-Invasive monitoring, colorimeter, Sodium Potassium Analyser, spectrophotometer, blood cell counter, auto analyzer (simplified schematic description).

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

-
- To Learn the different bio potential and its propagation.
- CO2: To get Familiarize the different electrode placement for various physiological recording
- CO3: Students will be able design bio amplifier for various physiological recording
- CO4: Students will understand various technique non electrical physiogical measurements

CO5: Understand the different biochemical measurements

TEXTBOOKS:

1. Leslie Cromwell, “Biomedical Instrumentation and measurement”, Prentice hall of India, New Delhi, 2007.
2. John G. Webster, “Medical Instrumentation Application and Design”, John Wiley and sons, New York, 2004. (Units I, II & V)

REFERENCES:

1. Myer Kutz, “Standard Handbook of Biomedical Engineering and Design”, McGraw Hill Publisher, 2003.
2. Khandpur R.S, “Handbook of Biomedical Instrumentation”, Tata McGraw-Hill, New Delhi, 2003.(Units II & IV)
3. Joseph J. Carr and John M. Brown, “Introduction to Biomedical Equipment Technology”, Pearson Education, 2004.

19153FE54A **INDUSTRIAL NANOTECHNOLOGY**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To elucidate on advantages of nanotechnology based applications in each industry
- To provide instances of contemporary industrial applications of nanotechnology
- To provide an overview of future technological advancements and increasing role of nanotechnology in each industry

UNIT I NANO ELECTRONICS 9

Advantages of nano electrical and electronic devices –Electronic circuit chips – Lasers - Micro and NanoElectromechanical systems – Sensors, Actuators, Optical switches,- Data memory – Lighting and Displays – Batteries - Fuel cells and Photo-voltaic cells – Electric double layer capacitors – Lead-free solder – Nanoparticle coatings for electrical products.

UNIT II BIONANOTECHNOLOGY 9

Nanoparticles in bone substitutes and dentistry – Implants and Prosthesis – Nanorobotics in Surgery –Nanosensors in Diagnosis– Neuro-electronic Interfaces– Therapeutic applications.

UNIT III TRANSMISSION SYSTEMS 9

Nanocatalyts – Smart materials – Heterogenous nanostructures and composites – Nanostructures for Molecular recognition (Quantum dots, Nanorods, Nanotubes) – Molecular Encapsulation and its applications – Nanoporous zeolites – Self-assembled Nanoreactors.

UNIT IV SUSPENSION AND BRAKES SYSTEMS 9

Nanotechnology in Agriculture -Precision farming, Smart delivery system – Insecticides using nanotechnology – Potential of nano-fertilizers - Nanotechnology in Food industry

UNIT V ALTERNATIVE ENERGY SOURCES 9

Nanofibre production - Electrospinning – Controlling morphologies of nanofibers – Tissue engineering application– Polymer nanofibers - Nylon-6 nanocomposites from polymerization - Nano-filled polypropylene fibers - Nano finishing in textiles (UV resistant, antibacterial, hydrophilic, self-cleaning, flame retardant finishes) – Modern textiles Cosmetics – Formulation of Gels, Shampoos, Hair-conditioners

TOTAL : 45 PERIODS

REFERENCES:

Neelina H. Malsch (Ed.),Biomedical Nanotechnology, CRC Press (2005)
2. Udo H. Brinker, Jean-Luc Mieusset (Eds.), Molecular Encapsulation: Organic Reactions in Constrained Systems,Wiley Publishers (2010).
3. Jennifer Kuzma and Peter VerHage, Nanotechnology in agriculture and food production, Woodrow Wilson International Center, (2006).

4. Lynn J. Frewer, Willehm Norde, R. H. Fischer and W. H. Kampers, Nanotechnology in the Agri-food sector, Wiley-VCH Verlag, (2011).
5. P. J. Brown and K. Stevens, Nanofibers and Nanotechnology in Textiles, Woodhead Publishing Limited, Cambridge, (2007).
6. Y-W. Mai,Polymer Nano composites, Woodhead publishing, (2006).
7. W.N. Chang,Nanofibres fabrication, performance and applications, Nova Science Publishers Inc, (2009)

19153FE54B **ENERGY CONSERVATION AND MANAGEMENT**

L	T	P	C
3	0	0	3

OBJECTIVES:

Understand and analyse the energy data of industries
 Carryout energy accounting and balancing
 Conduct energy audit and suggest methodologies for energy savings and
 Utilise the available resources in optimal ways

-

UNIT I INTRODUCTION 9

Energy - Power – Past & Present scenario of World; National Energy consumption Data – Environmental aspects associated with energy utilization – Energy Auditing: Need, Types, Methodology and Barriers. Role of Energy Managers. Instruments for energy auditing.

UNIT II ELECTRICAL SYSTEMS **9**

Components of EB billing – HT and LT supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors - Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED Lighting and scope of Encon in Illumination.

UNIT III THERMAL SYSTEMS **9**

Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency computation and encon measures. Steam: Distribution &U sage: Steam Traps, Condensate Recovery, Flash Steam Utilization, Insulators & Refractories

UNIT IV ENERGY CONSERVATION IN MAJOR UTILITIES **9**

Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. sets

UNIT V ECONOMICS **9**

Energy Economics – Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing –ESCO concept

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- **to analyse the energy data of industries.**
- Can carryout energy accounting and balancing
- Can suggest methodologies for energy savings
-

TEXTBOOKS:

Energy Manager Training Manual (4 Volumes) available at www.energymanager training.com,a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India, 2004.

REFERENCES:

Witte. L.C., P.S. Schmidt, D.R. Brown, “Industrial Energy Management and Utilisation” Hemisphere Publ, Washington, 1988.
2. Callaghn, P.W. “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981.
3. Dryden. I.G.C., “The Efficient Use of Energy” Butterworths, London, 1982
4. Turner. W.C., “Energy Management Hand book”, Wiley, New York, 1982.
5. Murphy. W.R. and G. Mc KAY, “Energy Management”, Butterworths, London 1987.

19154FE54A **RENEWABLE ENERGY SOURCES**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To get exposure on solar radiation and its environmental impact to power.
- To know about the various collectors used for storing solar energy.
- To know about the various applications in solar energy.
- To learn about the wind energy and biomass and its economic aspects.
- To know about geothermal energy with other energy sources.

UNIT I PRINCIPLES OF SOLAR RADIATION 10

Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

UNIT II SOLAR ENERGY COLLECTION 8

Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT III SOLAR ENERGY STORAGE AND APPLICATIONS 7

Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

UNIT IV WIND ENERGY 10

Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria BIO-MASS: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engine operation and economic aspects.

UNIT V GEOTHERMAL ENERGY 9

Resources, types of wells, methods of harnessing the energy, potential in India. OCEAN ENERGY: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics. DIRECT ENERGY CONVERSION: Need for DEC, Carnot cycle, limitations, principles of DEC.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Understanding the physics of solar radiation.
- Ability to classify the solar energy collectors and methodologies of storing solar energy.

- Knowledge in applying solar energy in a useful way.
- Knowledge in wind energy and biomass with its economic aspects.

Knowledge in capturing and applying other forms of energy sources like wind, biogas and geothermal energies.

TEXTBOOKS:

1. Rai G.D. , “Non-Conventional Energy Sources”, Khanna Publishers, 2011
2. Twidell & Wier, “Renewable Energy Resources”, CRC Press (Taylor & Francis), 2011

REFERENCES:

1. Tiwari and Ghosal, “Renewable energy resources”, Narosa Publishing House, 2007
2. Ramesh R & Kumar K.U , “Renewable Energy Technologies”,Narosa Publishing House, 2004
3. Mittal K M , “Non-Conventional Energy Systems”, Wheeler Publishing Co. Ltd, New Delhi, 2003
4. Kothari D.P, Singhal ., K.C., “Renewable energy sources and emerging technologies”, P.H.I, New Delhi, 2010

19154FE54B **AUTOMOTIVE SYSTEMS**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the construction and working principle of various parts of an automobile.
- To have the practice for assembling and dismantling of engine parts and transmission system

UNIT I AUTOMOTIVE ENGINE AUXILIARY SYSTEMS 9

Automotive engines- External combustion engines –Internal combustion engines -classification of engines- SI Engines- CI Engines- two stroke engines -four stroke engines- construction and working principles - IC engine components- functions and materials -valve timing –port timing diagram- Injection system -Unit injector system- Rotary distributor type - Electronically controlled injection system for SI engines-CI engines-Ignition system - Electronic ignition system -Transistorized ignition system, capacitive discharge ignition system.

UNIT II VEHICLE FRAMES AND STEERING SYSTEM **9**

Vehicle construction and different Chassis layouts –classifications of chassis- types of frames- frameless chassis construction –articulated vehicles- vehicle body - Vehicle aerodynamics-various resistances and its effects - steering system –conventional –sophisticated vehicle- and types of steering gear box-Power Steering- Steering geometry-condition for true rolling motion-Ackermann's- Devi's steering system - types of stub axle – Types of rear axles.

UNIT III TRANSMISSION SYSTEMS **9**

Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints –- Hotchkiss Drive and Torque Tube Drive- rear axle- Differential-wheels and tyres.

UNIT IV SUSPENSION AND BRAKES SYSTEMS **9**

Suspension Systems- conventional Suspension Systems -independent Suspension Systems –leaf spring – coil spring –taper-lite - eligo,s spring Types of brakes -Pneumatic and Hydraulic Braking Systems, Antilock Braking System (ABS), electronic brake force distribution (EBD) and Traction Control. Derive the equation of Forces acting while applying a brakes on plain surface - inclined road-gradient .

UNIT V ALTERNATIVE ENERGY SOURCES **9**

Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles- Engine modifications required –Performance, Combustion and Emission Characteristics of SI and CI engines with these alternate fuels - Electric and Hybrid Vehicles, Fuel Cell. Turbo chargers -Engine emission control by three way catalytic converter system.
Note: Practical Training in dismantling and assembling of Engine parts and Transmission Systems should be given to the students.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Upon completion of this course, the students will be able to identify the different components in automobile engineering.
- Have clear understanding on different auxiliary and transmission systems usual.

TEXTBOOKS:

Ganesan V. “Internal Combustion Engines”, Third Edition, Tata McGraw-Hill, 2007.

2. Jain K.K. and Asthana .R.B, “Automobile Engineering” Tata McGraw Hill Publishers, New Delhi, 2002.

3. Kirpal Singh, “Automobile Engineering”, Vol 1 & 2, Seventh Edition, Standard Publishers, New Delhi, 1997.

REFERENCES:

Heinz Heisler, “Advanced Engine Technology,” SAE International Publications USA, 1998.

2. Joseph Heitner, “Automotive Mechanics,” Second Edition, East-West Press, 1999.

3. Martin W, Stockel and Martin T Stockle , “Automotive Mechanics Fundamentals,” The Good heart –Will Cox Company Inc, USA ,1978.

4. Newton ,Steeds and Garet, “Motor Vehicles”, Butterworth Publishers,1989.

19155FE54A **AIR POLLUTION AND CONTROL ENGINEERING**

L	T	P	C
3	0	0	3

OBJECTIVES:

-
- To impart knowledge on the principle and design of control of Indoor/ particulate/ gaseous air pollutant and its emerging trends.
-

UNIT I NTRODUCTION 7

Structure and composition of Atmosphere – Definition, Scope and Scales of Air Pollution – Sources and classification of air pollutants and their effect on human health, vegetation, animals, property, aesthetic value and visibility- Ambient Air Quality and Emission standards.

UNIT II METEOROLOGY **6**

Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns- Atmospheric Diffusion Theories – Dispersion models, Plume rise.

UNIT III CONTROL OF PARTICULATE CONTAMINANTS 11

Factors affecting Selection of Control Equipment – Gas Particle Interaction – Working principle - Gravity Separators, Centrifugal separators Fabric filters, Particulate Scrubbers, Electrostatic Precipitators.

UNIT IV CONTROL OF GASEOUS CONTAMINANTS **11**

Factors affecting Selection of Control Equipment – Working principle - absorption, Adsorption, condensation, Incineration, Bio filters – Process control and Monitoring.

UNIT V INDOOR AIR QUALITY MANAGEMENT **10**

Sources, types and control of indoor air pollutants, sick building syndrome and Building related illness- Sources and Effects of Noise Pollution – Measurement – Standards –Control and Preventive measures.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

-
- basic concepts of air quality management
- Ability to identify, formulate and solve air and noise pollution problems
- Ability to design stacks and particulate air pollution control devices to meet applicable standards.
- Ability to select control equipments.
- Ability to ensure quality, control and preventive measures.
-

TEXTBOOKS:

Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, “Air Pollution Control Engineering”, Tokyo, springer science + science media LLC,2004.
2. Noel de Nevers, “Air Pollution Control Engineering”, Waveland press,Inc 2017.
3. Anjaneyulu. Y, “Air Pollution and Control Technologies‟, Allied Publishers (P) Ltd., India 2002.

REFERENCES:

1. David H.F. Liu, Bela G. Liptak, “Air Pollution”, Lweis Publishers, 2000.
2. Arthur C. Stern, “Air Pollution (Vol.I – Vol.VIII)”, Academic Press, 2006.
3. Wayne T.Davis, “Air Pollution Engineering Manual”, John Wiley & Sons, Inc, 2000.
4. M.N Rao and HVN Rao, “Air Pollution”, Tata Mcgraw Hill Publishing Company limited,2007.
5. C.S.Rao, “Environmental Pollution Control Engineering”, New Age International(P) Limited Publishers,2006.

19155FE54B **GEOGRAPHIC INFORMATION SYSTEM**

L	T	P	C
3	0	0	3

OBJECTIVES:

-
- To introduce the fundamentals and components of Geographic Information System
- To provide details of spatial data structures and input, management and output
- processes.

UNIT I FUNDAMENTALS OF GIS 9

Introduction to GIS - Basic spatial concepts - Coordinate Systems - GIS and Information Systems – Definitions – History of GIS - Components of a GIS – Hardware, Software, Data, People, Methods – Proprietary and open source Software - Types of data – Spatial, Attribute data- types of attributes – scales/ levels of measurements.

UNIT II SPATIAL DATA MODELS **9**

Database Structures – Relational, Object Oriented – ER diagram - spatial data models – Raster Data Structures – Raster Data Compression - Vector Data Structures - Raster vs Vector Models-TIN and GRID data models - OGC standards - Data Quality.

UNIT III DATA INPUT AND TOPOLOGY **9**

Scanner - Raster Data Input – Raster Data File Formats – Vector Data Input –Digitiser –Topology - Adjacency, connectivity and containment – Topological Consistency rules – Attribute Data linking – ODBC – GPS - Concept GPS based mapping.

UNIT IV DATA ANALYSIS **9**

Vector Data Analysis tools - Data Analysis tools - Network Analysis - Digital Education models - 3D data collection and utilisation.

UNIT V APPLICATIONS **9**

GIS Applicant - Natural Resource Management - Engineering - Navigation - Vehicle tracking and fleet management - Marketing and Business applications - Case studies.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

-
- Have basic idea about the fundamentals of GIS.
- Understand the types of data models.
- Get knowledge about data input and topology.
- Gain knowledge on data quality and standards.
- Understand data management functions and data output
-

TEXTBOOKS:

Kang - Tsung Chang, Introduction to Geographic Information Systems, McGraw Hill Publishing, 2nd Edition, 2011. 2. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, “An Introduction Geographical Information Systems, Pearson Education, 2nd Edition,2007.

REFERENCES:

Lo.C.P., Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems, Prentice-Hall India Publishers, 2006

OPEN ELECTIVEII

19150FE74A INTRODUCTION TO C PROGRAMMING L T P C
3 0 0 3 OBJECTIVES

• To develop C Programs using basic programming constructs • To develop C programs using arrays and strings • To develop applications in C using functions and structures

UNIT I INTRODUCTION 9

Structure of C program – Basics: Data Types – Constants –Variables - Keywords – Operators: Precedence and Associativity - Expressions - Input/Output statements, Assignment statements – Decision-making statements - Switch statement - Looping statements – Pre-processor directives - Compilation process – Exercise Programs: Check whether the required amount can be withdrawn based on the available amount – Menu-driven program to find the area of different shapes – Find the sum of even numbers Text Book: ReemaThareja (Chapters 2,3)

UNIT II ARRAYS 9

Introduction to Arrays – One dimensional arrays: Declaration – Initialization - Accessing elements – Operations: Traversal, Insertion, Deletion, Searching - Two dimensional arrays: Declaration – Initialization - Accessing elements – Operations: Read – Print – Sum – Transpose – Exercise Programs: Print the number of positive and negative values present in the array – Sort the numbers using bubble sort - Find whether the given is matrix is diagonal or not. Text Book: ReemaThareja (Chapters 5)

UNIT III STRINGS 9

Introduction to Strings - Reading and writing a string - String operations (without using built-in string functions): Length – Compare – Concatenate – Copy – Reverse – Substring – Insertion – Indexing – Deletion – Replacement – Array of strings – Introduction to Pointers – Pointer operators – Pointer arithmetic - Exercise programs: To find the frequency of a character in a string - To find the number of vowels, consonants and white spaces in a given text - Sorting the names. Text Book: ReemaThareja (Chapters 6 & 7)

UNIT IV FUNCTIONS 9

Introduction to Functions – Types: User-defined and built-in functions - Function prototype - Function definition - Function call - Parameter passing: Pass by value - Pass by reference - Built-in functions (string functions) – Recursive functions – Exercise programs: Calculate the total amount of power consumed by 'n' devices (passing an array to a function) – Menu-driven program to count the numbers which are divisible by 3, 5 and by both (passing an array to a function) – Replace the punctuations from a given sentence by the space character (passing an array to a function) Text Book: ReemaThareja (Chapters 4)

UNIT V STRUCTURES 9

Introduction to structures – Declaration – Initialization – Accessing the members – Nested Structures – Array of Structures – Structures and functions – Passing an entire structure – Exercise programs: Compute the age of a person using structure and functions (passing a structure to a function) – Compute the number of days an employee came late to the office by considering his arrival time for 30 days (Use array of structures and functions) Text Book: ReemaThareja (Chapters 8)

TOTAL:45 PERIODS

OUTCOMES

Upon completion of this course, the students will be able to

• Develop simple applications using basic constructs

• Develop applications using arrays and strings
• Develop applications using functions and structures

TEXT BOOK

1. ReemaThareja, “Programming in C”, Oxford University Press, Second Edition, 2016

REFERENCES:

1. Kernighan, B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2006
2. Paul Deitel and Harvey Deitel, “C How to Program”, Seventh edition, Pearson Publication
3. Juneja, B. L and Anita Seth, “Programming in C”, CENGAGE Learning India pvt. Ltd., 2011
4. PradipDey, Manas Ghosh, “Fundamentals of Computing and Programming in C”, First Edition, Oxford University Press, 2009

19150FE74B **DATA STRUCTURES AND ALGORITHMS** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the various algorithm design and analysis techniques
- To learn linear data structures – lists, stacks, and queues
- To learn different sorting and searching algorithms
- To understand Tree and Graph data structures

UNIT I ALGORITHM ANALYSIS, LIST ADT 11

Algorithms: Notation - analysis – running time calculations. Abstract Data Types (ADTs): List ADT – array-based implementation – linked list implementation – singly linked lists- applications of lists: Polynomial Manipulation. Implementation of List ADT using an array and using a linked list in C.

UNIT II STACKS AND QUEUES 7

Stack ADT - Applications - Evaluating arithmetic expressions- Conversion of Infix to Postfix- Recursion. Queue ADT – Priority Queue - applications of queues. Implementation of Stack ADT and palindrome checking using C. Implementation of Queue operations using arrays in C.

UNIT III SEARCHING AND SORTING ALGORITHMS 10

Divide and conquer methodology - Searching: Linear Search - Binary Search. Sorting: Insertion sort – Merge sort – Quick sort – Heap sort. Analysis of searching and sorting techniques. Implementation of linear search, binary search, insertion sort, merge sort and quick sort algorithms in C.

UNIT IV TREES 9

Tree ADT – tree traversals - Binary Tree ADT – expression trees – binary search tree ADT – applications of trees.Heap – applications of heap. Implementation of Binary search tree and its operations, tree traversal methods, finding height of the tree using C. Implementation of heap and heap sorting using arrays in C.

UNIT V GRAPHS 8

Definition – Representation of Graph – Breadth-first traversal - Depth-first traversal – Dynamic programming Technique – Warshall's and Floyd's algorithm – Greedy method - Dijkstra's algorithm – applications of graphs. Implementation of graph, graph traversal methods, finding shortest path using Dijkstra's algorithm in C

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students should be able to:

- Implement linear data structures and solve problems using them
- Implement and apply trees and graphs to solve problems.
- Implement the various searching and sorting algorithms.

TEXT BOOKS:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education,1997.
2. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, Pearson Education, 1988.

REFERENCES:

1. Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education,1983.
2. S.Sridhar, "Design and Analysis of Algorithms", First Edition, Oxford University Press. 2014
3. Byron Gottfried, Jitender Chhabra, "Programming with C" (Schaum's Outlines Series),Mcgraw Hill Higher Ed., III Edition, 2010
4. YashvantKanetkar, "Data Structures Through C", BPB publications, II edition, 2003

19152FE74A **ROBOTICS** **L T P C**
3 0 0 3

OBJECTIVES:
 To understand the functions of the basic components of a Robot. To study the use of various types of End of Effectors and Sensors To impart knowledge in Robot Kinematics and Programming To learn Robot safety issues and economics.

UNIT I FUNDAMENTALS OF ROBOT **6**
Robot - Definition - Robot Anatomy - Co ordinate Systems, Work Envelope Types and Classification-Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load- Robot Parts and their Functions-Need for Robots-Different Applications.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS **9**
Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT III SENSORS AND MACHINE VISION **12**
Requirements of a sensor, Principles and Applications of the following types of sensors- Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors ,binary Sensors., Analog Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing Image Data- Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications- Inspection, Identification, Visual Serving and Navigation.

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING **13**
Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems. Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs.

UNIT V IMPLEMENTATION AND ROBOT ECONOMICS **5**
RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

TOTAL: 45 PERIODS OUTCOME:
 Upon completion of this course, the students can able to apply the basic engineering knowledge for the design of robotics

TEXT BOOKS: 1. Klafter R.D., ChmielewskiT.A and Negin M., “Robotic Engineering - An Integrated Approach”, Prentice Hall, 2003. 2. GrooverM.P., “Industrial Robotics -Technology Programming and Applications”, McGraw Hill, 2001.

19152FE74B ELECTRONIC DEVICES L T P C 3 0 0 3

OBJECTIVES:

The student should be made to:

- Introduce the concept of diodes, Bipolar Junction Transistors and FET
- Study the various model parameters of Transistors
- Learn the concept of special semiconductor devices, Power & Display devices
- Impart the knowledge of various configurations, characteristics and applications.

UNIT I SEMICONDUCTOR DIODE 9

PN junction diode, Current equations, Energy Band diagram, Diffusion and drift current densities, forward and reverse bias characteristics, Transition and Diffusion Capacitances, Switching Characteristics, Breakdown in PN Junction Diodes.

UNIT II BIPOLAR JUNCTION TRANSISTORS 9

NPN -PNP -Operations-Early effect-Current equations – Input and Output characteristics of CE, CB, CC - Hybrid -p model - h-parameter model, Ebers Moll Model- GummelPoonmodel, Multi Emitter Transistor.

UNIT III FIELD EFFECT TRANSISTORS 9

JFETs – Drain and Transfer characteristics,-Current equations-Pinch off voltage and its significance-MOSFET- Characteristics- Threshold voltage -Channel length modulation, DMOSFET, E-MOSFET-Characteristics – Comparison of MOSFET with JFET.

UNIT IV SPECIAL SEMICONDUCTOR DEVICES 9

Metal-Semiconductor Junction - MESFET, FINFET, PINFET, CNTFET, DUAL GATE MOSFET, Point Contact Diode, p-i-n Diode, Avalanche Photodiode, Schottky barrier diodeZener diode-Varactor diode – Tunnel diode- Gallium Arsenide device, LASER diode, LDR.

UNIT V POWER DEVICES AND DISPLAY DEVICES 9

UJT, Thyristor - SCR, Diac, Triac, Power BJT- Power MOSFET- DMOS-VMOS. LED, LCD, Opto Coupler, Solar cell, CCD.

TOTAL: 45 PERIODS

OUTCOMES:

After this course, the student should be able to:

- Analyze the characteristics of semiconductor diodes.
- Analyze and solve problems of Transistor circuits using model parameters.
- Identify and characterize diodes and various types of transistors.
- Analyze the characteristics of special semiconductor devices.
- Analyze the characteristics of Power and Display devices.

TEXT BOOKS:

1. Millman and Halkias, “Electronic Devices and Circuits”, 4th Edition, McGraw Hill, 2015.

2. Mohammad Rashid, “Electronic Devices and Circuits”, Cengage Learning Pvt. Ltd, 2015.
3. Salivahanan. S, Suresh Kumar. N, “Electronic Devices and circuits”, 4TH Edition, McGraw Hill, 2016.

REFERENCES:

1. Donald A Neaman, “Semiconductor Physics and Devices”, 4th Edition, McGraw Hill, 2012.
2. Robert L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory” Pearson Prentice Hall, 11thEdition, 2014.
3. Bhattacharya and Sharma, “Solid State Electronic Devices”, 2ndEdition, Oxford University Press, 2014.
4. R.S.Sedha, “A Textbook of Electronic Devices and Circuits”, 2ndEdition, S.Chand Publications, 2008.
5. David A. Bell, “Electronic Devices and Circuits”, 5thEdition, Oxford University Press, 2008.

19153FE74B INTRODUCTION TO RENEWABLE ENERGY SYSTEMS L T P C

3 0 0 3

OBJECTIVES:

To Provide knowledge

- About the stand alone and grid connected renewable energy systems.
- Design of power converters for renewable energy applications.
- Wind electrical generators and solar energy systems.
- Power converters used for renewable energy systems.

UNIT I INTRODUCTION 9

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems.

UNIT II ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION

Reference theory fundamentals-principle of operation and analysis: IG and PMSG 9

UNIT III POWER CONVERTERS 9

Solar: Block diagram of solar photo voltaic system -Principle of operation: line commutated converters (inversion-mode) - Boost and buck-boost converters- selection of inverter, battery sizing, array sizing Wind: Three phase AC voltage controllers

UNIT IV ANALYSIS OF WIND AND PV SYSTEMS 9

Stand alone operation of fixed and variability speed wind energy conversion systems and solar system-Grid connection Issues -Grid integrated PMSG, SCIG Based WECS, grid Integrated solar system

UNIT V HYBRID RENEWABLE ENERGY SYSTEMS 9

Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind-PV Maximum Power Point Tracking (MPPT).

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.
- Ability to handle the engineering aspects of electrical energy generation and utilization.
- Ability to understand the stand alone and grid connected renewable energy systems.
- Ability to design of power converters for renewable energy applications.
- Ability to acquire knowledge on wind electrical generators and solar energy systems.
- Ability to design power converters used for hybrid renewable energy systems.

TEXT BOOK:

1. S. N. Bhadra, D.Kastha, S.Banerjee, "Wind Electrical Systems", Oxford University Press, 2005.
2. B.H.Khan Non-conventional Energy sources Tata McGraw-hill Publishing Company, New Delhi,2009.

REFERENCES:

1. Rashid .M. H "power electronics Hand book", Academic press, 2001.
2. Ion Boldea, "Variability speed generators", Taylor & Francis group, 2006.
3. Rai. G.D, "Non conventional energy sources", Khanna publishes, 1993.
4. Gray, L. Johnson, "Wind energy system", prentice hall linc, 1995.

5. Andrzej M. Trzynnadlowski, „Introduction to Modern Power Electronics", Second edition, wiley India Pvt. Ltd, 2012.

19155FE74B **WASTE WATER TREATMENT** **L T P C**

3 0 0 3

OBJECTIVES

- To make the student conversant with the water treatment methods including adsorption and oxidation process.
- To provide basic under standings about the requirements of water, its preliminary treatment.

UNIT I WATER QUALITY AND PRELIMINARY TREATMENT 9

Water Quality-physical- chemical and biological parameters of water- water quality requirement - potable water standards -wastewater effluent standards -water quality indices. Water purification systems in natural systems- physical processes-chemical processes and biological processes- primary, secondary and tertiary treatment-Unit operations-unit processes. Mixing, clarification - sedimentation; Types; aeration and gas transfer – coagulation and flocculation, coagulation processes - stability of colloids - destabilization of colloids- transport of colloidal particles, clariflocculation.

UNIT II INDUSTRIAL WATER TREATMENT 9

Filtration – size and shape characteristics of filtering media – sand filters hydraulics of filtration – design considerations – radial, upflow, highrate and multimedia filters, pressure filter. Water softening – lime soda, zeolite and demineralization processes – industrial water treatment for boilers.

UNIT III CONVENTIONAL TREATMENT METHODS 9

Taste and odour control – adsorption – activated carbon treatment – removal of color – iron and manganese removal – aeration, oxidation, ion exchange and other methods – effects of fluorides – fluoridation and defluoridation –desalination - corrosion prevention and control – factors influencing corrosion – Langelier index – corrosion control measures.

UNIT IV WASTEWATER TREATMENT 9

Wastewater treatment – pre and primary treatment – equalization neutralization – screening and grid removal – sedimentation – oil separation gas stripping of volatile organics – biological oxidation – lagoons and stabilization basins – aerated lagoons – activated sludge process – trickling filtration – anaerobic decomposition.

UNIT V ADSORPTION AND OXIDATION PROCESSES 9

Chemical process – adsorption – theory of adsorption – ion exchange process – chemical oxidation – advanced oxidation process – sludge handling and disposal – miscellaneous treatment processes.

TOTAL: 45 PERIODS

OUTCOMES

- Will have knowledge about adsorption and oxidation process.
- Will gain idea about various methods available for water treatment.
- Will appreciate the necessity of water and acquire knowledge of preliminary treatment.

TEXTBOOKS:

1. Metcalf and Eddy, “Wastewater Engineering”, 4th ed., McGraw Hill Higher Edu., 2002.
2. W. Wesley Eckenfelder, Jr., “Industrial Water Pollution Control”, 2nd Edn., McGraw Hill Inc., 1989.

REFERENCES

1. S.P. Mahajan, “Pollution control in process industries”, 27th Ed. Tata McGraw Hill Publishing Company Ltd., 2012.
2. M. Lancaster, “Green Chemistry: An Introductory Text”, 2nd edition, RSC publishing, 2010.
3. C.S. Rao, “Environmental Pollution Control Engineering”, New Age International, 2007.

SEMESTER – I

Sl. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	19148S11P	Transforms & Partial Differential Equations	3	1	0	4
2	19154H12P	Electrical drives and controls	3	0	0	3
3	19154H13P	Engineering Thermodynamics	3	1	0	4
4	19154H14P	Fluid Mechanics and Machinery	3	1	0	4
5	19154H15P	Foundry And Welding Technology	4	0	0	4
Total No of Credits						19

EMPLOYABILITY

ENTREPRENUEURSHIP

SKILL DEVELOPMENT

SEMESTER – II

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	19148S21P	Numerical Methods	3	1	0	4
2	19154H22P	Machine Tool Technology	3	0	0	3
3	19154H23P	Thermal Engineering	3	1	0	4
4	19154H24P	Strength of Materials	3	1	0	4
5	19154H25P	Engineering Materials and Metallurgy	4	0	0	4
Total No of Credits						19

SEMESTER – III

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	19148S31CP	Probability and Statistics	3	1	0	4
2	19154H32P	Kinematics of Machinery	3	1	0	4
3	19154H33P	Production Planning and Control	4	0	0	4
4	19154H34P	Engineering Metrology and Measurements	4	0	0	4
5	19154L35P	Computer Aided Simulation and Analysis Laboratory	0	0	3	2
					Total No of Credits	18

SEMESTER –IV

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	19154H41P	Power Plant Engineering	4	0	0	4
2	19154H42P	Dynamics of Machinery	3	1	0	4
3	19154H43P	Design of Machine Elements	3	1	0	4
4	19154E44-P	Elective -I	4	0	0	4
5	19154L45P	Dynamics Laboratory	0	0	3	2
					Total No of Credits	18

SEMESTER – V

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	19154H51P	Heat and Mass Transfer	3	1	0	4
2	19154H52P	Design of Transmission Systems	3	1	0	4
3	19154H53P	Automobile Engineering	4	0	0	4
4	19154E54-P	Elective-II	4	0	0	4
5	19154L55P	Heat Transfer Laboratory	0	0	3	2
					Total No of Credits	18

SEMESTER –VI

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	19154H61P	Finite Elements Analysis	3	1	0	4
2	19154H62P	Mechatronics	4	0	0	4
3	19154H63P	Computer Integrated Manufacturing	4	0	0	4
4	19154E64-P	Elective-III	4	0	0	4
5	19154L65P	Mechatronics Laboratory	0	0	3	2
					Total No of Credits	18

SEMESTER –VII

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	19160S71P	Total Quality Management	3	0	0	3
2	19154H72P	Process Planning and Cost Estimation	3	1	0	4
3	19154H73P	Applied Hydraulics and Pneumatics	4	0	0	4
4	19154E74-P	Elective-IV	3	0	0	3
5	19154P75P	Project Work	0	0	12	6
					Total No of Credits	20

EMPLOYABILITY

ENTREPRENUEURSHIP

SKILL DEVELOPMENT

TOTAL NO OF CREDITS FROM SEMESTER I TO VII – 130

LIST OF ELECTIVES

ELECTIVE I

SEMESTER – IV

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	19154E44AP	Gas Dynamics and Jet Propulsion	4	0	0	4
2	19154E44BP	Refrigeration and Air Conditioning	4	0	0	4
3	19154E44CP	Non Destructive Testing	4	0	0	4
4	19154E44DP	Renewable Sources of Energy	4	0	0	4

EMPLOYABILITY

ENTREPRENUEURSHIP

SKILL DEVELOPMENT

ELECTIVE II

SEMESTER – V

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	19154E54AP	Environmental Science and Engineering	4	0	0	4
2	19154E54BP	Composite Materials	4	0	0	4
3	19154E54CP	Robotics	4	0	0	4
4	19154E54DP	Design of Jigs, Fixtures and Press Tools	4	0	0	4

EMPLOYABILITY

ENTREPRENUEURSHIP

SKILL DEVELOPMENT

ELECTIVE III

SEMESTER – VI

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	19154E64AP	Principles of Management	4	0	0	4
2	19154E64BP	Nuclear Engineering	4	0	0	4
3	19154E64CP	Intellectual Property Rights	4	0	0	4
4	19148E64DP	Mathematics for Industrial Operations	4	0	0	4

EMPLOYABILITY

ENTREPRENUEURSHIP

SKILL DEVELOPMENT

ELECTIVE IV

SEMESTER – VII

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	19154E74AP	Quality Control and Reliability Engineering	3	0	0	3
2	19154E74BP	Vibration and Noise Control	3	0	0	3
3	19154E74CP	Unconventional Machining Process	3	0	0	3
4	19154E74DP	Industrial Engineering	3	0	0	3

EMPLOYABILITY

ENTREPRENUEURSHIP

SKILL DEVELOPMENT

19154C15P FOUNDRY & WELDING TECHNOLOGY

UNIT-I: INTRODUCTION 9

Introduction to moulding and casting Processes – Steps involved – advantages, limitations and application of casting process. Patterns – Types _ their applications – Pattern allowances – Pattern materials – Colour coding as per BIS. Pattern making cores – Core prints –Core boxes – core making.

UNIT – II: MOULDING PROCESSES 9

Manual moulding processes – equipments and tools – Moulding sand ingredients – Moulding sand properties, influence of ingredients on properties – sand preparation and control – sand testing – machine moulding – types of machines,

UNIT – III: CASTING PROCESSES 9

Sand casting processes –permanent mould casting processes-pressure die casting, centrifugal casting – precision/investment casting-shell moulding,– continuous casting –– electro slag casting processes, Vacuum process, magnetic moulding process.

UNIT – IV: SPECIAL WELDING PROCESSES 9

Gas tungsten arc (TIG) welding, Gas metal arc (MIG) welding, submerged arc welding, power sources and other characteristics for these individual processes, equipments and accessories, application and limitation of each process. Resistance welding processes-their principle-Types (spot, seam, projection).

UNIT – V: MODERN WELDING PROCESSES 9

Electron beam welding, laser beam welding, Plasma arc welding, friction welding, explosive welding, ultrasonic welding, stud welding, diffusion bonding, welding of dissimilar metals.

TUTORIALS: 15

TOTAL HOURS: 60

TEXT BOOK

1. Lal,Mand Khanna O.P “A Text Book of Foundry Technology” Dhanpat Rai and Sons, New Delhi 1986.
2. Workshop Technology Volume I &II,Hajra Choudry & Bhattacharya.

REFERENCES

1. Production Technology ,R.K.Jain & S.C.Gupta
2. Radhakrishnan.V.M. “Welding Technology and Design” New age International Pub. Ltd., New Delhi 2002

19154C22P MACHINE TOOL TECHNOLOGY

UNIT – I: METAL CUTTING THEORY 8

Introduction: material removal processes, types of machine tools – theory of metal cutting: chip formation, Types of metal cutting, cutting tool materials, Types of tool wear, Simple problems on Tool life.

UNIT –II: CENTRE LATHE AND SPECIAL PURPOSE LATHES 10

Centre lathe, constructional features, cutting tools, various operations, taper turning methods, thread cutting methods, special attachments, machining time and power estimation.
Capstan and turret lathes – automatic lathes : semi automatic, automats – single spindle : cutting off, multi spindle; cutting off machines.

UNIT – III: SHAPING, PLANING, SLOTTING & MILLING MACHINES 10

Reciprocating machine tools: shaper, planer, slotter ; milling : types, milling cutters, operations.

UNIT – IV: GRINDING, BROACHING AND GEAR CUTTING 10

Grinding: Introduction- Grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, surface grinding, centreless grinding – honing, lapping, super finishing, polishing and buffing.
Broaching Machines: broach Specification – push, pull, surface and continuous broaching machines, Gear cutting: forming, generation, shaping, Hobbing.

UNIT – V: CNC MACHINES AND APT PROGRAMMING 7

Numerical Control (NC) machine tools – CNC – Introduction, Types, constructional details, special features, Advantages and applications.
Part programming fundamentals – manual programming – computer assisted part programming – APT language.

TOTAL : 45

TEXT BOOKS :

1. Hajra Choudry, “Elements of Work Shop Technology – Vol. II”, Media Promoters. 2002
2. P.C. Sharma, “A Text Book of Production Engineering”, S. Chand and Co. Ltd, IV edition, 1993.

REFERENCES:

1. Rao, P.N. “Manufacturing Technology”, Metal Cutting and Machine Tools, Tata McGraw–Hill, New Delhi, 2003.

2. Richerd R. Kibbe, John E. Neely, Roland O. Merges and Warren J. White, "Machine Tool Practices", Prentice Hall of India, 2003.
3. **HMT – "Production Technology", Tata McGraw-Hill, 1998.**

19154C34P ENGINEERING METROLOGY AND MEASUREMENTS

UNIT – I: INTRODUCTION 9

Measurement -Introduction – Generalised measurement system-Units and standards-measuring instruments- range of accuracy, precision- repeatability-systematic and random errors-correction, calibration, interchangeability.

UNIT – II: LINEAR AND ANGULAR MEASURING DEVICES 9

Definition of Metrology-Linear measuring instruments: Vernier, micrometer, interval measurement, Slip gauges and classification, limit gauges- Comparators: Mechanical, pneumatic and electrical types, applications.

Angular measurements: -Sine bar, optical bevel protractor, angle Decker – Taper measurements.

UNIT – III: SCREW THREAD & GEAR FORM MEASUREMENT 9

Measurement of screw threads-Thread gauges, floating carriage micrometer-measurement of gears-tooth thickness-constant chord and base tangent method-.

UNIT – IV: LASER METROLOGY AND CMM 9

Precision instruments based on laser-Principles- laser interferometer-application in linear, angular measurements

Coordinate measuring machine (CMM)- Constructional features – types, applications –computer aided inspection.

UNIT – V: POWER, FLOW AND TEMPERATURE MEASUREMENT 9

Force, torque, power:-mechanical and pneumatic type-Flow measurement: Venturi, orifice, rotameter,–Temperature: bimetallic strip, pressure thermometers, thermocouples,

TEXT BOOKS:

1. Jain R.K., "Engineering Metrology", Khanna Publishers, 1994
2. Alan S. Morris, "The Essence of Measurement", Prentice Hall of India, 1997

REFERENCES:

1. Gupta S.C, “Engineering Metrology”, Dhanpat rai Publications, 1984
2. Jayal A.K, “Instrumentation and Mechanical Measurements”, Galgotia Publications 2000
3. Alan S. Morris, “The Essence of Measurement”, Prentice Hall of India, 1997
4. Donald D Eckman, “Industrial Instrumentation”, Wiley Eastern, 1985.

19154L35P COMPUTER AIDED SIMULATION AND ANALYSIS LABORATORY

LIST OF EXPERIMENTS

A. Simulation ***15***

1. Simulation of cam and follower mechanism using C / MAT Lab.

2. Analysis (Simple Treatment only) 30
3. Stress analysis of a plate with a circular hole.
4. Stress analysis of rectangular L bracket
5. Stress analysis of an axi-symmetric component
6. Stress analysis of beams (Cantilever, Simply supported, Fixed ends)
7. Mode frequency analysis of a 2 D component
8. Mode frequency analysis of beams (Cantilever, Simply supported, Fixed ends)
9. Harmonic analysis of a 2D component
10. Thermal stress analysis of a 2D component
11. Conductive heat transfer analysis of a 2D component
12. Convective heat transfer analysis of a 2D component

TOTAL : 45

19154C41P POWER PLANT ENGINEERING

UNIT – I: INTRODUCTION : 9

Layout of Steam, Hydel, Diesel, MHD, Nuclear and Gas Turbine Power Plants - Steam Boilers and Cycles – High Pressure and Super Critical Boilers – Fluidised Bed Boilers

UNIT – II: STEAM POWER PLANT 9

Fuel Handling and Ash Handling, Combustion Equipment for burning coal, MechanicalStokers, Pulveriser, Electrostatic Precipitator, Draught, Cooling Towers

UNIT – III: NUCLEAR AND HYDEL POWER PLANTS 9

Nuclear Energy – Fission, Fusion Reaction, Types of Reactors, pressurized water reactor, Boiling Water Reactor,.

Hydel Power Plant – Essential Elements, Selection of Turbines, Governing of Turbines- Micro Hydel developments.

UNIT – IV: DIESEL AND GAS TURBINE POWER PLANT 9

Types of Diesel Plants, Components, Selection of Engine Type, Applications Gas Turbine Power Plant – Fuels – Open and Closed Cycles – Reheating – Regeneration and Intercooling

UNIT – V: POWER PLANTS ECONOMICS 9

Geo thermal –OTEC – Tidel - Pumped storage - Solar thermal central receiver system.

Cost of Electric Energy – Fixed and operating Costs – Energy Rates –Economics of load sharing, comparison of economics of various power plants**.**

Total Hours: 45

TEXT BOOKS:

1. G.D.Rai, “Introduction to Power Plant Technology”, Khanna Publishers, 1995.

2. Nag P.K, “Power plant Engineering”, Tata McGraw-Hill, 1998.

REFERENCES:

1. K.K.Ramalingam, “Power Plant Engineering”, Scitech Publications, 2002.
2. Frank D.Graham “Power Plant Engineers Guide”, D.B. Taraporevala Sons & Co, New Delhi, 1993.
3. T.Morse Frederick, “Power Plant Engineering”, Prentice Hall of India, 1998

19154C43P DESIGN OF MACHINE ELEMENTS

UNIT – I : STRESSES IN MACHINE MEMBERS 9

Introduction to the design process - factor influencing machine design, selection of materials based on mechanical properties – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, Factor of safety - theories of failure – stress concentration – design for variable loading – Soderberg, Goodman and Gerber relations

UNIT – II: DESIGN OF SHAFTS AND COUPLINGS 9

Design of solid and hollow shafts based on strength, rigidity and critical speed – Design of keys and key ways - Design of rigid and flexible couplings – Introduction to gear and shock absorbing couplings

UNIT – III: DESIGN OF FASTNERS AND WELDED JOINTS 9

Threaded fastners - Design of bolted joints including eccentric loading – Design of welded joints for pressure vessels and structures -.

UNIT – IV: DESIGN OF SPRINGS AND LEVERS 9

Design of helical, leaf, disc and torsional springs under constant loads and varying loads – Concentric torsion springs - Belleville springs

UNIT – V: DESIGN OF BEARINGS AND FLYWHEELS 9

Design of bearings – sliding contact and rolling contact types. – Cubic mean load – Design of journal bearings – Mckees equation – Lubrication in journal bearings – calculation of bearing dimensions

TUTORIAL 15
TOTAL HOURS : 60

Note: (Use of P S G Design Data Book is permitted in the University examination)

TEXT BOOKS:

1. Juvinall R.C, and Marshek K.M, “Fundamentals of Machine Component Design”, John Wiley & Sons, Third Edition, 2002.
2. Bhandari V.B, “Design of Machine Elements”, Tata McGraw-Hill Book Co, 2003.

REFERENCES:

1. Norton R.L, "Design of Machinery", Tata McGraw-Hill Book Co, 2004.
2. Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.
3. Ugural A.C, "Mechanical Design – An Integral Approach, McGraw-Hill Book Co, 2004.
4. Spotts M.F., Shoup T.E "Design and Machine Elements" Pearson Education, 2004.

STANDARDS:

IS 10260 : Part 1 : 1982 Terms, definitions and classification of Plain bearings Part 1 : Construction.

IS 10260 : Part 1 : 1982 Terms, definitions and classification of Plain bearings Part 2 : Friction and Wear.

IS 10260 : Part 1 : 1982 Terms, definitions and classification of Plain bearings Part 3 : Lubrication.

19154L45P DYNAMICS LABORATORY

LIST OF EXPERIMENTS

1. Governors - Determination of sensitivity, effort, etc. for Watt, Porter
2. Cam - Study of jump phenomenon and drawing profile of the cam.
3. Motorised Gyroscope-Verification of laws -Determination of gyroscopic couple.
4. Whirling of shaft-Determination of critical speed of shaft with concentrated loads.
5. Balancing of rotating masses.
6. Determination of moment of inertia by oscillation method for connecting rod and flywheel.
7. Vibrating system - Spring mass system-Determination of damping co-efficient of single degree of freedom system.
8. Determination of torsional frequencies for compound pendulum and flywheel system with lumped Moment of inertia.
9. Transverse vibration –free- Beam. Determination of natural frequency and deflection of beam.

Total Hours: 45

19154C52P DESIGN OF TRANSMISSION SYSTEMS

UNIT – I: DESIGN OF TRANSMISSION SYSTEMS 9

Selection of V belts and pulleys – selection of Flat belts and pulleys -– Selection of Transmission chains and Sprockets. Design of pulleys and sprockets.

UNIT – II: SPUR GEARS AND PARALLEL AXIS HELICAL GEARS 9

Gear Terminology-Speed ratios and number of teeth-Force analysis - Dynamic effects - Fatigue strength - Factor of safety - Gear materials – Module and Face width-power rating calculations based on strength and wear considerations -– Pressure angle in the normal and transverse plane-Equivalent number of teeth-forces and stresses.

UNIT – III: BEVEL AND CROSS HELICAL GEARS 9

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears.
Cross helical: Terminology-helix angles-Estimating the size of the pair of cross helical gears.

UNIT – IV: GEAR BOXES DESIGN 9

Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box -Constant mesh gear box. – Design of multi speed gear box.

UNIT – V: DESIGN OF CAM, CLUTCHES AND BRAKES 9

Cam Design: Types-pressure angle and under cutting base circle determination-forces and surface stresses.
Design of plate clutches –axial clutches-cone clutches-internal expanding rim clutches-

TUTORIALS 30

TOTAL HOURS: 75

Note: (Usage of P.S.G Design Data Book is permitted in the University examination)

TEXT BOOKS

1. Prabhu. T.J., "Design of Transmission Elements", Mani Offset, Chennai, 2000,
2. Bhandari, V.B., "Design of Machine Elements", Tata McGraw-Hill Publishing Company Ltd., 1994.

REFERENCES

1. Maitra G.M., Prasad L.V., "Hand book of Mechanical Design", II Edition, Tata McGraw-Hill, 1985.
2. Shigley J.E and Mischke C. R., "Mechanical Engineering Design", McGraw-Hill International Editions, 1989.

19154C53P AUTOMOBILE ENGINEERING

UNIT – I: STRUCTURE OF VEHICLESAND ENGINES 10

Types of Automobiles - Vehicle Construction – Chassis – Frame and Body –aerodynamics. Components of Engine – Their forms, Functions and Materials - Review of Cooling and Lubrication systems in Engine – Turbo Chargers –.

UNIT – II: ENGINE AUXILIARY SYSTEMS 10

Carburetor–working principle- Electronic fuel injection system – Mono-point and Multi - Point Injection Systems – Construction, Operation and Maintenance of Lead Acid Battery - Electrical systems – Battery generator – Starting Motor and Drives – Lighting and Ignition (Battery, Magneto Coil and Electronic Type)-Regulators-cut outs.

UNIT – III: TRANSMISSION SYSTEMS 10

Clutch – Types and Construction – Gear Boxes, Manual and Automatic – Simple Floor Mounted Shift Mechanism – Over Drives – Transfer Box Fluid flywheel-Torque convertors– Propeller shaft – Slip Joint – Universal Joints – Differential and Rear Axle.

UNIT – IV: STEERING, BRAKES AND SUSPENSION 10

Wheels and Tyres – Wheel Alignment Parameters - Steering Geometry and Types of steering gear box– Power Steering – Types of Front Axle – Suspension systems – Braking Systems – Types and Construction.

UNIT – V: ALTERNATIVE ENERGY SOURCES 5

Use of Natural Gas, LPG, Biodiesel, Gasohol and Hydrogen in Automobiles - Electric and Hybrid Vehicles, Fuel Cells.

Note: Practical training in dismantling and assembling of Engine parts Transmission System should be given to the students

Total Hours : 45

TEXT BOOKS:

1. Sethi H.M, "Automobile Technology", Tata McGraw-Hill-2003
2. Kirpal Singh "Automobile Engineering Vol. 1& 2", Standard Publishers, New Delhi.

REFERENCES:

1. Crouse and Anglin "Automotive Mechanism", 9th Edition. Tata McGraw-Hill, 2003.
2. Newton, Steeds and Garet, "Motor vehicles", Butterworth Publishers, 1989.
3. Srinivasan.S , " Automotive Mechanics" 2nd edition, 2003, Tata McGraw-Hill.

19154L55P THERMAL ENGINEERING LABORATORY II

LIST OF EXPERIMENTS

HEAT TRANSFER **30**

1. Thermal conductivity measurement by guarded plate method
2. Thermal conductivity of pipe insulation using lagged pipe apparatus
3. Natural convection heat transfer from a vertical cylinder
4. Forced convection Inside tube
5. Heat transfer from Pin-fin (natural & forced convection modes)
6. Determination of Stefan-Boltzmann constant
7. Determination of Emissivity of a grey surface
8. Effectiveness of Parallel/counter flow heat exchanger

REFRIGERATION AND AIR CONDITIONING **15**

1. Determination of COP of a refrigeration system
2. Experiments on air-conditioning system
3. Performance test on single/two stage reciprocating air compressor.

Total Hours : 45

19154C62P MECHATRONICS

UNIT – I: INTRODUCTION 9

Introduction to Mechatronics – Measurement Systems – Control Systems – Microprocessor based Controllers.

Sensors and Transducers – Performance Terminology – Sensors for Displacement, Position and Proximity; Velocity, Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature, Light Sensors – Selection of Sensors

UNIT – II: POWER DRIVE SYSTEM 9

Pneumatic and Hydraulic Systems – Directional Control Valves – Rotary Actuators.

Mechanical Actuation Systems – Cams – Gear Trains – Ratchet and pawl – Belt and Chain Drives – Bearings.

Electrical Actuation Systems – Mechanical Switches – Solid State Switches – Solenoids – D.C Motors – A.C Motors – Stepper Motors.

UNIT – III: SYSTEM MODELS AND CONTROLLERS 9

Building blocks of Mechanical, Electrical, Fluid and Thermal Systems, Rotational – Transnational Systems, Electromechanical Systems – Hydraulic – Mechanical Systems.

Continuous and discrete process Controllers – Control Mode – Two – Step mode – Proportional Mode – Derivative Mode – Integral Mode – PID Controllers.

UNIT – IV: PROGRAMMING LOGIC CONTROLLERS(PLC) 9

Programmable Logic Controllers – Basic Structure – Input / Output Processing – Programming – Mnemonics – Timers, Internal relays and counters – Shift Registers – Master and Jump Controls – Data Handling – Analogs Input / Output .

UNIT – V: DESIGN OF MECHATRONICS SYSTEM 9

Stages in designing Mechatronics Systems – Traditional and Mechatronic Design - Possible Design Solutions

Case Studies of Mechatronics Systems, Pick and place robot – Automatic Car Park Systems

Total Hours : 45

TEXT BOOKS:

1. W. Bolton, "Mechatronics", Pearson Education, Second Edition, 1999.

REFERENCES

1. Michael B. Histand and David G. Alciatore, " Introduction to Mechatronics and Measurement Systems", McGraw-Hill International Editions, 2000.
2. Bradley D. A., Dawson D., Buru N.C. and. Loader A.J, "Mechatronics", Chapman and Hall, 1993.
3. Dan Necsulesu, "Mechatronics", Pearson Education Asia, 2002 (Indian Reprint).

19154C63P COMPUTER INTEGRATED MANUFACTURING

UNIT – I: INTRODUCTION 8

CIM-Introduction. - External communication - islands of automation and software-dedicated and open systems-manufacturing automation protocol - product related activities of a company- marketing engineering - production planning - plant operations - physical distribution.

UNIT – II: GROUP TECHNOLOGY AND CAPP 10

History of group technology- role of G.T. in CAD/CAM integration - part families - classification and coding - DCLASS and MICLASS and OPITZ coding systems-facility design using G.T. -benefits of G.T. - cellular manufacturing.

approaches to computer aided process planning -variant approach and generative approaches - CAPP and CMPP process planning systems.

UNIT – III: SHOP FLOOR CONTROL AND BASICS OF FMS 9

Shop floor control -factory data collection system -automatic identification methods- Bar code technology-automated data collection system.

FMS-components of FMS - types -FMS workstation -material handling and storage systems- FMS layout

UNIT – IV: CIM IMPLEMENTATION AND LAN 10

CIM and company strategy - system modeling tools -IDEF models - activity cycle diagram - CIM open system architecture (CIMOSA)- manufacturing enterprise wheel-CIM architecture.

Communication fundamentals- local area networks -topology - LAN implementations - network management and installations.

UNIT – V: OPEN SYSTEM AND DATABASE FOR CIM 8

Open systems-open system inter connection - manufacturing automations protocol and technical office protocol (MAP /TOP)

Development of databases -database terminology- architecture of database systems-data modeling and data associations -relational data bases - database operators - advantages of data base and relational database.

Total Hours : 45

TEXT BOOKS*:*

1. Mikell.P.Groover "Automation, Production Systems and computer integrated manufacturing", Pearson Education 2001.
2. Radhakrishnan P, Subramanyan S.and Raju V., "CAD/CAM/CIM", 2nd Edition New Age International (P) Ltd, New Delhi. 2000.

REFERENCES:

1. Roger Hanman "Computer Intergrated Manufacturing", Addison –Wesley, 1997.
2. Mikell.P.Groover and Emory Zimmers Jr., "CAD/CAM", Prentice hall of India Pvt. Ltd., New Delhi-1.1998.

19154L65P MECHATRONICS LABORATORY

LIST OF EXPERIMENTS

1. Fluid power circuits to control
   (i) single and double acting cylinder
2. Design of circuits with logic sequence using Electro pneumatic trainer kits.
3. Circuits with multiple cylinder sequences in Electro pneumatic using PLC.
4. Servo controller interfacing for open loop
5. Servo controller interfacing for closed loop
6. Stepper motor interfacing with 8051 Micro controller
   (i) full step resolution (ii) half step resolution
7. Computerized data logging system with control for process variables like pressure flow and temperature.

TOTAL : 45

19160C71P TOTAL QUALITY MANAGEMENT

UNIT – I: BASICS OF TQM 9

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT – II: PRINCIPLES OF TQM 9

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Performance Measures – Basic Concepts, Strategy, Performance Measure.

UNIT – III: QUALITY CONCEPTS 9

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Concept of six sigma,

UNIT – IV: TQM TOOLS 9

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, FMEA – Stages of FMEA.

UNIT – V: ISO STANDARDS 9

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, ISO 14000 – Concept, Requirements and Benefits.

TOTAL : 45

TEXT BOOKS:

1. Dale H. Besterfiled, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6.
2. Basker, " TOTAL QUALITY MANAGEMENT", Anuradha Agencies.

REFERENCES:

1. Feigenbaum.A.V. "Total Quality Management", McGraw Hill, 1991.
2. Oakland.J.S. "Total Quality Management", Butterworth – Hcinemann Ltd., Oxford. 1989.
3. Narayana V. and Sreenivasan, N.S. "Quality Management – Concepts and Tasks", New Age International 1996

19154C72P PROCESS PLANNING AND COST ESTIMATION

UNIT-I: WORK STUDY AND TIME STUDY 10

Method study – Definition – Objectives-Motion economy- Principles – Tools and Techniques-Applications – Work measurements- purpose – use – procedure – tools and techniques- Standard time –Time study– principles – applications.

UNIT-II: PROCESS PLANNING 10

Definition – Objective –approaches to process planning- Process planning activities – Finished part requirements- manufacturing sequences- machine selection – material selection parameters-Set of documents for process planning-process chart - production time calculation – selection of cost optimal processes.

UNIT-III: INTRODUCTION TO COST ESTIMATION 7

Objective of cost estimation- costing – cost accounting- classification of cost- Elements of cost.

UNIT-IV: COST ESTIMATION 8

Types of estimates – methods of estimates – data requirements and sources- collection of cost

UNIT-V: PRODUCTION COST ESTIMATION 10

Estimation of material cost, labour cost and over heads, allocation of overheads – Estimation for different types of jobs.

Total Hours : 45

TEXT BOOKS:

1 Sinha.B.P., "Mechanical Estimating and Costing", Tata McGraw-Hill, Publishing Co., 1995
2 Russell.R.S and Tailor, B.W, "Operations Management", PHI, 4th Edition, 2003.

REFERENCES:

1. Phillip.F Ostwalal and Jairo Munez, "Manufacturing Processes and systems", John Wiley, 9th Edition, 1998.
2. Chitale.A.V. and Gupta.R.C., "Product Design and Manufacturing", PHI, 2nd Edition, 2002.

19154C73P APPLIED HYDRAULICS AND PNEUMATICS

UNIT – I: FUNDAMENTALS OF FLUID POWER SYSTEM 9

Fluid power, Advantages Application .Types of fluid power systems, Properties of hydraulic fluids – General types of fluids – Fluid power symbols.

Basics of Hydraulics- Pascals Law- Laminar and Turbulent flow – Reynold's number

UNIT – II: HYDRAULIC SYSTEM & COMPONENTS 9

Sources of Hydraulic Power: Pump classification – Gear pump, Vane Pump, piston pump, construction and working of pumps – pump characteristics – Variable displacement pumps.

Actuators: Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, Double acting special cylinders like tanden, Rodless, Telescopic, Cushioning mechanism, Construction of double acting cylinder, Rotary actuators – Fluid motors, Gear, Vane and Piston motors.

UNIT – III: DESIGN OF HYDRAULIC CIRCUITS 9

Construction of Control Components : Director control valve – 3/2 way valve – 4/2 way valve – Shuttle valve – check valve – pressure control valve –Flow control valve – Fixed and adjustable, electrical control solenoid valves, Relays, ladder diagram.

Accumulators and Intensifiers : Types of accumulators – Accumulators circuits, sizing of accumulators, intensifier – Applications of Intensifier – Intensifier circuit.

UNIT – IV: PNEUMATIC SYSTEMS AND COMPONENTS 9

Pneumatic Components: Properties of air – Compressors – Filter, Regulator, Lubricator Unit – Air control valves, Quick exhaust valves, pneumatic actuators.

Fluid Power Circuit Design, Speed control circuits, synchronizing circuit, , Sequential circuit design for simple applications using cascade method.

UNIT – V: DESIGN OF PNEUMATIC CIRCUITS 9

Servo systems – Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves.

Fluidics – Introduction to fluidic devices, simple circuits,. Fluid power circuits; failure and troubleshooting.

Total Hours : 45

TEXT BOOKS :

1. Anthony Esposito, “Fluid Power with Applications”, Pearson Education 2000.
2. Dudelyt, A. Pease and John T. Pippenger, “Basic Fluid Power”, Prentice Hall, 1987.

REFERENCES:

1. Anthony Lal, “Oil hydraulics in the service of industry”, Allied publishers, 1982.
2. Michael J, Prinches and Ashby J. G, “Power Hydraulics”, Prentice Hall, 1989.
3. Majumdar S.R., “Oil Hydraulics”, Tata McGraw-Hill, 2000.

LIST OF ELECTIVES

19154E44AP GAS DYNAMICS AND JET PROPULSION

UNIT – I: FUNDAMENTALS OF COMPRESSIBLE FLOW 8

Energy and momentum equations for compressible fluid flows, various regions of flows, reference velocities, stagnation state, velocity of sound, critical states, Mach number, critical Mach number, Mach cone, Mach angle, effect of Mach number on compressibility.

UNIT – II: FLOW THROUGH VARIABLE AREA DUCTS 9

Isentropic flow through variable area ducts, T-s and h-s diagrams for nozzle and diffuser flows, area ratio as a function of Mach number, mass flow rate through nozzles and diffusers, effect of friction in flow through nozzles.

UNIT – III : Flow through Constant Area Ducts 10

Flow in constant area ducts with friction (Fanno flow) – Fanno curves and Fanno flow equation, variation of flow propertiesFlow in constant area ducts with heat transfer (Rayleigh flow), Rayleigh line and Rayleigh flow equation, variation of flow properties,

UNIT – IV: NORMAL SHOCK 8

Governing equations, variation of flow parameters like static pressure, static temperature, density, stagnation pressure and entropy across the normal shock, Prandtl - Meyer equation, flow in convergent and divergent nozzle with shock, normal shock in Fanno and Rayleigh flows,

UNIT – V: PROPULSION 10

Aircraft propulsion – types of jet engines – energy flow through jet engines, study of turbojet engine components – diffuser, compressor, combustion chamber, turbine and exhaust systems, performance of turbo jet engines – thrust, thrust power, propulsive and overall efficiencies, ram jet and pulse jet engines

TUTORIAL 15
TOTAL HOURS : 60

Note: (Use of approved gas tables is permitted in the University examination)

TEXT BOOKS

1. Yahya. S.M., "Fundamental of compressible flow", New Age International (p) Ltd., New Delhi, 1996.
2. Patrich.H. Oosthvizen, William E.Carscallen, "Compressible fluid flow", McGraw-Hill, 1997

REFERENCES:

1. Cohen. H., Rogers R.E.C and Sravanamutoo, "Gas turbine theory", Addison Wesley Ltd., 1987.
2. Ganesan. V., "Gas Turbines", Tata McGraw-Hill, New Delhi, 1999
3. Rathakrishnan.E, "Gas Dynamics", Prentice Hall of India, New Delhi, 2001

19154E44BP REFRIGERATION AND AIR CONDITIONING

UNIT – I: REFRIGERATION CYCLES 9

Review of thermodynamic principles of refrigeration. Vapour compression refrigeration cycle - use of P-H charts - multistage systems - cascade system - COP comparison. Vapor absorption refrigeration system. Ammonia water and Lithium Bromide water systems.

UNIT – II: REFRIGERANTS AND SYSTEM COMPONENTS 9

Compressors - reciprocating & rotary (Fundamentals only) - condensers - evaporators - cooling towers. Refrigerants - properties - selection of refrigerants, Alternate Refrigerants, Refrigeration plant controls - testing and charging of refrigeration units. Applications to refrigeration systems - ice plant - food storage plants.

UNIT – III: PSYCHROMETRY 9

Psychrometric processes- use of psychrometric charts - - Grand and Room Sensible Heat Factors - bypass factor - requirements of comfort air conditioning - comfort charts - factors governing optimum effective temperature,

UNIT – IV: COOLING LOAD CALCULATIONS 9

Types of load - design of space cooling load - heat transmission through building. Solar radiation - infiltration - internal heat sources (sensible and latent) - outside air and fresh air load - estimation of total load - Domestic, commercial and industrial systems - central air conditioning systems.

UNIT – V: AIRCONDITIONING SYSTEM 9

Air conditioning equipments – air cleaning and air filters - humidifiers - dehumidifiers - air washers - condenser – cooling tower and spray ponds - elementary treatment of duct design - air distribution system. Thermal insulation of air conditioning systems. - applications: car, industry, stores, and public buildings

Total Hours : 45

TEXT BOOKS:

1. Manohar Prasad, "Refrigeration and Air Conditioning", Wiley Eastern Ltd., 1983.
2. Arora. C.P., "Refrigeration and Air Conditioning", Tata McGraw-Hill New Delhi, 1988.

REFERENCES:

1. Jordon and Prister, “Refrigeration and Air Conditioning”, Prentice Hall of India PVT Ltd., New Delhi, 1985.
2. Stoecker N.F and Jones,"Refrigeration and Air Conditioning"TMH, New Delhi,

19154E44CP NON DESTRUCTIVE TESTING

UNIT I: OVERVIEW OF NDT 9

NDT Versus Mechanical testing, Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterisation. Relative merits and limitations, Various physical characteristics of materials and their applications in NDT., Visual inspection – Unaided and aided.

UNIT II: SURFACE NDE METHODS 9

Liquid Penetrant Testing - Principles, types and properties of liquid penetrants, developers, advantages and limitations of various methods, Testing Procedure, Interpretation of results. Magnetic Particle Testing- Theory of magnetism, inspection materials Magnetisation methods, Interpretation and evaluation of test indications, Principles and methods of demagnetization, Residual magnetism.

UNIT III:THERMOGRAPHY AND EDDY CURRENT TESTING (ET) 9

Thermography- Principles, Contact and non contact inspection methods, Techniques for applying liquid crystals, Advantages and limitation - infrared radiation and infrared detectors, Instrumentations and methods, applications. Eddy Current Testing-Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Probes, Instrumentation, Types of arrangement, Applications, advantages, Limitations, Interpretation/Evaluation.

UNIT IV: ULTRASONIC TESTING (UT) AND ACOUSTIC EMISSION (AE) 9

Ultrasonic Testing-Principle, Transducers, transmission and pulse-echo method, straight beam and angle beam, instrumentation, data representation, A/Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight Diffraction. Acoustic Emission Technique – Principle, AE parameters, Applications.

UNIT V: RADIOGRAPHY (RT) 9

Principle, interaction of X-Ray with matter, imaging, film and film less techniques, types and use of filters and screens, geometric factors, Inverse square, law, characteristics of films - graininess, density, speed, contrast, characteristic curves, Penetrameters, Exposure charts, Radiographic equivalence. Fluoroscopy- Xero-Radiography, Computed Radiography, Computed Tomography

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Baldev Raj, T.Jayakumar, M.Thavasimuthu “Practical Non-Destructive Testing”, Narosa Publishing House, 2014.
2. Ravi Prakash, “Non-Destructive Testing Techniques”, 1st revised edition, New Age International Publishers, 2010

REFERENCES:

1. ASM Metals Handbook, ”Non-Destructive Evaluation and Quality Control”, American Society of Metals, Metals Park, Ohio, USA, 200, Volume-17.
2. ASNT, American Society for Non Destructive Testing, Columbus, Ohio, NDT Handbook,Vol. 1, Leak Testing, Vol. 2, Liquid Penetrant Testing, Vol. 3, Infrared and Thermal Testing Vol. 4, Radiographic Testing, Vol. 5, Electromagnetic Testing, Vol. 6, Acoustic Emission Testing, Vol. 7, Ultrasonic Testing
3. Charles, J. Hellier,“ Handbook of Nondestructive evaluation”, McGraw Hill, New York 2001.
1. 4. Paul E Mix, “Introduction to Non-destructive testing: a training guide”, Wiley, 2nd Edition New Jersey, 2005

19154E44DP RENEWABLE SOURCES OF ENERGY

UNIT– I: FACTORS AFFECTING ENERGY SOURCES: 9

Primary energy sources - world energy resources- energy cycle of the earth –environmental aspects of energy utilisation, CO_2 emissions and Global warming–renewable energy resources and their importance. Potential impacts of harnessing the different renewable energy resources.

UNIT – II: SOLAR ENERGY : 9

Principles of Solar energy collection -Solar radiation - measurements - instruments - data and estimation- types of collectors - characteristics and design principles of different type of collectors - performance of collectors - testing of collectors. Solar thermal applications - water heaters and air heaters - performance and applications - simple calculations - solar cooling - solar drying - solar ponds - solar tower concept - solar furnace.

UNIT – III: WIND, TIDAL AND GEO THERMAL ENERGY 9

Energy from the wind - general theory of windmills - types of windmills - design aspects of horizontal axis windmills - applications. Energy from tides and waves – working principles of tidal plants and ocean thermal energy conversion plants - power from geothermal energy - principle of working of geothermal power plants.

UNIT – IV: BIO ENERGY 9

Energy from bio mass & bio gas plants -various types - design principles of biogas plants - applications. Energy from wastes - waste burning power plants - utilization of industrial and municipal wastes - energy from the agricultural wastes.

UNIT – V: RECENT ADVANCEMENTS 9

Direct energy conversion (Description, principle of working and basic design aspects only) – Magneto hydrodynamic systems (MHD) - thermoelectric generators – thermionic generators -

fuel cells - solar cells - types,

Total Hours : 45

TEXT BOOKS

1. Rai G.D, "Non conventional Energy sources" (1999) Khanna Publishers, New Delhi
2. Ashok V Desai, "Non-conventional Energy", Wiley Eastern Ltd, New Delhi, 1990

REFERENCES

1. Sukhatme, S.P., Solar Energy, 2nd edition, TMH, 2003
2. Sulton, "Direct Energy Conversion", McGraw-Hill, 1966.
3. Duffie and Beckmann, "Solar Energy Thermal Processes, John Wiley, 1974.

19154E54BP COMPOSITE MATERIALS

1. INTRODUCTION TO COMPOSITES 8

Fundamentals of composites - need for composites – Enhancement of properties - classification of composites – Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC) – Reinforcement – Particle reinforced composites, Fibre reinforced composites. Applications of various types of composites.

2. POLYMER MATRIX COMPOSITES 12

Polymer matrix resins – Thermosetting resins, thermoplastic resins – Reinforcement fibres – Rovings – Woven fabrics – Non woven random mats – various types of fibres. PMC processes - Hand lay up processes – Spray up processes – Compression moulding – Reinforced reaction injection moulding - Resin transfer moulding – Pultrusion – Filament winding – Injection moulding. Fibre reinforced plastics (FRP), Glass fibre reinforced plastics (GRP).

3. METAL MATRIX COMPOSITES 9

Characteristics of MMC, Various types of Metal matrix composites Alloy vs. MMC, Advantages of MMC, Limitations of MMC, Metal Matrix, Reinforcements – particles – fibres. Effect of reinforcement - Volume fraction – Rule of mixtures. Processing of MMC – Powder metallurgy process - diffusion bonding – stir casting – squeeze casting.

4. CERAMIC MATRIX COMPOSITES 9

Engineering ceramic materials – properties – advantages – limitations – Monolithic ceramics - Need for CMC – Ceramic matrix - Various types of Ceramic Matrix composites- oxide ceramics – non oxide ceramics – aluminium oxide – silicon nitride – reinforcements – particles- fibres- whiskers. Sintering - Hot pressing – Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing).

5. ADVANCES IN COMPOSITES 7

Carbon /carbon composites – Advantages of carbon matrix – limitations of carbon matrix Carbon fibre – chemical vapour deposition of carbon on carbon fibre perform. Sol gel technique. Composites for aerospace applications.

TOTAL : 45

TEXT BOOKS

1. Mathews F.L. and Rawlings R.D., "Composite materials: Engineering and Science", Chapman and Hall, London, England, 1st edition, 1994.
2. Chawla K.K., "Composite materials", Springer – Verlag, 1987

REFERENCES

1. Clyne T.W. and Withers P.J., "Introduction to Metal Matrix Composites", Cambridge University Press, 1993.
2. Sharma S.C., "Composite materials", Narosa Publications, 2000.
3. "Short Term Course on Advances in Composite Materials, Composite Technology Centre, Department of Metallurgy", IIT- Madras, December 2001.

19154E54CP ROBOTICS

UNIT-I: INTRODUCTION OF ROBOT BASICS 7

Robot – Definition – Robot Anatomy – Co-ordinate Systems, Work Envelope, types and classification – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and Their Functions – Need for Robots – Different Applications

UNIT-II: ROBOT ACTUATORS AND END EFFECTORS 10

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of all these Drives

End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered Internal Grippers and External Grippers;

UNIT-III: SENSORS AND MACHINE VISION SYSTEM 10

Requirements of a sensor, Principles and Applications of the following types of sensors – Position of sensors - Piezo Electric Sensor, LVDT, Optical Encoders, Range Sensors, Proximity Sensors - nductive, Hall Effect, Capacitive, Ultrasonic Touch Sensors, Sensing and Digitizing Image Data – Signal Conversion, Image Storage, Lighting Techniques. Image Processing and Analysis – Data Reduction, Segmentation, Feature Extraction, Object Recognition.

UNIT-IV: ROBOT KINEMATICS AND ROBOT PROGRAMMING 10

Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional),
Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effecter commands, and Simple programs

UNIT – V: IMPLEMENTATION AND ROBOT ECONOMICS 8

RGV, AGV; Implementation of Robots in Industries – Various Steps; Safety Considerations for Robot Operations; Economic Analysis of Robots – Pay back Method, Rate of Return Method.

Total Hours : 45

TEXT BOOKS:

1. M.P.Groover, "Industrial Robotics – Technology, Programming and Applications", McGraw-Hill, 2001

REFERENCES

1. Fu.K.S. Gonzalz.R.C., and Lee C.S.G., "Robotics Control, Sensing, Vision and Intelligence", McGraw-Hill Book Co., 1987

2. Yoram Koren, "Robotics for Engineers", McGraw-Hill Book Co., 1992
3. Janakiraman.P.A., "Robotics and Image Processing", Tata McGraw-Hill, 1995

19154E54DP DESIGN OF JIGS, FIXTURES AND PRESS TOOLS

UNIT-I: TYPES AND FUNCTIONS OF JIGS AND FIXTURES 8

Tool design objectives - Production devices - Inspection devices - Materials used in Jigs and Fixtures – Types of Jigs - Types of Fixtures-Mechanical actuation-pneumatic and hydraulic actuation-Analysis of clamping force.

UNIT-II: JIGS 9

Drill bushes –different types of jigs-plate latch, channel, box, post, angle plate, angular post, turnover, pot jigs-. Air operated Jigs components. Design and development of Jigs for given components.

UNIT-III: FIXTURES 9

General principles of boring, lathe, milling and broaching fixtures- Grinding, planning and shaping fixtures, assembly, Inspection and welding fixtures- Modular fixtures. Design and development of fixtures for given component.

UNIT-IV: PRESS WORKING 10

Press working terminology-Presses and press accessories-Computation of capacities and tonnage requirements. Elements of progressive combination and compound dies:. Bolster plate-punch plate-punch holder-guide pins and bushes.

UNIT-V: DESIGN AND DEVELOPMENT OF DIES 9

Design and development of progressive and compound dies for Blanking and piercing operations. Bending dies – development of bending dies-forming and drawing dies-Development of drawing dies.

Total Hours : 45

(Use of approved design data book is permitted)

TEXT BOOKS:

1. Edward G Hoffman, "Jigs & Fixture Design", Thomson – Delmar Learning, Singapore 2004
2. Donaldson. C, "Tool Design", Tata McGraw-Hill, 1986

REFERENCES:

1. Kempster, "Jigs & Fixtures Design", The English Language Book Society", 1978
2. Joshi, P.H., "Jigs & Fixtures", Second Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi 2004
3. "Fundamentals of Tool Design", CEEE Edition, ASTME, 1983
4. Design Data Handbook PSG College of Technology, Coimbatore

19154E64AP UNCONVENTIONAL MACHINING PROCESSES

UNIT – I: INTRODUCTION: 5

Non traditional machining Process – Introductions-Need–types- Brief overview of all techniques.

UNIT – II: AJM, WJM & USM 10

Abrasive Jet Machining – Water Jet Machining – Ultrasonic Machining. (AJM, WJM and USM). Working Principles – equipment used – Process parameters – MRR-Variation in techniques used – Applications.

UNIT – III: EDM 8

Electric Discharge Machining (EDM)- working Principles-equipments-Process Parameters-MRR- electrode / Tool – Power Circuits-Tool Wear – Dielectric – Flushing – Wire cut EDM – Applications.

UNIT – IV: ECM & ECG 12

Chemical Machining and Electro-Chemical machining (CHM and ECM)-Etchants-maskant-techniques of applying maskants-Process Parameters – MRR-Applications.

Principles of ECM-equipments-MRR-Electrical circuit-Process Parameters-ECG and ECH Applications.

UNIT – V: LBM, PAM & EBM 10

Laser Beam machining (LBM), plasma Arc machining (PAM) and Electron Beam Machining (EBM). Principles-Equipment-Types-Beam control techniques – Applications.

Total Hours : 45

TEXT BOOKS:

1. Vijay.K. Jain "Advanced Machining Processes" Allied Publishers Pvt. Ltd., New Delhi (2002) ISBN 81-7764-294-4.
2. Benedict. G.F. "Nontraditional Manufacturing Processes" Marcel Dekker Inc., New York (1987).

REFERENCES:

1. Pandey P.C. and Shan H.S. "Modern Machining Processes" Tata McGraw-Hill, New Delhi (1980).
2. Mc Geough, "Advanced Methods of Machining" Chapman and Hall, London (1998).

19154E64BP NUCLEAR ENGINEERING

UNIT-I: **NUCLEAR PHYSICS** **9**

Nuclear model of an atom-Equivalence of mass and energy-binding- radio activity-half life-neutron interactions-cross sections.

UNIT-II: NUCLEAR REACTIONS AND REACTION MATERIALS 9

Mechanism of nuclear fission and fusion- radio activity- chain reactions-critical mass and composition-nuclear fuel cycles and its characteristics-uranium production and purification-Zirconium, thorium, beryllium.

UNIT-III: REPROCESSING 9

Reprocessing: nuclear fuel cycles-spent fuel characteristics-role of solvent extraction in reprocessing-solvent extraction equipment.

UNIT-IV: NUCLEAR REACTOR 9

Nuclear reactors: types of fast breeding reactors-design and construction of fast breeding reactors-heat transfer techniques in nuclear reactors- reactor shielding. Fusion reactors.

UNIT-V: SAFETY AND DISPOSAL 9

Safety and disposal: Nuclear plant safety-safety systems-changes and consequences of accident-criteria for safety-nuclear waste-types of waste and its disposal-radiation hazards and their prevention-weapons proliferation.

Total Hours : 45

TEXT BOOKS :

1. Thomas J.Cannoly, "Fundamentals of nuclear Engineering" John Wiley 1978.

REFERENCES:

1. Collier J.G., and Hewitt G.F, "Introduction to Nuclear power", Hemisphere publishing, New York. 1987
2. Wakil M.M.El., "Power Plant Technology" – McGraw-Hill International, 1984.

19154E64CP INTELLECTUAL PROPERTY RIGHTS

UNIT I: INTRODUCTION 9

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II: REGISTRATION OF IPRs 10

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III: AGREEMENTS AND LEGISLATIONS 10

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV: DIGITAL PRODUCTS AND LAW 9

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT V: ENFORCEMENT OF IPRs 7

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL :45 PERIODS

TEXT BOOKS:

1. S.V. Satarkar, Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002.
2. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012

REFERENCES:

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli,"Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.

1. 3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

19148E64DP MATHEMATICS FOR INDUSTRIAL OPERATIONS

Unit I Introduction to Linear Programming (LP)

Introduction to applications of operations research in functional areas of management. Linear Programming – formulation, solution by graphical and simplex methods (Primal – Penalty, Two Phase), Special cases, Sensitivity Analysis.

Unit II Transportation and Assignment models

Transportation Models (Minimizing and Maximizing Cases) – Balanced and unbalanced cases – Initial Basic feasible solution by N-W Corner Rule, Least cost and Vogal's approximation methods. Check for optimality. Solution by MODI / Stepping Stone method. Cases of degeneracy. Transportation Models. Assignment Models (Minimizing and Maximizing Cases) – Balanced and Unbalanced Cases. Solution by Hungarian and Branch and Bound Algorithms. Travelling Salesman problem. Crew Assignment Models.

Unit III Integer Linear Programming and Game Theory

Solution to pure and mixed integer programming problem by Branch and Bound and cutting plane algorithms. Game Theory – Two person zero sum games – Saddle point, Dominance Rule, Convex Linear Combination (Averages), methods of matrices, graphical and L.P. Solutions.

Unit IV Dynamic Programming, Simulation and Decision Theory

Dynamic Programming (DP) – Deterministic Cases – Maximizing and Minimizing problems. DP techniques for L.P. problems, decision making under risk – decision trees – decision making under uncertainty. Application of simulation techniques for decision making.

Unit V Queuing Theory and Replacement Models

Basic elements of the Queuing Model, of the Poisson and Exponential Distributions, Queuing with combined arrivals and departures, Queues with priorities for service, P.E.R.T. & C.P.M. and replacement model: drawing networks – identifying critical path – probability of completing the project within given time – project crashing – optimum cost and optimum duration.

Total no. of hrs: 60 hrs.

TEXT BOOK

1. K. Kannan, Operation Research, Anuradha publication
2. Hamdy, A. Taha, Operation Research: An Introduction, Prentice-Hall of India; New Delhi 2007.
3. Premkumar Gupta, Hira, Operations Research, S. Chand, 2008

REFERENCES BOOKS

1. J. K Sharma, Operations Research: Theory and Applications, Macmillan India, 2007.
2. Barry Render, Ralph M. Stair. Jr. Michael E. Hanna, Quantitative Analysis for Management, 9/e PHI Pvt. Ltd New Delhi 2007.
3. N.D. Vohra, Quantitative Techniques in Management, TMH, New Delhi, 2007
4. Winston, Operations Research, Cengage, 2008.

19160E74AP QUALITY CONTROL AND RELIABILITY ENGINEERING

UNIT - I : INTRODUCTION 10

Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality cost-Variation in process- factors – process capability – process capability studies and simple problems –

UNIT - II : CONTROL CHARTS FOR VARIABLES AND ATTRIBUTES 8 Theory of Control chart-variables-X- chart, R –chart, control chart for attributes –control chart for proportion or fraction defectives – p chart and np chart

UNIT-III : ACCEPTANCE SAMPLING 9

Lot by lot sampling – types – probability of acceptance in single, double, – O.C. curves – producer's Risk and consumer's Risk. AQL, LTPD, AOQL concepts- - uses of standard sampling plans.

UNIT –IV: LIFE TESTING - RELIABILITY 9

Life testing – Objective – failure data analysis, Mean failure rate, mean time to failure, mean time between failure, hazard rate, system reliability, series, parallel and mixed configuration – simple problems. Maintainability and availability – simple problems**.**

UNIT-V : QUALITY AND RELIABLITY 9

Reliability improvements – techniques- use of Pareto analysis – design for reliability – redundancy unit and standby redundancy – Optimization in reliability

Total Hours : 45

Note : Use of approved Statistical table permitted in the examination.

TEXT BOOKS:

1. R.C.Gupta, "Statistical Quality control", Khanna Publishers, 1997.
2. L.S.Srinath, "Reliability Engineering", Affiliated East west press, 1991.

REFERENCES:

1. Monohar Mahajan, "Statistical Quality Control", Dhanpat Rai & Sons, 2001
2. Besterfield D.H., "Quality Control", Prentice Hall, 1993.
3. Sharma S.C., "Inspection Quality Control and Reliability", Khanna Publishers, 1998.

19154E74BP VIBRATION AND NOISE CONTROL

1. **BASICS OF VIBRATION** **9**

Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear and non linear vibration, response of damped and undamped systems under harmonic force, analysis of single degree and two degree of freedom systems.

2. BASICS OF NOISE **9**

Introduction, amplitude, frequency, wavelength and sound pressure level, addition, subtraction and averaging decibel levels, noise dose level, legislation, measurement and analysis of noise, measurement environment, equipment, frequency analysis,

3. AUTOMOTIVE NOISE SOURCES **9**

Noise Characteristics of engines, engine overall noise levels, assessment of combustion noise, assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine accessory contributed noise, transmission noise, brake noise.

4. CONTROL TECHNIQUES **9**

Vibration isolation, tuned absorbers, un tuned viscous dampers, damping treatments, application dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers.

5. SOURCE OF NOISE AND CONTROL **9**

Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption.

TOTAL : 45

TEXT BOOKS

1. Singiresu S.Rao - “Mechanical Vibrations” - Pearson Education, ISBM –81-297-0179-0 - 2004.
2. Kewal Pujara “Vibrations and Noise for Engineers, Dhanpat Rai & Sons, 1992.

REFERENCES

1. Bernard Challen and Rodica Baranescu - “Diesel Engine Reference Book” - Second edition - SAE International - ISBN 0-7680-0403-9 – 1999.
2. Julian Happian-Smith - “An Introduction to Modern Vehicle Design”- Butterworth-Heinemann, ISBN 0750-5044-3 - 2004
3. John Fenton - “Handbook of Automotive body Construction and Design Analysis - Professional Engineering Publishing, ISBN 1-86058-073- 1998.

19160E74CP PRINCIPLES OF MANAGEMENT

(COMMON TO ALL BRANCHES)

UNIT I - Nature of Management 9

Definitions, meaning, scope, administration and management - Science and art Mgmt as a profession, University of management Hierarchy (Top, middle and supervisory, Levels), Principles of Management

UNIT II - Development of Management Thought 9

Taylor and Scientific Management, Principles of Scientific Management Contributions of fayol,Barnard and social system theory, Contributions of Herbert Simon, Contributions of Peter Drucker, Contributions of behavioral scientists ,Contribution of system scientists

UNIT III - Planning and organizing 9

Definition and features of planning, Nature of planning, Importance of planning
Types of planning, Steps in planning. Management by objectives, Strategies and policies, Definition of organization, Importance of organization, Principles of organization, Span of management

UNIT IV - Direction and Coordination 9

Meaning, definition, principles of direction, Techniques of direction - Meaning of supervision, Functions of supervisor, Meaning of coordination Element and features of coordination, Importance of coordination Cooperation and coordination systems approach Steps for effective coordination Meaning and causes of conflicts, Management of conflicts

UNIT V – Controlling 9

Definition, Meaning .elements, steps in establishing control procedure Control Techniques, Requirements of good control systems Budget –meaning, definitions, types Zero based budgeting, responsibility accounting, budgetary control, Report –meaning types PERT and CPM Management by Exception

Total Hours: 45

Textbooks:

1. Prasad L.M ., Principles and practice of Management ,New Delhi Sultan Chand and sons ,1998

References:

1. saxena ,s.c principles and practice of management Agra : sahitya bhawan 1998
2. Koontz Harold and others ,Management New York :McGraw Hill 1980
3. stoner james and others ,Management ,New Delhi :PHI ,1997
4. Dale Yoder : Personnel Management and industrial Relations ,New Delhi PHI 1974

19154E74DP INDUSTRIAL ENGINEERING

Unit I Introduction to Industrial Engineering

Introduction to Industrial Engineering – Evolution of modern Concepts in Industrial Engineering – Functions of Industrial Engineering – Field of application of Industrial Engineering Product Development and research- Design function – Objectives of design- Manufacturing Vs purchase- Development of designs- Experimentation- prototype production and testing simplification and standardization – Selection of materials and processes- Human factors in design- value Engineering job plan.

Unit II Plant layout

Plant layout - Types of layouts- Product, process, fixed, Group technology, Flexible manufacturing system- elementary concepts and structure, flow charts, use of time study data, physical facilities- Constructional details- environmental control like lighting, temperature, humidity, Ventilation, noise and dust, Industrial waste disposal-

Unit III - Material handling

Principles of material handling- Types of material handling equipments- Selection and application maintenance and replacements- Preventive and brake- down maintenance and replacement- Preventive and brake- down maintenance- economic aspect, Replacement of equipment- Method of providing for depreciation- Determination of economic life, Criteria for selection of equipment- Simple problem.

Unit IV Organization,

Principles of organization, Development of Organizational charts like line, staff, line and staff & functional types. Resources, Human relationship. Factory acts, payment of wages, workmen compensation, E.S.I. Sales management & forecasting cost accounting, Budgetary control. , partnership, Joint stock & co-operative stores.

Unit V Labour welfare and Industrial Safety

Workers participation in management- Labour welfare and social security- Industrial safety- Important statutory provisions in labour legislation. Safety engineering, accident prevention program , safety design concepts, fire protection-industrial noise-Legislations on safety in industry . Recent Developments in maintenance methods-RCM- CBM –DMS – TPM etc.

References:

1. Industrial Engineering and Management - O. P. Khanna
2 Industrial Engineering & Production Management, M Mahajan - Dhanpat Rai (pub).
3. Industrial Engineering - Dr. B. Kumar – Khanna pub.

DEPARTMENT OF MECHANICAL ENGINEERING

PROGRAMME HANDBOOK

M.Tech. – Manufacturing Technology

FULL TIME PROGRAMME

Regulation 2019

Semester - 1

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
19248S11E	Advanced Engineering Mathematics	3	1	-	4
19254C12	Theory of Metal Cutting	4	-	-	4
19254C13	Advanced Manufacturing Processes	4	-	-	4
19254C14	Mechanical Metallurgy	4	-	-	4
19254C15	Automated Computer Integrated Manufacturing Systems	4	-	-	4
19254E16_	Elective – I	3	-	-	3
19254L17	CIM Lab	-	-	3	3
19254CRS	Research Led Seminar				1
TOTAL NO. OF CREDITS					**27**

Semester - 2

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
19254C21	Production Management	4	-	-	4
19254C22	MEMS and Nano Technology	4	-	-	4
19254C23	Manufacturing Metrology and Quality Control	4	-	-	4
19254E24_	Elective - II	3	-	-	3
19254E25_	Elective - III	3	-	-	3
19254L26	Automation Lab	-	-	3	3
192TECWR	Technical Writing/Seminar	-	-	3	3
19254CRM	Research Methodology	3	-	-	3
19254CBR	Participation in Bounded Research				2
TOTAL NO. OF CREDITS					**29**

Semester - 3

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
19254C31	Metal Forming Process	4	-	-	4
19254E32_	Elective - IV	3	-	-	3
19254E33_	Elective - V	3	-	-	3
19254E34_	Elective - VI	3	-	-	3
19254P35	Project Work Phase - I	-	-	10	10
19254CRS	Design Project /Socio- Technical Project	6	-	-	6
TOTAL NO. OF CREDITS					**29**

Semester – 4

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
19254P41	Project Work Phase - II	-	-	15	15
TOTAL NO. OF CREDITS					**15**

ELECTIVE –I

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
19254E16A	Materials Management and Logistics	3	-	-	3
19254E16B	Financial Management	3	-	-	3
19254E16C	Manufacturing Information Systems	3	-	-	3

ELECTIVE –II

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
19254E24A	Finite Element Application in Manufacturing	3	-	-	3
19254E24B	Lean Manufacturing	3	-	-	3
19254E24C	Design and Analysis of Experiments	3	-	-	3

ELECTIVE –III

Course Code	Title of Paper	L	T	P	C
19254E25A	Advanced Metrology and Computer Aided Inspection	3	-	-	3
19254E25B	Maintenance Management	3	-	-	3
19254E25C	Optimization Techniques	3	-	-	3

ELECTIVE –IV

Course Code	Title of Paper	L	T	P	C
19254E32A	Manufacturing Systems and Simulation	3	-	-	3
19254E32B	Instrumentation and Control Engineering	3	-	-	3
19254E32C	Artificial Intelligence and Neural Networks	3	-	-	3

ELECTIVE -V

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
19254E33A	Product Design and Development	3	-	-	3
19254E33B	Fluid Power Automation	3	-	-	3

ELECTIVE -VI

Course Code	Title of Paper	L	T	P	C
19254E34A	Advanced Material Technology	3	-	-	3
19254E34B	Industrial Ergonomics	3	-	-	3

Total No of Credits - 100

DEPARTMENT OF MECHANICAL ENGINEERING

M.Tech., MANUFACTURING TECHNOLOGY – FULL TIME PROGRAMME SYLLABI-REGULATIONS- 2019

I - SEMESTER

19254H12 - THEORY OF METAL CUTTING **4 0 0 4**

OBJECTIVE:
To know about the mechanics of chip formation, to analyse the tool failure, and thermodynamics involved in metal cutting and evaluation of tool materials.

UNIT- I: Orthogonal Cutting: **12**
Orthogonal Cutting – Theories of merchant – Lee and Shaffer – Merchant's circle diagram – shear angle relationship – chip velocity – force – velocity relationships

UNIT-II: Chip Formation: **12**
Mechanism of chip formation – Types of Chips – discontinuous,continuous continuous with BUE – Chip Formation in drilling and Milling – effect of cutting variables of chip reduction coefficient.

UNIT-III : Tool Life and Machinability: **12**
Tool Failure:Mode of Plastic failure – Measurement of tool wear – tool life tests – tool life equation for variable theories – variables affecting tool life – machinability – machinability index – problems.

UNIT-IV: Thermal Analysis in Metal Cutting: **12**
Thermodynamics of orthogonal cutting – analysis of temperature at shear plane and tool face – experimental methods for temperature measurement.

UNIT-V: Chatter: **12**
Chatter - Importance of Chatter in machining – types of chatter – avoidance of chatter.Tools materials – requirements – alloy tools - HSS – carbides –PCD and CBN- properties and application.

TOTAL: 60 PERIODS

BOOKS FOR REFERENCES:

1. Juneja .B.L, "Fundamentals of Metal cutting and Machine tools", New Age International, 1995.

2. Bhattacharya.A, "Metal Cutting Theory and Practice", Central book publications.

3. Kuppusamy .G, "Principle of Metal Cutting", University Press,1996.
4. Shaw .M.C, "Metal Cutting Principles",I BH Publications,1992.
5. Armarego E.J.A and Brown R.H, "The Machining of Metals", Prentice Hall,1969

9254H13 ADVANCED MANUFACTURING PROCESSES 4 0 0 4

AIM:

To expose the students in the art of manufacturing new products due to the development of new materials and processes. The students will totally get a feel of the relevant suitable process while evaluating and deciding.

OBJECTIVE:

• To inform the students about the various alternative manufacturing processes available.
• To develop an altitude to look for the unconventional manufacturing process to machine
• To make them to understand and appreciate the latest manufacturing process for micro fabrication and devices.

UNIT I NEWER MACHINING PROCESSES - I 12

(Non thermal energy) – Abrasive machining – water jet machining - ultrasonic machining – chemical machining – electro chemical machining – construction working principle – steps - types – process parameters – derivations – problems, merits, demerits and applications .

UNIT II NEWER MACHINING PROCESS – II 12

Wire cut EDM - Electro chemical machining – ECG - Electric discharge machining – construction – principle – types – control - circuits – tool design – merits, demerits & applications.

UNIT III NEWER MACHINING PROCESS – III 12

Laser beam machining – Electron beam machining – Plasma arc machining – Ion beam machining – construction working principle types – process parameter – derivations – problems, merits, demerits and applications.

UNIT IV FABRICATION OF MICRO DEVICES 12

Semiconductors – films and film depurification – Oxidation - diffusion – ion implantation – etching – metallization – bonding – surface and bulk machining – LIGA Process – Solid free form fabrication.

UNIT V MICROFABRICATION TECHNOLOGY 12

Wafer preparation – monolithic processing – moulding – PCB board hybrid & mcm technology – programmable devices & ASIC – electronic material and processing.–
steriolithography SAW devices, Surface Mount Technology,

TOTAL: TOTAL: 60 PERIODS

BOOKS FOR REFERENCES:

1. Serope kelpekijian & stevan r. schmid- manufacturing process engg material – 2003
2. Micro senors Mems & smart devices- Julian W.Hardner – 2002
3. Brahem T. Smith, Advanced machining I.F.S. UK 1989.
4. Jaeger R.C., Introduction to microelectronic fabrication Addison Wesley, 1988.
5. Nario Taniguchi – Nano technology – Oxford University Press 1996.
6. Pandey P.C. & Shan HS Modern Machining Processes, Standard Publishing Co., 1980

7. More Madon, Fundamentals of Microfabrication, CRC Press, 1997.

19254H14 MECHANICAL METALLURGY 4 0 0 4

OBJECTIVE:

To study about the behaviour of Metals during the loading conditions related to distribution of Stress and Strain. To know about the fracture of metals and various test procedures.

UNIT-I: Tensile Study: 12

Study of Engineering stress-strain curve: Derivation of tensile strength , yield strength ductility, Young's modulus, resilience and toughness from stress strain curves, study of stress-strain curves for different materials-true stress-strain curve: true stress at ultimate load, true fracture strain, true uniform strain, true necking strain-necking factor-effect of strain rate, temperature- test of flow properties-Notch tensile test-tensile properties of steel-strengthening theory- strain hardening-strain aging-Yield point phenomena-Solid solution strengthening-Martensite strengthening-Grain refinement,

UNIT-II: Hardness and Toughness: 12

Hardness and Toughness: Hardness introduction, Hardness measurement methods-Brinell hardness, Meyer hardness, Vickers hardness, Rockwell hardness and Micro hardness- Relationship between hardness and the flow curve-Hardness at higher temperatures-Toughness –introduction, Toughness measurements: Charpy, Izod and instrumented Charpy-TTT curves: Significance, metallurgical factors affecting the curves, Drop weight test, explosion crack starter test.

UNIT-III: Fatigue: 12

Fatigue study: Introduction: Different stress cycles, S-N curves, Goodman diagram, Soderberg diagram, Gerbar diagram-Cyclic stress curve-Low cycle fatigue- Strain life equation-Fatique mechanism-High cycle fatigue-Effect of folloeing parameters on fatigue: Mean stress , stress concentration, specimen size, surface roughness, residual stress, micro structure and temperature. Fatique crack propagation.

UNIT-IV: Fracture Behaviour: 12

Fracture – Introduction –Types – Ductile and Brittle Cohesive Strength of Metals- Griffith Theory-Metallographic Examination of Fracture – Fractography – Notch Effect – Concept of Fracture curve – Fracture under combined stresses- Environment sensitive fracture: Hydrogen Embrittlement and Corrosion Cracking

UNIT-V: Creep: 12

Creep: Creep Curve – Stress rupture test- Structural changes during creep- Creep deformation-Deformation Mechanisms Maps – Activation Energy for Steady state creep – Fracture at higher temperatures.

TOTAL: 60 PERIODS

BOOKS FOR REFERENCES:

1. George E. Dieter, "Mechanical Metallurgy", Mc Graw Hill, NewYork, 1988.
2. M.A. Meyers and K.Chawla, "Mechanical Metallurgy", PHI.
3. Metals Hand Book, "Mechanical Testing", Vol. 8, 9th Ed., ASM.
4. Thomas Countney.H., "Mechanical Behaviour of Materials",McGraw Hill, 2nd Ed., 2000.
5. Hertzberg R.W., "Deformation and Fracture Mechanics of Engineering Materials", 2ne Ed., John Wiley & Sons. 1983.

19254H15 AUTOMATED COMPUTER INTEGRATED MANUFACTURING SYSTEMS 4 0 0 4

AIM:

To stress the role of computers in production.

OBJECTIVE:

To teach the role of computers in processing the information knowing across the various Stages and various departments in a manufacturing concern.

UNIT I INTRODUCTION 10

Introduction to CAD, CAM, CAD/CAM and CIM - Evolution of CIM – CIM wheel and cycle – Production concepts and mathematical models – Simple problems in production models – CIM hardware and software – Major elements of CIM system – Three step process for implementation of CIM – Computers in CIM – Computer networks for manufacturing – The future automated factory – Management of CIM – Impact of CIM on personnel – CIM status.

UNIT II AUTOMATED MANUFACTURING SYSTEMS 14

Automated production line – system configurations, work part transfer mechanisms – Fundamentals of Automated assembly system – System configuration, Part delivery at workstations – Design for automated assembly – Overview of material handling equipments – Consideration in material handling system design – The 10 principles of Material handling. Conveyor systems – Types of conveyors – Operations and features. Automated Guided Vehicle system – Types of vehicles and AGVs applications – Vehicle guidance technology – Vehicle management and safety. Storage system performance – storage location strategies – Conventional storage methods and equipments – Automated storage/Retrieval system and Carousel storage system Deadlocks in Automated manufacturing systems – Petrinet models – Applications in Dead lock avoidance.

UNIT III GROUP TECHNOLOGY AND FMS 14

Part families – Visual – Parts classification and coding – Production flow analysis – Grouping of parts and Machines by rank order clustering method – Benefits of GT – Case studies. FMS – Components – workstations – FMS layout configurations – Computer control systems – FMS planning and implementation issues – Architecture of FMS – flow chart showing various operations in FMS – Machine cell design – Composite part concept, Holier method, Key machine concept – Quantitative analysis of FMS – Bottleneck model – Simple and complicated problems – Extended Bottleneck model - sizing the FMS, FMS applications, Benefits.

UNIT IV PROCESS PLANNING 12

Process planning – Activities in process planning, Information’s required. From design to process planning – classification of manufacturing processes – Selection of primary manufacturing processes – selecting among casting process, forming process and machining process. Sequencing of operations according to Anteriorities – various examples – forming of Matrix of Anteriorities – case study. Typical process sheet – case studies in Manual process planning. Computer Aided Process Planning – Process planning module and data base – Variant process planning – Two stages in VPP – Generative process planning – Flow chart showing various activities in generative PP – Semi generative process planning.

UNIT V TYPES OF PROCESS CONTROL AND AUTOMATIC DATA CAPTURE 10

Introduction to process model formulation – linear feedback control systems – Optimal control – Adaptive control –Sequence control and PLC. Computer process control – Computer process interface – Interface hardware – Computer process monitoring – Direct digital control and Supervisory computer control. Overviews of Automatic identification methods – Bar code technology – Other Automatic data capture technologies.

TOTAL: 60 PERIODS

BOOKS FOR REFERENCES:

1. Mikell P.Groover, “Automation, Production system and Computer integrated Manufacturing”, Prentice Hall of India Pvt. Ltd., 2008.
2. Radhakrishnan,P., Subramanian,S., and Raju,V., “CAD/CAM/CIM” New Age International Publishers, 2000.
3. James A.Retrg, Herry W.Kraebber, “Computer Integrated Manufacturing”, Pearson Education, Asia, 2001.
4. Viswanathan,N., and Narahari,Y., “Performance Modeling and Automated Manufacturing Systems”, Prentice Hall of India Pvt. Ltd., 2000.
5. Alavudeen and Venkateshwaran, “Computer Integrated Manufacturing”, PHI Learning Pvt. Ltd., New Delhi, 2008.

19254L19 CIM LAB 0 0 3 3

AIM:

To impart the knowledge on training the students in the area of CAD/CAM.

OBJECTIVES:

To teach the students about the drafting of 3D components and analyzing the same using various CAD/CAM software’s.

CAM LABORATORY

1. Exercise on CNC Lathe: Plain Turning, Step turning, Taper turning, Threading, Grooving & canned cycle
2. Exercise on CNC Milling Machine: Profile Milling, Mirroring, Scaling & canned cycle.
3. Study of Sensors, Transducers & PLC: Hall-effect sensor, Pressure sensors, Strain gauge, PLC, LVDT, Load cell, Angular potentiometer, Torque, Temperature & Optical Transducers.
4. Mini project on any one of the CIM elements is to be done. This can be either a software or hardware simulating a CIM element. At the end of the semester, the students has to submit a mini report and present his work before a Committee.

CAD LABORATORY

2D modeling and 3D modeling of components such as

1. Bearing
2. Couplings
3. Gears
4. Sheet metal components
5. Jigs, Fixtures and Die assemblies.

TOTAL: 30 PERIODS.

SEMESTER II

19254H21 PRODUCTION MANAGEMENT 4 0 0 4

OBJECTIVE:

To gain knowledge in operation management principles and the related quantitative approaches.

UNIT-I : Manufacturing System: 12

The concept of system - types of manufacturing system- the concept of a model - model classification - model building - decision making approaches. Forecasting: qualitative and quantitative methods - moving averages- single and multiple regression models.

UNIT-II : Aggregate Planning : 12

Methods of aggregate planning- graphical and charting methods, trial and error, transportation method- concepts of linear decision rule.

UNIT-III: Inventory Management Systems and Models 12

EOQ, model (without and with shortages)- inventory models allowing price breaks, EPQ model - single period inventory model - inventory control systems - P,Q and S-s system - selective inventory control techniques.

UNIT-IV: MRP & JIT: 12

Materials requirement planning (MRP) - master production schedule, bill of materials, MRP concepts, lot sizing - lot-for-lot technique, EOQ approach, silver-meal approach, period order quantity approach, least unit cost approach, least total cost approach. Principles of JIT production pull and push system, kanban, JIT purchasing, supply chain management.

UNIT-V: Scheduling: 12

Scheduling and assignment problems - notation and definitions - criteria, objective functions for scheduling - job shop scheduling: sequencing of n job s thorough 1 machine - priority rules, n jobs through 3, m machines - Johnsons rule, CDS algorithm, 2 jobs on m machine - graphical method- multi product assignment problem - index method, Hungarian method.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Production Operation Management:Theory And Problems, Chary:S.N, TMH, New delhi,1990.
2. Production Operation Management, Pannerselvam.R, PHI, 1999.

REFERENCE BOOKS:

1. Operation Management Theory And Problems, Monks.J,G., McGraw HILL,1987.
2. Production operation management, chase.R.B,. Aquiliano.N.J and Jacobs.R.R.,8th Edition, TMH, 1988.
3. Production Planning And Inventory Control, Narashimhan. S.L., Mcleavy.D.W.,and Billington.P.J., 2nd Edition., PHI,1997

19254H22 MEMS AND NANO TECHNOLOGY 4 0 0 4

AIM:

To inspire the students to expect to the trends in manufacturing micro components and measuring systems to nano scale.

OBJECTIVES:

• To expose the students to the evolution of micro electromechanical systems, to the various fabrication techniques and to make students to be award of micro actuators.

• Also to impart knowledge to the students about nano materials and various nano measurements techniques.

UNIT I OVER VIEW OF MEMS AND MICROSYSTEMS 10

Definition – historical development – fundamentals – properties, micro fluidics, design and fabrication micro-system, microelectronics, working principle and applications of micro system.

UNIT II MATERIALS, FABRICATION PROCESSES AND MICRO SYSTEM PACKAGING 14

Substrates and wafers, silicon as substrate material, mechanical properties of Si, Silicon Compounds silicon piezo resistors, Galium arsenide, quartz, polymers for MEMS, conductive polymers. Photolithography, photo resist applications, light sources, in implantation, diffusion process exudation – thermal oxidation, silicon diode, chemical vapour deposition, sputtering - deposition by epitoxy – etching – bulk and surface machining – LIGA process Micro system packaging – considerations packaging – levels of micro system packaging die level, device level and system level.

UNIT III MICRO DEVICES AND MATERIALS 12

Sensors – classification – signal conversion ideal characterization of sensors micro actuators, mechanical sensors – measurands displacement sensors, pressure and flow sensors, micro actuators – smart materials – applications.

UNIT IV SCIENCE OF NANO MATERIALS 12

Classification of nano structures – effect of the nanometer length scale effects of nano scale dimensions on various properties – structural, thermal, chemical, mechanical, magnetic, optical and electronic properties – effect of nanoscale dimensions on biological systems. Fabrication methods – Top down processes – bottom up process.

UNIT V CHARACTERIZATION OF NANO MATERIALS 12

Nano-processing systems – Nano measuring systems – characterization – analytical imaging techniques – microscopy techniques, electron microscopy scanning electron microscopy, transmission electron microscopy, transmission electron microscopy, scanning tunneling microscopy, atomic force microscopy, diffraction techniques – spectroscopy techniques – Raman spectroscopy, 3D surface analysis – Mechanical, Magnetic and thermal properties – Nano positioning systems.

TOTAL: 60 PERIODS

BOOKS FOR REFERENCES:

1. Tai – Ran Hsu, MEMS and Microsystems Design and Manufacture, Tata-McGraw Hill, New Delhi, 2002.
2. Mark Madou Fundamentals of Microfabrication, CRC Press, New York, 1997.
3. Norio Taniguchi, Nano Technology, Oxford University Press, New York, 2003
4. The MEMS Hand book, Mohamed Gad-el-Hak, CRC Press, New York, London.
5. Charles P Poole, Frank J Owens, Introduction to Nano technology, John Wiley and Sons, 2003

6. Julian W. Hardner Micro Sensors, Principles and Applications, CRC Press 1993.

19254H23 MANUFACTURING METROLOGY AND QUALITY CONTROL 4 0 0 4

AIM:

To expose the students, the importance of measurement and the various latest measuring techniques using Laser, Coordinate measuring machines and Optoelectronics devices. Also to stress upon the Importance of quality in manufacturing.

OBJECTIVES:

To impart through knowledge in various latest measurement systems such as laser metrology, coordinate measuring machines and electro-optical devices. Also to make the students to understand quality

UNIT – I LASER METROLOGY 11

Introduction – types of lasers – laser in engineering metrology – metrological laser methods for applications in machine systems – Interferometry applications – speckle interferometry – laser interferometers in manufacturing and machine tool alignment testing – calibration systems for industrial robots laser Doppler technique – laser Doppler anemometry.

UNIT – II PRECISION INSTRUMENTS BASED ON LASER 11

Laser telemetric systems – detection of microscopic imperfections on high quality surface Pitter NPL gauge interferometer – classification of optical scanning systems – high inertia laser scan technique – rotating mirror technique – laser gauging – bar coding – laser dimensional measurement system.

UNIT – III CO-ORDINATE MEASURING MACHINE 14

Co-ordinate metrology – CMM configurations – hardware components – software – Probe sensors – displacement devices – Performance Evaluations – Software – Hardware – Dynamic errors – Thermal effects diagram – temperature variations environment control – applications.

UNIT – IV OPTO ELECTRONICS AND VISION SYSTEM 12

Opto electronic devices – CCD – On-line and in-process monitoring in production – applications image analysis and computer vision – Image analysis techniques – spatial feature – Image extraction – segmentation – digital image processing – Vision system for measurement – Comparison laser scanning with vision system.

UNIT – V QUALITY IN MANUFACTURING ENGINEERING 12

Importance of manufacturing planning for quality – concepts of controllability – need for quality management system and models – quality engineering tools and techniques – statistical process control – six sigma concepts – Poka Yoke – Computer controlled systems used in inspection.

TOTAL: 60 PERIODS

REFERENCES:

1. John A. Bosch, Giddings and Lewis Dayton, Co-ordinate Measuring Machines and Systems, Marcel Dekker, Inc, 1999.
2. Juran J.M. and Gyna F.M., Quality Planning and Analysis, Tata-McGraw Hill, New Delhi
3. Zuech, Nello Understanding and Applying Machine Vision, Marcel Dekker, Inc, 2000
4. Elanchezhian.C, Vijaya Ramnath.B and Sunder Selwyn, T., Engineering Metrology, Eswar Press, Chennai, 2004.

19254L26 AUTOMATION LAB 0 0 3 3

AIM:

To impart knowledge in the area of hydraulic and pneumatic components and its functions.

OBJECTIVE:

• To make the students to learn the basic concepts of hydraulics and pneumatics and its applications in the area of manufacturing process.
• To simulate the various hydraulics and pneumatics circuits.

EXPERIMENTS:

1. Simulation of single and double acting cylinder circuits
2. Simulation of Hydraulic circuits
3. Simulation of electro pneumatic circuits
4. Simulation of electro hydraulic circuits
5. Simulation of PLC circuits
6. Exercises on linear and angular measurements
7. Exercises on speed measurements
8. Exercises on Vibration measurements
9. Exercises on Motion controller using servo motors, encoders, etc.
10. Exercises on fiber optics transducers.
11. Exercises on stepper motor.
12. Exercises on microprocessor based data acquisition system.
13. Software simulation of fluid power circuits using Automation studio.

TOTAL : 30 PERIODS

192TECWR Technical Writing/Seminar 0 0 3 3

Seminar should be based on the literature survey on any topic relevant to CAD/CAM/CAE. It may be leading to selection of a suitable topic of dissertation. The report shall contain some contribution by the candidate in the form of experimental results, deductions, compilation and inferences etc.

• Each student has to prepare a write-up of about 25 pages. The report typed on A4 sized sheets and bound in the necessary format should be submitted after approved by the guide and endorsement of the Head of Department.

• The student has to deliver a seminar talk in front of the teachers of the department and his classmates. The Guide based on the quality of work and preparation and understanding of the candidate shall do an assessment of the seminar.

19219254CRM **Research Methodology**

AIM: **3 0 0 3**

To give an exposure to development of research questions and the various statistical methods suitable to address them through available literature, with basic computational operators.

OBJECTIVES:

- To understand the approaches towards and constraints in good research.
- To identify various statistical tools used in research methodology
- To appreciate and compose the manuscript for publication
- To train in basic computational and excel- skills for research in engineering.

OUTCOME:

Ability to develop research questions and the various research strategies, and compile research results in terms of journal manuscripts.

PREREQUISITES:

Research Methodology course in UG level or equivalent knowledge.

UNIT I **9**

Introduction to Research — Criteria of Good Research, Research Problem: Definition of research problem, selecting the problem - Necessity of defining the problem - Techniques involved in defining the problem-Basic principles of experimental designs-Descriptive and experimental design – different types of experimental design – Validity of findings – internal and external validity – Variables in Research – Measurement and Scaling – Different scales. Ethics & Misconduct in research, Plagiarism,

UNIT II **9**

Formulation of Hypothesis – Sampling techniques –Sampling error and sample size-Methods of data collection – Primary and secondary data – observation – Collection of literature, manual collection from library, usage of library, collection of literature from Scopus, Science Direct etc., compiling literature, software utilization in literature collection- Processing and analysis of data – editing – coding – transcription – tabulation –outline of statistical analysis.

UNIT III **9**

Data Analysis using Excel- Tabulation of Data in excel (Creating Master Table and Sub Table), Formulas and Functions, Filters and Sort and Validation Lists, Data from External Sources. Data Analysis Using Charts and Graphs(Pivot Table & Charts), Time Value of Money, Measure of central tendency: mean, median, mode, Measure of dispersion: variance, standard deviation, Coefficient of variation. Correlation, regression lines. Z-test, t- test F-test, ANOVA one way classification, Chi square test, independence of attributes. Time series: forecasting Method of least squares, Moving average method, Introduction to presentation tool, features and functions, Creating Presentation, Customizing presentation.

UNIT IV **9**

Various research methods-Design of Experiments, Response Surface Methodology, Taguchi Methods- Modeling & Simulation of Engineering Systems, Artificial Neural Networks, Fuzzy Logic, MATLAB - Graph Theory- Finite Element Methods, Computational Fluid Dynamics -R programming in Statistics- open source software

UNIT V **9**

Review of literature, Report writing – target audience – types of reports – contents of reports – styles and Conventions in reporting – steps in drafting a report. Basic concept of research paper writing for Journals and formats of publications in Journals, Report Structure - writing research abstract - introduction, review of literature, result, conclusions, Concepts of Bibliography and references

References:

1. C. R. Kothari, Research Methodology, New Age International Publishers. New Delhi, 2004.
2. Rajammal.P. Devadas, 1976, A hand book of methodology of research, RMM Vidyalaya Press.
3. R.A Day and A.L. Underwood, Quantitative analysis, Prentice Hall, 1999.
4. R. Gopalan, Thesis writing, Vijay Nicole Imprints Private Ltd., 2005.
5. W.J. DeCoursey, Statistics and Probability for Engineering Applications With Microsoft® Excel, Newnes, 2003.
6. Archibald Fripp, Jon Fripp, Michael Fripp; Just-in-Time Math for Engineers, Elsevier Science & Technology Books, 2003.

SEMESTER III

19254H31 **METAL FORMING PROCESS** **4 0 0 4**

OBJECTIVE:

To study about the response of materials under plastic deformation and the various techniques for finding the stress for various metal working processes, and the recent developments in high speed forming.

UNIT-I: Stress and Strain: 10

Stress-State of stress in two dimensions – three dimensions – stress tensor-Mohr's circles – 2D and 3D state of stress – Description of strain at a point – Mohr's circle of strain- Hydrostatic and stress deviator component of stress- Plasticity- flow curve- true and true strain yield criteria for ductile loads combined stress test-plastic stress and strain relations- Levy Mises equations-Prandyl_Resus equations.

UNIT-II: Analysis of Metal Forming: 14

Work Load analysis – work formula for homogeneous deformation- rolling, rod drawing and extrusion processes -Determination of load by stress evaluation method-Determination of drawing load – strip drawing with wedge shaped dies and cylindrical rod drawing with a conical die.

UNIT-III: Stress Evaluation: 12

Stress evaluation method-Determination of forging load-plane strain forging of a thin strip and a flat circular disc- Determination of extrusion load for round band flat strip- upper bound analysis – plane strain indentation with frictionless interface

UNIT-IV: High velocity Forming: 12

Study of effect of high speed on stress strain relationships- High velocity forming equipment- Description of high speed forming machine – hot forging, pneumatic-mechanical, high velocity forging – Fuel combustion process- Electro magnetic forming –Introduction- Procedure - process variables- Applications

UNIT-V: Advanced Forming process: 12

Explosive Forming – Explosives – characteristics- stand off and contact operations- stress waves and their effects- process variables – properties of formed components- applications- Electro hydraulic forming – principles, requirements and characteristics – process variables- water hammer forming- principles and parameters- governing the process.

BOOKS FOR REFERENCES:

1. George E.Dieter, "Mechanical Metallurgy", Mc Graw Hill International Edition, New York,1988
2. Rowe G.W,Edward , "An Introduction to the Principles of Metal Working", Edward Arnold publications.
3. Davies.R and Austin.E.R, "Developments in High Metal Forming", The Machinery Publishing Co.Ltd
4. Robert H.Wagoner and Jean Loup Chenot, "Fundamentals of Metal Forming", John Wiley and Sons Inc, New York,1992

List of Electives - Elective I

19254E16A MATERIALS MANAGEMENT AND LOGISTICS 3 0 0 3

AIM:

To introduce to the students the various functions of materials management and logistics

OBJECTIVE:

To make the students familiar with the various concepts and functions of material management, so that the students will be in a position to manage the materials management department independently.

UNIT I INTRODUCTION 6

Introduction to materials management – Objectives – Functions – Operating Cycle – Value analysis – Make or buy decisions.

UNIT II MANAGEMENT OF PURCHASE 7

Purchasing policies and procedures – Selection of sources of supply – Vendor development – Vendor evaluation and rating – Methods of purchasing – Imports – Buyer – Seller relationship – Negotiations.

UNIT III MANAGEMENT OF STORES AND LOGISTICS 12

Stores function – Location – Layout – Stock taking – Materials handling – Transportation – Insurance – Codification – Inventory pricing – stores management – safety – warehousing – Distribution linear programming – Traveling Salesman problems – Network analysis – Logistics Management.

UNIT IV MATERIALS PLANNING 10

Forecasting – Materials requirements planning – Quantity – Periodic – Deterministic models – Finite production.

UNIT V INVENTORY MANAGEMENT 10

ABC analysis – Aggregate planning – Lot size under constraints – Just in Time (JIT) system.

TOTAL: 45 periods

BOOKS FOR REFERENCES:

1. Lamer Lee and Donald W.Dobler, Purchasing and Material Management, Text and cases, Tata McGraw Hill, 1996.
2. Gopalakrishnan.P, Handbook of Materials Management, Prentice Hall of India, 1996.
3. Guptha P.K. and Manmohan, Problems in Operations Research, Suttan Chand & Sons, 2003.
4. Dr.R. Kesavan, C.Elanchezian and B.Vijaya Ramnath, Production Planning and Control, Anuratha Publications, Chennai, 2008.
5. G. Reghuram, N. Rangaraj, Logistics and supply chain management – cases and concepts, Macmillan India Ltd., 2006.

19254E16B FINANCIAL MANAGEMENT 3 0 0 3

AIM:

To introduce the concepts of financial and various functions of financial management so that the students will be able to handle higher level financial decisions.

OBJECTIVES:

To train students in various functions of finance such as working capital management, current assets management so that students will be able to make high investment decisions when they take up senior managerial positions.

UNIT – I FINANCIAL ACCOUNTING 8

Accounting principles - Basic records - Preparation and interpretation of profit and loss statement - balance sheet - Fixed assets - Current assets.

UNIT – II COST ACCOUNTING 12

Elements of cost - cost classification - material cost - labour costs - overheads - cost of a product - costing systems - cost determination - process - costing - Allocation of overheads - Depreciation - methods.

UNIT – III MANAGEMENT OF WORKING CAPITAL 10

Current assets - Estimation of working capital requirements - Management of accounts receivable - Inventory - Cash - Inventory valuation methods.

UNIT – IV CAPITAL BUDGETING 8

Significance of capital budgeting - payback period - present value method – accounting rate of return method - Internal rate of return method.

UNIT – V PROFIT PLANNING AND ANALYSIS 7

Cost - Volume profit relationship relevant costs in decision making profit management analysis - Break even analysis.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCES:

1. Presanna Chandra, Financial Management, Tata McGraw Hill, 1998.
2. G.B.S. Narang, Production and Costing, Khanna Publishers, 1993.
3. R. Kesavan, C.Elanchezian, Sundar Selwyn, Engineering Economics and Financial Accounting, Laxmi Publications, New Delhi, 2005.
4. R Kesavan, C. Elanchezian, B.Vijaramnath, Engineering Economics and Cost Analysis Anuratha Publications, Chennai.

19254E16C MANUFACTURING INFORMATION SYSTEMS 3 0 0 3

AIM:

To impart the knowledge in manufacturing information system.

OBJECTIVE:

On completion of this course, the students are expected to be conversant with order policies, data base terminologies, designing, manufacturing considerations and information system for manufacturing.

UNIT I INTRODUCTION 5

The Evolution of order policies, from MRP to MRP II, the role of Production organization, Operations control.

UNIT II DATABASE 7

Terminologies – Entities and attributes – Data models, schema and subschema - Data Independence – ER Diagram – Trends in database.

UNIT III DESIGNING DATABASE 13

Hierarchical model – Network approach- Relational Data model concepts, principles, keys, relational operations – functional dependence – Normalization types – Query.

UNIT IV MANUFACTURING CONSIDERATION 10

The product and its structure, inventory and process flow – Shop floor control Data structure and procedure – various model – the order scheduling module, Input/output analysis module the stock status database – the complete IOM database.

UNIT V INFORMATION SYSTEM FOR MANUFACTURING 10

Parts oriented production information system – concepts and structure – Computerized production scheduling, online production control systems; Computer based production management system, computerized manufacturing information system – case study.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCES:

1. Luca G.Sartori, "Manufacturing Information Systems", Addison-Wesley Publishing Company, 1988.
2. Date.C.J.,"An Introduction to Database Systems" Addison Wesley, 8th Edn,.2003
3. Orlicky.G., "Material Requirements Planning", McGraw-Hill, 1994.
4. Kerr.R, "Knowledge based Manufacturing Management", Addison-Wesley,1991.
5. Manufacturing Information & Data Systems Analysis, Design & Practice,CECELJA FRANJO, 2002.

List of Electives - Elective II

19254E24A FINITE ELEMENT APPLICATIONS IN MANUFACTURING 3 0 0 3

AIM:

To impart knowledge in the area of finite element methods and its application in manufacturing.

OBJECTIVE:

To study the fundamentals of one dimensional and two dimensional problems using FEA in manufacturing.

UNIT I INTRODUCTION 6

Fundamentals – Initial, boundary and eigen value problems – weighted residual, Galerkin and Raleigh Ritz methods - Integration by parts – Basics of variational formulation – Polynomial and Nodal approximation.

UNIT II ONE DIMENSIONAL ANALYSIS 10

Steps in FEM – Discretization. Interpolation, derivation of elements characteristic matrix, shape function, assembly and imposition of boundary conditions-solution and post processing – One dimensional analysis in solid mechanics and heat transfer.

UNIT III SHAPE FUNCTIONS AND HIGHER ORDER FORMULATIONS 10

Shape functions for one and two dimensional elements- Three noded triangular and four nodded quadrilateral element Global and natural co-ordinates—Non linear analysis – Isoparametric elements – Jacobian matrices and transformations – Basics of two dimensional, plane stress, plane strain and axisymmetric analysis.

UNIT IV COMPUTER IMPLEMENTATION 9

Pre Processing, mesh generation, elements connecting, boundary conditions, input of material and processing characteristics – Solution and post processing – Overview of application packages – Development of code for one dimensional analysis and validation.

UNIT V ANALYSIS OF PRODUCTION PROCESSES 10

FE analysis of metal casting – special considerations, latent heat incorporation, gap element – Time stepping procedures – Crank – Nicholson algorithm – Prediction of grain structure – Basic concepts of plasticity and fracture – Solid and flow formulation – small incremental deformation formulation – Fracture criteria – FE analysis of metal cutting, chip separation criteria, incorporation of strain rate dependency – FE analysis of welding.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCES:

1. Reddy, J.N. An Introduction to the Finite Element Method, McGraw Hill,1985.
2. Rao, S.S., Finite Element method in engineering, Pergammon press, 1989.
3. Lewis R.W.Morgan, K, Thomas, H.R. and Seetharaman, K.N. The Finite Element Method in Heat Transfer Analysis, John Wiley, 1994.

19254E24B LEAN MANUFACTURING 3 0 0 3

AIM:

To introduce the concepts of lean manufacturing system.

OBJECTIVES:

- To study the various tools for lean manufacturing (LM).
- To apply the above tools to implement LM system in an organization.

UNIT – I INTRODUCTION TO LEAN MANUFACTURING 7

Conventional Manufacturing versus Lean Manufacturing – Principles of Lean Manufacturing – Basic elements of lean manufacturing – Introduction to LM Tools.

UNIT – II CELLULAR MANUFACTURING, JIT, TPM 9

Cellular Manufacturing – Types of Layout, Principles of Cell layout, Implementation. JIT – Principles of JIT and Implementation of Kanban. TPM – Pillars of TPM, Principles and implementation of TPM.

UNIT – III SET UP TIME REDUCTION, TQM, 5S, VSM 10

Set up time reduction – Definition, philosophies and reduction approaches. TQM – Principles and implementation. 5S Principles and implementation - Value stream mapping - Procedure and principles.

UNIT – IV SIX SIGMA 9

Six Sigma – Definition, statistical considerations, variability reduction, design of experiments – Six Sigma implementation.

UNIT – V CASE STUDIES 10

Various case studies of implementation of lean manufacturing at industries.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCES:

1. Design and Analysis of Lean Production Systems, Ronald G. Askin & Jeffrey B. Goldberg, John Wiley & Sons, 2003
2. Rother M. and Shook J, 1999 ‘Learning to See: Value Stream Mapping to Add Value and Eliminate Muda’ , Lean Enterprise Institute, Brookline, MA.
4. Mikell P. Groover (2002) ‘Automation, Production Systems and CIM.

19254E24C DESIGN AND ANALYSIS OF EXPERIMENTS 3 0 0 3

1. INTRODUCTION7

Defining Research, Scientific Enquiry, Hypothesis, Scientific Method, Types of Research, Research Process and steps in it. Research Proposals – Types, contents, sponsoring agent's requirements, Ethical, Training, Cooperation and Legal aspects.

2. RESEARCH DESIGN 10

Meaning, Need, Concepts related to it, categories; Literature Survey and Review, Dimensions and issues of Research Design, Research Design Process – Selection of type of research, Measurement and measurement techniques ,Selection of Sample, Selection of Data Collection Procedures, Selection of Methods of Analysis, Errors in Research. Research Problem Solving – Types, Process and Approaches – Logical, Soft System and Creative; Creative problem solving process, Development of Creativity, Group Problem Solving Techniques for Idea Generation – Brain storming and Delphi Method.

3. RESEARCH MODELING 10

Mathematical – Classification of Models, Development of Models, Stages in Model building, Principles of Modeling, Use of Analogy, Models as Approximations, Data consideration and Testing of Models (b) Heuristics and Simulation – Definition, Applications and reasons for using Heuristics, Heuristic Methods and approaches, Meta-Heuristics; Simulation – Meaning, Applications and Classification of Simulation Models, Process of Simulation, Steps and Features of Simulation Experiments and their Validation.

4. EXPERIMENTATION 8

Objective, Strategies, Factorial Experimental Design, Applications of Experimental Design, Basic Principles – Replication, Randomization and Blocking, Guidelines for designing experiments; Laboratory Experiments, Methods of manipulating Variables, Errors in Experiments, Steps in Design of Experiments.

5. PROCESS OPTIMIZATION AND ANALYSIS 10

Factorial Design principles, Two factor Factorial Design, General Factorial Design, Fitting response Curves and Surfaces, Blocking, Taguchi Approach to Parameter Design, Robust Design. Analysis of Variance and Co-variance, Hypothesis Testing – Parametric. Report Writing: Pre-writing Considerations, Principles of Thesis Writing, Format of Report Writing, Format of Publication in Research Journals

REFERENCES FOR BOOKS:

1. Krishnaswamy, K.N., Sivakumar, Appa Iyer & Mathirajan M., (2006) -Management Research Methodology: Integration of Principles, Methods & Techniques (New Delhi, Pearson Education)

2. Montgomery, Douglas C. (2004) – Design & Analysis of Experiments, 5/e. (New York, John Wiley & Sons)

3. Kothari, C.K. (2004) – Research Methodology, Methods & Techniques, 2/e. (New Delhi, New Age International Ltd. Publishers)

4. Ross, Phillip J. (1996) – Taguchi Techniques for Quality Engineering, 2/e. (New York, McGraw Hill)

5. Rao S. S. (2004) – Engineering Optimization Theory & Practices, 3/e (New Delhi, New Age International Ltd., Publishers)

List of Electives - Elective III

19254E25A ADVANCED METROLOGY AND COMPUTER AIDED INSPECTION 3 0 0 3

AIM:

To give a thorough knowledge of measurement and instrumentation of increasing importance in industry. The student will be knowledgeable in various standards and proliferation of computerized and automated inspecting techniques along with the classical metrology.

OBJECTIVES:

- To teach the students basic concepts in various methods of engineering measurement techniques and applications, understand the importance of measurement and inspection in manufacturing industries.
- Expose the students to various modern metrological instruments and the procedure used to operate these instruments.

UNIT I GENERAL CONCEPTS OF MEASUREMENT 8

Definition – Standards of measurement – Errors in measurement – Interchangeability and Selective assembly – Accuracy and Precision – Calibration of instruments.

UNITII MEASUREMENT OF SURFACE FINISH AND MEASURING MACHINES 9

Definitions – Types of Surface Texture: Surface Roughness Measurement Methods- Comparison, Profilometer, 3D Surface Roughness Measurement – Instruments.

UNIT III INTERFEROMETRY 8

Interferometry – Introduction, Principles of light interference – Interferometers – Measurement and Calibration – Laser Interferometry.

UNIT IV COMPUTER AIDED AND LASER METROLOGY 10

Tool Makers Microscope – Microhite – Co – Ordinate measuring machine – Applications – Laser Micrometer, Laser Scanning gauge, Non contact and in-process inspection, Vision system.

UNIT V IMAGE PROCESSING 10

Overview, Computer imaging systems, Image Analysis, Preprocessing, Human vision system, Image model, Image enhancement, gray scale models, histogram models, Image Transforms.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCES:

1. GUPTA, I.C, "A Text Book of engineering metrology", Dhanpat Rai and Sons, 1996.
2. G.N.GALYER F.W. and C.R.SHOTBOLT, "Metrology for engineers", ELBS, 1990.
3. GRAHAM T.SMITH, "Industrial Metrology", Springer, 2002
4. "ASTE Handbook of Industries Metrology", Prentice Hall of India Ltd., 1992.
5. R.K.RAJPUT, "Engineering Metrology and Instrumentations", Kataria & Sons Publishers, 2001.
6. MILAN SONKA, VACLAV HLAVAC and ROGER BOYLE, "Image Processing, Analysis, and Machine Vision", Cengage-Engineering; 3 edition (March 19, 2007).

19254E25B MAINTENANCE MANAGEMENT 3 0 0 3

OBJECTIVE:

To understand the concepts of maintenance management and to have knowledge in developing a suitable maintenance system for any type of an organization.

UNIT I: Introduction to Maintenance Management: 7

Maintenance: Its role and scope in total Organizational contexts - role of Maintenance. Centralized and decentralized maintenance organization structures. Maintenance Economics – reliability and Availability – MTBF, MTTR.

UNIT II: Maintenance Categories: 10

Maintenance system– Categories - Design and its selection – Breakdown Maintenance –Routine Maintenance- Predictive Maintenance –Preventive Maintenance- Corrective Maintenance-Total Productive Maintenance –Maintenance Schedule – Repair Cycle.

UNIT III: Spare Parts Management: 8

Pareto's principles for repetitive breakdown analysis, spares management, planning considerations for each type of activities.

UNIT – IV: Condition Monitoring: 10

Condition Monitoring (CM) – Introduction- Economics of CM – On-load and off-load testing – Methods and instruments for CM – Temperature sensitive tapes – Pistol thermometers – wear-debris analysis.

UNIT V: Maintenance Manpower Cost, Performance Management: 10

Maintenance man power planning - Selection training - Scheduling maintenance costs - Budget preparation and budgetary control of maintenance expenditures Maintenance effectiveness various performance indices - evaluation, uses and limitations - Monitoring of Maintenance performance.

TEXT BOOKS FOR REFERENCES:

1. Gopalakrishnan P. and Sundarajan 1996. Maintenance Management. New Delhi, Prentice-Hall of India.
2. Srivastava S.K., "Industrial Maintenance Management", - S. Chand & Co.,1981.
3. Higgirs L.T and Morrow L.C., 1997, ``Maintenance Engineering Handbook``, McGraw Hill.
Armstrong, "Condition Monitoring", BSIRSA, 1988.

19254E25C OPTIMIZATION TECHNIQUES 3 0 0 3

UNIT I - INTRODUCTION TO OPTIMIZATION 7

Formulation of an optimization problem- Classification of optimization problem – optimization techniques- Classical optimization technique – Single variable optimization – Multi variable optimization algorithms

UNIT II - MINIMIZATION METHODS 8

One dimensional minimization methods: unimodal function – elimination methods: unrestricted search, exhaustive search, Dichotomous search, Fibonacci methods, Golden section methods, Interpolation methods: Quadratic and cubic interpolation methods.

UNIT III - CONSTRAINED OPTIMIZATION TECHNIQUES 10

Optimization with equality and inequality constraints - Direct methods – Indirect methods using penalty functions, Lagrange multipliers - separable programming and Geometric programming.

UNIT IV - UNCONSTRAINED OPTIMIZATION TECHNIQUES 10

Multi variable unconstrained optimization techniques: Direct search methods: Random search method, unvaried method, pattern search method, steepest descent method and Conjugate gradient method.

UNIT V - APPLICATIONS OF HEURISTICS IN OPTIMIZATION 10

Heuristics-Introduction-Multi objective optimization: Genetic algorithms and Simulated Annealing techniques; neural network & Fuzzy logic principles in optimization.

BOOKS FOR REFERENCES:

1. Rao, Singaresu, S., “Engineering Optimization – Theory & Practice”, New Age International (P) Limited, New Delhi, 2000.
2. Johnson Ray, C., “Optimum design of mechanical elements”, Wiley, John & Sons, 1990.
3. Kalyanamoy Deb, “Optimization for Engineering design algorithms and Examples”, Prentice Hall of India Pvt. 1995.
4. Goldberg, D.E., “Genetic algorithms in search, optimization and machine”, Barnen, Addison-Wesley, New York, 1989.

List of Electives - Elective IV

19254E32A MANUFACTURING SYSTEMS AND SIMULATION 3 0 0 3

AIM:

To introduce the various concepts of manufacturing system simulation.

OBJECTIVES:

- To model manufacturing systems of different kinds.
- To make use of simulation languages for manufacturing systems.

UNIT I INTRODUCTION 8

Basic concepts of system – elements of manufacturing system - concept of simulation – simulation as a decision making tool – types of simulation – Monte-Carlo simulation - system modeling – types of modeling – Limitations and Areas of application of simulation.

UNIT II RANDOM NUMBERS 10

Probability and statistical concepts of simulation – Pseudo random numbers – methods of generating random numbers – discrete and continuous distribution – testing of random numbers – kolmogorov-mirnov test, the Chi-Square test - sampling - simple, random and simulated.

UNIT III DESIGN OF SIMULATION EXPERIMENTS 10

Problem formulation – data collection and reduction – time flow mechanical – key variables - logic flow chart starting condition – run size – experimental design consideration – output analysis, interpretation and validation – application of simulation in engineering industry.

UNIT IV SIMULATION LANGUAGE 9

Comparison and selection of simulation languages - Study of GPSS (Basic blocks only) Generate, Queue, Depart, Size, Release, Advance, Terminate, Transfer, Enter and Leave.

UNIT V CASE STUDIES 10

Development of simulation models using GPSS for queuing, production, inventory, maintenance and replacement systems – case studies.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCES:

1. Jerry Banks and John S.Carson, “Discrete event system simulation”, Prentice Hall 1991
2. 1 .John H.Mize and J.Grady Cox, “Essentials of simulation” – Prentice hall 1989.
3. Geoffrey Gordon “System simulation” – Prentice Hall of India, 1992
4. Jeffrey L.Written, Lonnie D, Bentley and V.M. Barice, “System analysis and Design Methods”, Galgotia publication, 1995
5. Averill M.Law and W.David Kelton, “Simulation Modeling and analysis”, McGraw Hill International Editions, 1991
6. Shannon R.E., “System simulation”, Prentice Hall 1993.

19254E32B INSTRUMENTATION AND CONTROL ENGINEERING 3 0 0 3

UNIT–I: Introduction to Instrumentation: 8

Mechanical Instrumentation- General concepts, General measurement system. Classification of Instruments - indicators, recorders and integrators- working principles, Precision and Accuracy: Measurement Error and calibration.

UNIT–II: Measuring Devices 10

Measurement of speed, frequency, acceleration - Vibrometer, Accelerometer etc. Pressure measurement: Gravitational, Bourdon, elastic transducers, strain gauge, pressure cells, and measurement of high and low pressure. Temperature measurement: Bi-Metallic, Resistance Thermometer, Thermocouples, Pyrometer, thermostats, Magnetic flow meter , Ultrasonic flow meter.

UNIT – III: Transducers: 8

Transducers – Introduction – Types -Variable resistance Transducers-Variable reactive transducers- Piezo Electric transducers- Fibre optic transducers- Laser instrumentation-analogue and digital type -incremental and absolute measurement.

UNIT – IV: Machine Diagnostic and Condition Monitoring: 10

Machine Diagnostics – Basic Concepts - Analysis of failure in machines-Distribution of fault occurrences-Objectives of monitoring-Monitoring techniques applied to Machineries.

UNIT – V: Computer Control System: 9

Data acquisition system-Introduction-Direct Digital control-Programmable Logic Controls (PLC) -Ladder diagrams-Communication used in PLC.

BOOKS FOR REFERENCES:

1. Thomas Beckwith, Lewis Buck N.Ray, D. Maragoni, “Mechabical Measurements”, Narosia Publishing House, NewDelhi.
2. M.P.Groover - " Automation, Production Systems and computer Intergrated Manufacturing ", Prentice Hall.
3. A.K. Sawhney, “Elecrical and Electronics Measurements & Instrumentation”, Dhanpat Rai & Sons, 1993
4. C.S.Rangan,V.S.V.Mani and G.R.Sarma - " Instrumentation Devices and systems", Tata McGraw Hill,1983

19254E32C ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS 3 0 0 3

UNIT – I - Neural Networks 8

Introduction to soft Computing-Neural Networks-Supervised Learning Neural Networks – Perceptrons – Adaline – Back propagation Multilayer perceptrons – Radial Basic Function Networks – Unsupervised Learning and Other Neural Networks – Competitive Learning Networks – Kohonen Self – Organizing Networks – Learning Vector Quantization – Habbian Learning.

UNIT – II - Fuzzy Logic: 10

Fuzzy Sets – Basic Definition and Terminology – Set –theoretic operations – Member Function Formulation and parameterization – Fuzzy Rules and Fuzzy Reasoning. Fuzzy Logic: Extension principle and Fuzzy Relations – Fuzzy If – Then Rules – Fuzzy Reasoning – Fuzzy Inference Systems – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models – Input Space Partitioning and Fuzzy Modeling.

UNIT – III Genetic Algorithm: 9

Derivative – based Optimization – Descent Methods – The Method of steepest Descent – Classical Newton's Method – Step Size Determination – Derivative – free Optimization – Genetic Algorithms – Simulated Annealing – Random Search – Downhill Simplex Search.

UNIT – IV Neuro Fuzzy Modeling: 10

Adaptive Neuro – Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm – learning Methods that Cross – Fertilize ANFIS and RBFN – Coactive Neuro – Fuzzy Modeling – Framework – Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum.

UNIT – V Applications: 8

Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency prediction – Soft Computing for Color Recipe Prediction – Single MLP approaches –CANFIS modeling for color recipe prediction

BOOKS FOR REFERENCES:

1. Jang, J.S.R., C.T. Sun and E. Mizutani., "Neuro – Fuzzy and Soft Computing", PHI, Person Education, 2004.
2. Eberhart, R., simpson, P. and Dobbins, R., " Computatuonal Intelligence PC Tools", AP Professional, Boston 1996.
3. Goldberg, Davis E., "Optimization and Machine Learning" Addison Wesley, New York, 1989.
4. S. Rajasekaran and Pai, G.A.V., "Neural Networks, Fuzzy Logic and Genetic Algorithms",Prentice Hall of India, New Delhi, 2003.

List of Electives - Elective V

19254E33A PRODUCT DESIGN AND DEVELOPMENT 3 0 0 3

UNIT I - INTRODUCTION 7

Significance of product design, product design and development process, sequential engineering design method, the challenges of product development.

UNIT II - PRODUCT PLANNING AND PROJECT SELECTION 8

Identifying opportunities evaluate and prioritize projects, allocation of resources Identifying Customer Needs, Interpret raw data in terms of customers need, organize needs in hierarchy and establish the relative importance of needs.

UNIT III - PRODUCT SPECIFICATIONS 8

Establish target specifications, setting final specifications, Concept Generation: Activities of concept generation, clarifying problem, search both internally and externally.

UNIT IV - INDUSTRIAL DESIGN AND CONCEPT SELECTION 10

Assessing need for industrial design, industrial design process, management, assessing quality of industrial design, Overview, concept screening and concept scoring, methods of selection.

UNIT V - THEORY OF INVENTIVE PROBLEM SOLVING (TRIZ) AND CONCEPT TESTING 12

Fundamentals, methods and techniques, General Theory of Innovation and TRIZ, Value engineering Applications in Product development and design, Model-based technology for generating innovative ideas Elements of testing: qualitative and quantitative methods including survey, measurement of customers' response, Intellectual Property: Elements and outline, patenting procedures.

BOOKS FOR REFERENCES:

1. Ulrich K. T, and Eppinger S.D, Product Design and Development, Tata McGraw Hill
2. Otto K, and Wood K, Product Design, Pearson
3. Engineering of creativity: introduction to TRIZ methodology of inventive Problem Solving, By Semyon D. Savransky, CRC Press.
4. Inventive thinking through TRIZ: a practical guide, By Michael A. Orloff, Springer.
5. Systematic innovation: an introduction to TRIZ ; (theory of inventive Problem Solving), By John Terninko, Alla Zusman, CRC Press.

19254E33B FLUID POWER AUTOMATION 3 0 0 3

AIM:

To impart knowledge in the area of hydraulics, pneumatic and fluid power components and its functions.

OBJECTIVE:

- To make the students to learn the basic concepts of hydraulics and pneumatics and their controlling elements in the area of manufacturing process.
- To train the students in designing the hydraulics and pneumatic circuits using ladder diagram.

UNIT I INTRODUCTION 5

Need for Automation, Hydraulic & Pneumatic Comparison – ISO symbols for fluid power elements, Hydraulic, pneumatics – Selection criteria.

UNIT II FLUID POWER GENERATING/UTILIZING ELEMENTS 8

Hydraulic pumps and motor gears, vane, piston pumps-motors-selection and specification-Drive characteristics – Linear actuator – Types, mounting details, cushioning – power packs – construction. Reservoir capacity, heat dissipation, accumulators – standard circuit symbols, circuit (flow) analysis.

UNIT III CONTROL AND REGULATION ELEMENTS 8

Direction flow and pressure control valves-Methods of actuation, types, sizing of ports pressure and temperature compensation, overlapped and under lapped spool valves operating characteristics-electro hydraulic servo valves-Different types-characteristics and performance.

UNIT IV CIRCUIT DESIGN 10

Typical industrial hydraulic circuits-Design methodology – Ladder diagram-cascade, method-truth table-Karnaugh map method-sequencing circuits-combinational and logic circuit.

UNIT V ELECTRO PNEUMATICS & ELECTRONIC CONTROL OF HYDRAULIC AND PNEUMATIC CIRCUITS 7

Electrical control of pneumatic and hydraulic circuits-use of relays, timers, counters, Ladder diagram. Programmable logic control of Hydraulics Pneumatics circuits, PLC ladder diagram for various circuits, motion controllers, use of field busses in circuits. Electronic drive circuits for various Motors.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCES:

1. Antony Esposito, Fluid Power Systems and control Prentice-Hall, 1988.
2. Peter Rohner, Fluid Power logic circuit design. The Macmillan Press Ltd.,London, 1979
3. E.C.Fitch and J.B.Suryaatmadyn. Introduction to fluid logic, McGraw Hill, 1978.
4. W.Bolton, Mechatronics, Electronic control systems in Mechanical and Electrical Engineering Pearson Education, 2003.
5. Peter Rohner, Fluid Power Logic Circuit Design, Mcmelan Prem, 1994.

List of Electives - Elective VI

19254E34A ADVANCED MATERIAL TECHNOLOGY 3 0 0 3

AIM:

To impart knowledge on advance concepts of material technology

OBJECTIVE:

- To enlight the PG students on elastic, plastic and fractured behaviour of engineering Materials.
- To train the PG students in selection of metallic and non-metallic materials for the various engineering applications.

UNIT I ELASTIC AND PLASTIC BEHAVIOR 10

Elasticity in metals and polymers Anelastic and visco-elastic behaviour – Mechanism of plastic deformation and non metallic shear strength of perfect and real crystals – Strengthening mechanisms, work hardening, solid solutioning, grain boundary strengthening, poly phase mixture, precipitation, particle, fibre and dispersion strengthening. Effect of temperature, strain and strain rate on plastic behaviour – Super plasticity – Deformation of non crystalline materials.

UNIT II FRACTURE BEHAVIOUR 10

Griffith's theory, stress intensity factor and fracture toughness – Toughening mechanisms – Ductile, brittle transition in steel – High temperature fracture, creep – Larson Miller parameter – Deformation and fracture mechanism maps – Fatigue, low and high cycle fatigue test, crack initiation and propagation mechanisms and Paris law. Effect of surface and metallurgical parameters on fatigue – Fracture of non metallic materials – Failure analysis, sources of failure, procedure of failure analysis.

UNIT III SELECTION OF MATERIALS 10

Motivation for selection, cost basis and service requirements – Selection for mechanical properties, strength, toughness, fatigue and creep – Selection for surface durability corrosion and wear resistance – Relationship between materials selection and processing – Case studies in materials selection with relevance to aero, auto, marine, machinery and nuclear applications – Computer aided materials selection.

UNIT IV MODERN METALLIC MATERIALS 8

Dual phase steels, High strength low alloy (HSLA) steel, Transformation induced plasticity (TRIP) Steel, Maraging steel, Nitrogen steel – Intermetallics, Ni and Ti aluminides – smart materials, shape memory alloys – Metallic glass and nano crystalline materials.

UNIT V NON METALLIC MATERIALS 7

Polymeric materials – Formation of polymer structure – Production techniques of fibers, foams, adhesives and coating – structure, properties and applications of engineering polymers – Advanced structural ceramics, WC, TIC, TaC, Al2O3, SiC, Si3N4 CBN and diamond – properties, processing and applications.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCES:

1. George E.Dieter, Mechanical Metallurgy, McGraw Hill, 1988.
2. Thomas H. Courtney, Mechanical Behaviour of Materials, (2nd edition), McGraw Hill, 2000.
3. Flinn, R.A., and Trojan, P.K., Engineering Materials and their Applications, (4th Edition) Jaico, 1999.
4. ASM Hand book, Vol.11, Failure Analysis and Prevention, (10th Edition), ASM, 2002.
5. Ashby M.F., Material Selection in Mechanical Design, 3rd Edition, Butter Worth 2005.

M.Tech. – Manufacturing Technology

PART TIME PROGRAMME

Regulation 2019

SEMESTER-I

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
19248S11EP	Advanced Engineering Mathematics	3	1	-	4
19254C12P	Theory of Metal Cutting	3	1	-	4
19254C13P	Advanced Manufacturing Processes	3	1	-	4
19254L14P	CIM Lab	-	-	3	3
19254CRSP	Research Led Seminar	0	-	-	1
TOTAL NO. OF CREDITS					**16**

SEMESTER-II

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
19254C21P	Production Management	3	1	-	4
19254C22P	MEMS and Nano Technology	4	-	-	4
19254E23_P	Elective - I	4	-	-	3
19254L24P	Automation Lab	-	-	3	3
192TECWRP	Technical Writing/Seminars	-	-	3	3
19254CRMP	Research Methodology	4	-	-	3
19254CBRP	Participation in Bounded Research	0	-	-	2
TOTAL NO. OF CREDITS					**22**

SEMESTER-III

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
19254C31P	Mechanical Metallurgy	3	1	-	4
19254C32P	Automated Computer Integrated Manufacturing Systems	3	1	-	4
19254E33_P	Elective II	4	-	-	3
19254CSRP	Design /Socio Technical Project	-	-	6	6
TOTAL NO. OF CREDITS					17

SEMESTER-IV

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
19254C41P	Manufacturing Metrology and Quality Control	4	-	-	4
19254C42P	Metal Forming Process	4	-	-	4
19254E43_p	Elective III	4	-	-	3
19254P44P	Project Work Phase - I	-	-	10	10
TOTAL NO. OF CREDITS					21

SEMESTER-V

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
19254E51_P	Elective IV	4	-	-	3
19254E52_P	Elective V	4	-	-	3
19254E53_P	Elective VI	4	-	-	3
TOTAL NO. OF CREDITS					9

SEMESTER-VI

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
19254P61P	Project Work Phase - II	-	-	15	15

TOTAL NO. OF CREDITS	**15**

ELECTIVE-I

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
19254E23AP	Finite Element Application in Manufacturing	4	-	-	3
19254E23BP	Lean Manufacturing	4	-	-	3
19254E23CP	Design and Analysis of Experiments	4	-	-	3

ELECTIVE-II

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
19254E33AP	Materials Management and Logistics	4	-	-	3
19254E33BP	Financial Management	4	-	-	3
19254E33CP	Manufacturing Information Systems	4	-	-	3

ELECTIVE-III

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
19254E43AP	Advanced Metrology and Computer Aided Inspection	4	-	-	3
19254E43BP	Maintenance Management	4	-	-	3
19254E43CP	Optimization Techniques	3	1	-	3

ELECTIVE-IV

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
19254E51AP	Manufacturing Systems and Simulation	4	-	-	3
19254E51BP	Instrumentation and Control Engineering	4	-	-	3
19254E51CP	Artificial Intelligence and Neural Networks	3	1	-	3

ELECTIVE-V

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
19254E52AP	Product Design and Development	4	-	-	3
19254E52BP	Fluid Power Automation	4	-	-	3

ELECTIVE-VI

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
19254E53AP	Advanced Material Technology	4	-	-	3
19254E53BP	Industrial Ergonomics	4	-	-	3

DEPARTMENT OF MECHANICAL ENGINEERING

M.TECH., MANUFACTURING TECHNOLOGY - PART TIME PROGRAMME SYLLABUS-REGULATIONS- 2019

I - SEMESTER

19254H12P THEORY OF METAL CUTTING 3 1 0 4

OBJECTIVE:

To know about the mechanics of chip formation, to analyse the tool failure, and thermodynamics involved in metal cutting and evaluation of tool materials.

UNIT- I: Orthogonal Cutting:

Orthogonal Cutting – Theories of merchant – Lee and Shaffer – Merchant's circle diagram – shear angle relationship – chip velocity – force – velocity relationships

UNIT-II: Chip Formation:

Mechanism of chip formation – Types of Chips – discontinuous,continuous continuous with BUE – Chip Formation in drilling and Milling – effect of cutting variables of chip reduction coefficient.

UNIT-III : Tool Life and Machinability:

Tool Failure:Mode of Plastic failure – Measurement of tool wear – tool life tests – tool life equation for variable theories – variables affecting tool life – machinability – machinability index – problems.

UNIT-IV: Thermal Analysis in Metal Cutting:

Thermodynamics of orthogonal cutting – analysis of temperature at shear plane and tool face – experimental methods for temperature measurement.

UNIT-V: Chatter:

Chatter - Importance of Chatter in machining – types of chatter – avoidance of chatter.Tools materials – requirements – alloy tools - HSS – carbides –PCD and CBN-properties and application.

BOOKS FOR REFERENCE:

1. Juneja .B.L, "Fundamentals of Metal cutting and Machine tools", New Age International,1995.

2. Bhattacharya.A, "Metal Cutting Theory and Practice", Central book publications
3. Kuppusamy .G, "Principle of Metal Cutting", University Press,1996.
4. Shaw .M.C, "Metal Cutting Principles",I BH Publications,1992.

Armarego E.J.A and Brown R.H, "The Machining of Metals", Prentice Hall,1969

19254H13P ADVANCED MANUFACTURING PROCESSES 4 0 0 4

AIM:

To expose the students in the art of manufacturing new products due to the development of new materials and processes. The students will totally get a feel of the relevant suitable process while evaluating and deciding.

OBJECTIVE:

• To inform the students about the various alternative manufacturing processes available.
• To develop an altitude to look for the unconventional manufacturing process to machine
• To make them to understand and appreciate the latest manufacturing process for micro fabrication and devices.

UNIT I NEWER MACHINING PROCESSES - I 9

(Non thermal energy) – Abrasive machining – water jet machining - ultrasonic machining – chemical machining – electro chemical machining – construction working principle – steps - types – process parameters – derivations – problems, merits, demerits and applications .

UNIT II NEWER MACHINING PROCESS – II 9

Wire cut EDM - Electro chemical machining – ECG - Electric discharge machining – construction – principle – types – control - circuits – tool design – merits, demerits & applications.

UNIT III NEWER MACHINING PROCESS – III 9

Laser beam machining – Electron beam machining – Plasma arc machining – Ion beam machining – construction working principle types – process parameter – derivations – problems, merits, demerits and applications.

UNIT IV FABRICATION OF MICRO DEVICES 9

Semiconductors – films and film depurification – Oxidation - diffusion – ion implantation – etching – metallization – bonding – surface and bulk machining – LIGA Process – Solid free form fabrication.

UNIT V MICROFABRICATION TECHNOLOGY 9

Wafer preparation – monolithic processing – moulding – PCB board hybrid & mcm technology – programmable devices & ASIC – electronic material and processing.–
steriolithography SAW devices, Surface Mount Technology,

TOTAL: 45 PERIODS

BOOKS FOR REFERENCE:

1. Serope kelpekijian & stevan r. schmid- manufacturing process engg material – 2003
2. Micro senors Mems & smart devices- Julian W.Hardner – 2002
3. Brahem T. Smith, Advanced machining I.F.S. UK 1989.
4. Jaeger R.C., Introduction to microelectronic fabrication Addison Wesley, 1988.
5. Nario Taniguchi – Nano technology – Oxford University Press 1996.
6. Pandey P.C. & Shan HS Modern Machining Processes, Standard Publishing Co., 1980
7. More Madon, Fundamentals of Microfabrication, CRC Press, 1997.

19254L14P CIM LAB 0 0 3 3

AIM:

To impart the knowledge on training the students in the area of CAD/CAM.

OBJECTIVES:

To teach the students about the drafting of 3D components and analyzing the same using various CAD/CAM software's.

CAM LABORATORY

1. Exercise on CNC Lathe: Plain Turning, Step turning, Taper turning, Threading, Grooving & canned cycle
2. Exercise on CNC Milling Machine: Profile Milling, Mirroring, Scaling & canned cycle.
3. Study of Sensors, Transducers & PLC: Hall-effect sensor, Pressure sensors, Strain gauge, PLC, LVDT, Load cell, Angular potentiometer, Torque, Temperature & Optical Transducers.
4. Mini project on any one of the CIM elements is to be done. This can be either a software or hardware simulating a CIM element. At the end of the semester, the students has to submit a mini report and present his work before a Committee.

CAD LABORATORY

2D modeling and 3D modeling of components such as

1. Bearing
2. Couplings
3. Gears
4. Sheet metal components
5. Jigs, Fixtures and Die assemblies.

TOTAL: 30 PERIODS.

19254H21P PRODUCTION MANAGEMENT 3 1 0 4

OBJECTIVE:
To gain knowledge in operation management principles and the related quantitative approaches.

UNIT-I : Manufacturing System:
The concept of system - types of manufacturing system- the concept of a model - model classification - model building - decision making approaches. Forecasting: qualitative and quantitative methods - moving averages- single and multiple regression models.

UNIT-II : Aggregate Planning :
Methods of aggregate planning- graphical and charting methods, trial and error, transportation method- concepts of linear decision rule.

UNIT-III: Inventory Management Systems and Models
EOQ, model (without and with shortages)- inventory models allowing price breaks, EPQ model - single period inventory model - inventory control systems - P,Q and S-s system - selective inventory control techniques.

UNIT-IV: MRP & JIT:
Materials requirement planning (MRP) - master production schedule, bill of materials, MRP concepts, lot sizing - lot-for-lot technique, EOQ approach, silver-meal approach, period order quantity approach, least unit cost approach, least total cost approach.
Principles of JIT production pull and push system, kanban, JIT purchasing, supply chain management.

UNIT-V: Scheduling:
Scheduling and assignment problems - notation and definitions - criteria, objective functions for scheduling - job shop scheduling: sequencing of n job s thorough 1 machine - priority rules, n jobs through 3, m machines - Johnsons rule, CDS algorithm, 2 jobs on m machine - graphical method- multi product assignment problem - index method, Hungarian method.

BOOKS FOR REFERENCE:

1. Production Operation Management:Theory And Problems, Chary:S.N, TMH, New delhi,1990.
2. Production Operation Management, Pannerselvam.R, PHI, 1999.
3. Operation Management Theory And Problems, Monks.J,G., McGraw HILL,1987.
4. Production operation management, chase.R.B,. Aquiliano.N.J and Jacobs.R.R.,8th Edition, TMH, 1988.
5. Production Planning And Inventory Control, Narashimhan. S.L., Mcleavy.D.W.,and Billington.P.J., 2nd Edition., PHI,1997

SEMESTER II

19254H22P MEMS AND NANO TECHNOLOGY 4 0 0 4

AIM:

To inspire the students to expect to the trends in manufacturing micro components and measuring systems to nano scale.

OBJECTIVES:

• To expose the students to the evolution of micro electromechanical systems, to the various fabrication techniques and to make students to be award of micro actuators.

• Also to impart knowledge to the students about nano materials and various nano measurements techniques.

UNIT I OVER VIEW OF MEMS AND MICROSYSTEMS 6

Definition – historical development – fundamentals – properties, micro fluidics, design and fabrication micro-system, microelectronics, working principle and applications of micro system.

UNIT II MATERIALS, FABRICATION PROCESSES AND MICRO SYSTEM PACKAGING 10

Substrates and wafers, silicon as substrate material, mechanical properties of Si, Silicon Compounds silicon piezo resistors, Galium arsenide, quartz, polymers for MEMS, conductive polymers. Photolithography, photo resist applications, light sources, in implantation, diffusion process exudation – thermal oxidation, silicon diode, chemical vapour deposition, sputtering - deposition by epitoxy – etching – bulk and surface machining – LIGA process Micro system packaging – considerations packaging – levels of micro system packaging die level, device level and system level.

UNIT III MICRO DEVICES AND MATERIALS 8

Sensors – classification – signal conversion ideal characterization of sensors micro actuators, mechanical sensors – measurands displacement sensors, pressure and flow sensors, micro actuators – smart materials – applications.

UNIT IV SCIENCE OF NANO MATERIALS 10

Classification of nano structures – effect of the nanometer length scale effects of nano scale dimensions on various properties – structural, thermal, chemical, mechanical, magnetic, optical and electronic properties – effect of nanoscale dimensions on biological systems. Fabrication methods – Top down processes – bottom up process.

UNIT V CHARACTERIZATION OF NANO MATERIALS 11

Nano-processing systems – Nano measuring systems – characterization – analytical imaging techniques – microscopy techniques, electron microscopy scanning electron microscopy, transmission electron microscopy, transmission electron microscopy, scanning tunneling microscopy, atomic force microscopy, diffraction techniques – spectroscopy techniques – Raman spectroscopy, 3D surface analysis – Mechanical, Magnetic and thermal properties – Nano positioning systems.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCE:

1. Tai – Ran Hsu, MEMS and Microsystems Design and Manufacture, Tata-McGraw Hill, New Delhi, 2002.
2. Mark Madou Fundamentals of Microfabrication, CRC Press, New York, 1997.
3. Norio Taniguchi, Nano Technology, Oxford University Press, New York, 2003
4. The MEMS Hand book, Mohamed Gad-el-Hak, CRC Press, New York, London.
5. Charles P Poole, Frank J Owens, Introduction to Nano technology, John Wiley and Sons, 2003
6. Julian W. Hardner Micro Sensors, Principles and Applications, CRC Press 1993.

19254L24P AUTOMATION LAB 0 0 3 3

AIM:

To impart knowledge in the area of hydraulic and pneumatic components and its functions.

OBJECTIVE:

• To make the students to learn the basic concepts of hydraulics and pneumatics and its applications in the area of manufacturing process.
• To simulate the various hydraulics and pneumatics circuits.

EXPERIMENTS:

1. Simulation of single and double acting cylinder circuits
2. Simulation of Hydraulic circuits
3. Simulation of electro pneumatic circuits
4. Simulation of electro hydraulic circuits
5. Simulation of PLC circuits
6. Exercises on linear and angular measurements
7. Exercises on speed measurements
8. Exercises on Vibration measurements
9. Exercises on Motion controller using servo motors, encoders, etc.
10. Exercises on fiber optics transducers.
11. Exercises on stepper motor.
12. Exercises on microprocessor based data acquisition system.
13. Software simulation of fluid power circuits using Automation studio.

TOTAL : 30 PERIODS

SEMESTER II

192TECWRP Technical Writing/Seminar: 0 0 3 3

Seminar should be based on the literature survey on any topic relevant to CAD/CAM/CAE. It may be leading to selection of a suitable topic of dissertation. The report shall contain some contribution by the candidate in the form of experimental results, deductions, compilation and inferences etc.

• Each student has to prepare a write-up of about 25 pages. The report typed on A4 sized sheets and bound in the necessary format should be submitted after approved by the guide and endorsement of the Head of Department.

• The student has to deliver a seminar talk in front of the teachers of the department and his classmates. The Guide based on the quality of work and preparation and understanding of the candidate shall do an assessment of the seminar.

Research Methodology

AIM:

To give an exposure to development of research questions and the various statistical methods suitable to address them through available literature, with basic computational operators.

OBJECTIVES:

- To understand the approaches towards and constraints in good research.
- To identify various statistical tools used in research methodology
- To appreciate and compose the manuscript for publication
- To train in basic computational and excel- skills for research in engineering.

OUTCOME:

Ability to develop research questions and the various research strategies, and compile research results in terms of journal manuscripts.

PREREQUISITES:

Research Methodology course in UG level or equivalent knowledge.

UNIT I

Introduction to Research — Criteria of Good Research, Research Problem: Definition of research problem, selecting the problem - Necessity of defining the problem - Techniques involved in defining the problem-Basic principles of experimental designs-Descriptive and experimental design – different types of experimental design – Validity of findings – internal and external validity – Variables in Research – Measurement and Scaling – Different scales. Ethics & Misconduct in research, Plagiarism,

UNIT II

Formulation of Hypothesis – Sampling techniques –Sampling error and sample size-Methods of data collection – Primary and secondary data – observation – Collection of literature, manual collection from library, usage of library, collection of literature from Scopus, Science Direct etc., compiling literature, software utilization in literature collection- Processing and analysis of data – editing – coding – transcription – tabulation –outline of statistical analysis.

UNIT III

Data Analysis using Excel- Tabulation of Data in excel (Creating Master Table and Sub Table), Formulas and Functions, Filters and Sort and Validation Lists, Data from External Sources. Data Analysis Using Charts and Graphs(Pivot Table & Charts), Time Value of Money, Measure of central tendency: mean, median, mode, Measure of dispersion: variance, standard deviation, Coefficient of variation. Correlation, regression lines. Z-test, t- test F-test, ANOVA one way classification, Chi square test, independence of attributes. Time series: forecasting Method of least squares, Moving average method, Introduction to presentation tool, features and functions, Creating Presentation, Customizing presentation.

UNIT IV

Various research methods-Design of Experiments, Response Surface Methodology, Taguchi Methods- Modeling & Simulation of Engineering Systems, Artificial Neural Networks, Fuzzy Logic, MATLAB - Graph Theory- Finite Element Methods, Computational Fluid Dynamics -R programming in Statistics- open source software

UNIT V

Review of literature, Report writing – target audience – types of reports – contents of reports – styles and Conventions in reporting – steps in drafting a report. Basic concept of research paper writing for Journals and formats of publications in Journals, Report Structure - writing research abstract - introduction, review of literature, result, conclusions, Concepts of Bibliography and references

References:

1. C. R. Kothari, Research Methodology, New Age International Publishers. New Delhi, 2004.

2. Rajammal.P. Devadas, 1976, A hand book of methodology of research, RMM Vidyalaya Press.

3. R.A Day and A.L. Underwood, Quantitative analysis, Prentice Hall, 1999.

4. R. Gopalan, Thesis writing, Vijay Nicole Imprints Private Ltd., 2005.

5. W.J. DeCoursey, Statistics and Probability for Engineering Applications With Microsoft® Excel, Newnes, 2003.

6. Archibald Fripp, Jon Fripp, Michael Fripp; Just-in-Time Math for Engineers, Elsevier Science & Technology Books, 2003.

SEMESTER III

19254H31P MECHANICAL METALLURGY 3 1 0 4

OBJECTIVE:

To study about the behaviour of Metals during the loading conditions related to distribution of Stress and Strain. To know about the fracture of metals and various test procedures.

UNIT-I: Tensile Study:

Study of Engineering stress-strain curve: Derivation of tensile strength , yield strength ductility, Young's modulus, resilience and toughness from stress strain curves, study of stress-strain curves for different materials-true stress-strain curve: true stress at ultimate load, true fracture strain, true uniform strain, true necking strain-necking factor-effect of strain rate, temperature- test of flow properties-Notch tensile test-tensile properties of steel-strengthening theory- strain hardening-strain aging-Yield point phenomena-Solid solution strengthening-Martensite strengthening-Grain refinement,

UNIT-II: Hardness and Toughness:

Hardness and Toughness: Hardness introduction, Hardness measurement methods-Brinell hardness, Meyer hardness, Vickers hardness, Rockwell hardness and Micro hardness- Relationship between hardness and the flow curve-Hardness at higher temperatures-Toughness –introduction, Toughness measurements: Charpy, Izod and instrumented Charpy-TTT curves: Significance, metallurgical factors affecting the curves, Drop weight test, explosion crack starter test.

UNIT-III: Fatigue:

Fatigue study: Introduction: Different stress cycles, S-N curves, Goodman diagram, Soderberg diagram, Gerbar diagram-Cyclic stress curve-Low cycle fatigue- Strain life equation-Fatique mechanism-High cycle fatigue-Effect of folloeing parameters on fatigue: Mean stress , stress concentration, specimen size, surface roughness, residual stress, micro structure and temperature. Fatique crack propagation.

UNIT-IV: Fracture Behaviour:

Fracture – Introduction –Types – Ductile and Brittle Cohesive Strength of Metals-Griffith Theory-Metallographic Examination of Fracture – Fractography – Notch Effect – Concept of Fracture curve – Fracture under combined stresses- Environment sensitive fracture: Hydrogen Embrittlement and Corrosion Cracking

UNIT-V: Creep:

Creep: Creep Curve – Stress rupture test- Structural changes during creep- Creep deformation- Deformation Mechanisms Maps – Activation Energy for Steady state creep – Fracture at higher temperatures.

TEXT BOOKS:

1. George E. Dieter, "Mechanical Metallurgy", Mc Graw Hill, NewYork, 1988.
2. M.A. Meyers and K.Chawla, "Mechanical Metallurgy", PHI.

BOOKS FOR REFERENCE:

1. Metals Hand Book, "Mechanical Testing", Vol. 8, 9th Ed., ASM.
2. Thomas Countney.H., "Mechanical Behaviour of Materials", Mc Graw hill, 2nd Ed., 2000.
3. Hertzberg R.W., "Deformation and Fracture Mechanics of Engineering Materials", 2ne Ed., John Wiley & Sons. 1983.

SEMESTER III

19254H32P AUTOMATED COMPUTER INTEGRATED MANUFACTURING SYSTEMS 4 0 0 4

AIM:

To stress the role of computers in production.

OBJECTIVE:

To teach the role of computers in processing the information knowing across the various Stages and various departments in a manufacturing concern.

UNIT I INTRODUCTION 6

Introduction to CAD, CAM, CAD/CAM and CIM - Evolution of CIM – CIM wheel and cycle – Production concepts and mathematical models – Simple problems in production models – CIM hardware and software – Major elements of CIM system – Three step process for implementation of CIM – Computers in CIM – Computer networks for manufacturing – The future automated factory – Management of CIM – Impact of CIM on personnel – CIM status.

UNIT II AUTOMATED MANUFACTURING SYSTEMS 10

Automated production line – system configurations, work part transfer mechanisms – Fundamentals of Automated assembly system – System configuration, Part delivery at workstations – Design for automated assembly – Overview of material handling equipments – Consideration in material handling system design – The 10 principles of Material handling. Conveyor systems – Types of conveyors – Operations and features. Automated Guided Vehicle system – Types of vehicles and AGVs applications – Vehicle guidance technology – Vehicle management and safety. Storage system performance – storage location strategies – Conventional storage methods and equipments – Automated storage/Retrieval system and Carousel storage system Deadlocks in Automated manufacturing systems – Petrinet models – Applications in Dead lock avoidance.

UNIT III GROUP TECHNOLOGY AND FMS 10

Part families – Visual – Parts classification and coding – Production flow analysis – Grouping of parts and Machines by rank order clustering method – Benefits of GT – Case studies. FMS – Components – workstations – FMS layout configurations – Computer control systems – FMS planning and implementation issues – Architecture of FMS – flow chart showing various operations in FMS – Machine cell design – Composite part concept, Holier method, Key machine concept – Quantitative analysis of FMS – Bottleneck model – Simple and complicated problems – Extended Bottleneck model - sizing the FMS, FMS applications, Benefits.

UNIT IV PROCESS PLANNING 10

Process planning – Activities in process planning, Information's required. From design to process planning – classification of manufacturing processes – Selection of primary manufacturing processes – selecting among casting process, forming process and machining process. Sequencing of operations according to Anteriorities – various examples – forming of Matrix of Anteriorities – case study. Typical process sheet – case studies in Manual process planning. Computer Aided Process Planning – Process planning module and data base – Variant process planning – Two stages in VPP – Generative process planning – Flow chart showing various activities in generative PP – Semi generative process planning.

UNIT V TYPES OF PROCESS CONTROL AND AUTOMATIC DATA CAPTURE 9

Introduction to process model formulation – linear feedback control systems – Optimal control – Adaptive control –Sequence control and PLC. Computer process control – Computer process interface – Interface hardware – Computer process monitoring – Direct digital control and Supervisory computer control. Overviews of Automatic identification methods – Bar code technology – Other Automatic data capture technologies.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCE:

1. Mikell P.Groover, “Automation, Production system and Computer integrated Manufacturing”, Prentice Hall of India Pvt. Ltd., 2008.
2. Radhakrishnan,P., Subramanian,S., and Raju,V., “CAD/CAM/CIM” New Age International Publishers, 2000.
3. James A.Retrg, Herry W.Kraebber, “Computer Integrated Manufacturing”, Pearson Education, Asia, 2001.
4. Viswanathan,N., and Narahari,Y., “Performance Modeling and Automated Manufacturing Systems”, Prentice Hall of India Pvt. Ltd., 2000.
5. Alavudeen and Venkateshwaran, “Computer Integrated Manufacturing”, PHI Learning Pvt. Ltd., New Delhi, 2008.

SEMESTER IV

19254H41P MANUFACTURING METROLOGY AND QUALITY CONTROL 3 1 0 4

AIM:

To expose the students, the importance of measurement and the various latest measuring techniques using Laser, Coordinate measuring machines and Optoelectronics devices. Also to stress upon the Importance of quality in manufacturing.

OBJECTIVES:

To impart through knowledge in various latest measurement systems such as laser metrology, coordinate measuring machines and electro-optical devices. Also to make the students to understand quality

UNIT – I LASER METROLOGY 8

Introduction – types of lasers – laser in engineering metrology – metrological laser methods for applications in machine systems – Interferometry applications – speckle interferometry – laser interferometers in manufacturing and machine tool alignment testing – calibration systems for industrial robots laser Doppler technique – laser Doppler anemometry.

UNIT – II PRECISION INSTRUMENTS BASED ON LASER 9

Laser telemetric systems – detection of microscopic imperfections on high quality surface Pitter NPL gauge interferometer – classification of optical scanning systems – high inertia laser scan technique – rotating mirror technique – laser gauging – bar coding – laser dimensional measurement system.

UNIT – III CO-ORDINATE MEASURING MACHINE 10

Co-ordinate metrology – CMM configurations – hardware components – software – Probe sensors – displacement devices – Performance Evaluations – Software – Hardware – Dynamic errors – Thermal effects diagram – temperature variations environment control – applications.

UNIT – IV OPTO ELECTRONICS AND VISION SYSTEM 9

Opto electronic devices – CCD – On-line and in-process monitoring in production – applications image analysis and computer vision – Image analysis techniques – spatical feature – Image extraction – segmentation – digital image processing – Vision system for measurement – Comparison laser scanning with vision system.

UNIT – V QUALITY IN MANUFACTURING ENGINEERING 9

Importance of manufacturing planning for quality – concepts of controllability – need for quality management system and models – quality engineering tools and techniques – statistical process control – six sigma concepts – Poka Yoke – Computer controlled systems used in inspection.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCE:

1. John A. Bosch, Giddings and Lewis Dayton, Co-ordinate Measuring Machines and Systems, Marcel Dekker, Inc, 1999.
2. Juran J.M. and Gyna F.M., Quality Planning and Analysis, Tata-McGraw Hill, New Delhi
3. Zuech, Nello Understanding and Applying Machine Vision, Marcel Dekker, Inc, 2000

4. Elanchezhian.C, Vijaya Ramnath.B and Sunder Selwyn, T., Engineering Metrology, Eswar Press, Chennai, 2004.

SEMESTER IV

19254H42P METAL FORMING PROCESS 4 0 0 4

OBJECTIVE: To study about the response of materials under plastic deformation and the various techniques for finding the stress for various metal working processes, and the recent developments in high speed forming.

UNIT-I: Stress and Strain:

Stress-State of stress in two dimensions – three dimensions – stress tensor-Mohr's circles – 2D and 3D state of stress – Description of strain at a point – Mohr's circle of strain- Hydrostatic and stress deviator component of stress- Plasticity- flow curve-true and true strain yield criteria for ductile loads combined stress test-plastic stress and strain relations- Levy Mises equations-Prandyl_Resus equations.

UNIT-II: Analysis of Metal Forming:

Work Load analysis – work formula for homogeneous deformation- rolling, rod drawing and extrusion processes -Determination of load by stress evaluation method-Determination of drawing load – strip drawing with wedge shaped dies and cylindrical rod drawing with a conical die.

UNIT-III: Stress Evaluation:

Stress evaluation method-Determination of forging load-plane strain forging of a thin strip and a flat circular disc- Determination of extrusion load for round band flat strip-upper bound analysis – plane strain indentation with frictionless interface

UNIT-IV: High velocity Forming:

Study of effect of high speed on stress strain relationships- High velocity forming equipment-Description of high speed forming machine – hot forging, pneumatic-mechanical, high velocity forging – Fuel combustion process- Electro magnetic forming –Introduction- Procedure - process variables- Applications

UNIT-V: Advanced Forming process:

Explosive Forming – Explosives – characteristics- stand off and contact operations-stress waves and their effects- process variables – properties of formed components-applications- Electro hydraulic forming – principles, requirements and characteristics – process variables- water hammer forming- principles and parameters- governing the process.

BOOKS FOR REFERENCE:

1. George E.Dieter, "Mechanical Metallurgy", Mc Graw Hill International Edition, New York,1988
2. Rowe G.W,Edward , "An Introduction to the Principles of Metal Working", Edward Arnold publications.
3. Davies.R and Austin.E.R, "Developments in High Metal Forming", The Machinery Publishing Co.Ltd
4. Robert H.Wagoner and Jean Loup Chenot, "Fundamentals of Metal Forming", John Wiley and Sons Inc, New York,1992

List of Electives - Elective I

19254E23AP - FINITE ELEMENT APPLICATIONS IN MANUFACTURING 3 10 4

AIM:

To impart knowledge in the area of finite element methods and its application in manufacturing.

OBJECTIVE:

To study the fundamentals of one dimensional and two dimensional problems using FEA in manufacturing.

UNIT I INTRODUCTION 6

Fundamentals – Initial, boundary and eigen value problems – weighted residual, Galerkin and Raleigh Ritz methods - Integration by parts – Basics of variational formulation – Polynomial and Nodal approximation.

UNIT II ONE DIMENSIONAL ANALYSIS 10

Steps in FEM – Discretization. Interpolation, derivation of elements characteristic matrix, shape function, assembly and imposition of boundary conditions-solution and post processing – One dimensional analysis in solid mechanics and heat transfer.

UNIT III SHAPE FUNCTIONS AND HIGHER ORDER FORMULATIONS 10

Shape functions for one and two dimensional elements- Three noded triangular and four nodded quadrilateral element Global and natural co-ordinates—Non linear analysis – Isoparametric elements – Jacobian matrices and transformations – Basics of two dimensional, plane stress, plane strain and axisymmetric analysis.

UNIT IV COMPUTER IMPLEMENTATION 9

Pre Processing, mesh generation, elements connecting, boundary conditions, input of material and processing characteristics – Solution and post processing – Overview of application packages – Development of code for one dimensional analysis and validation.

UNIT V ANALYSIS OF PRODUCTION PROCESSES 10

FE analysis of metal casting – special considerations, latent heat incorporation, gap element – Time stepping procedures – Crank – Nicholson algorithm – Prediction of grain structure – Basic concepts of plasticity and fracture – Solid and flow formulation – small incremental deformation formulation – Fracture criteria – FE analysis of metal cutting, chip separation criteria, incorporation of strain rate dependency – FE analysis of welding.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCE:

1. Reddy, J.N. An Introduction to the Finite Element Method, McGraw Hill,1985.
2. Rao, S.S., Finite Element method in engineering, Pergammon press, 1989.
3. Lewis R.W.Morgan, K, Thomas, H.R. and Seetharaman, K.N. The Finite Element Method in Heat Transfer Analysis, John Wiley, 1994.

19254E23BP LEAN MANUFACTURING 4 0 0 4

AIM:

To introduce the concepts of lean manufacturing system.

OBJECTIVES:

- To study the various tools for lean manufacturing (LM).
- To apply the above tools to implement LM system in an organization.

UNIT – I INTRODUCTION TO LEAN MANUFACTURING 7

Conventional Manufacturing versus Lean Manufacturing – Principles of Lean Manufacturing – Basic elements of lean manufacturing – Introduction to LM Tools.

UNIT – II CELLULAR MANUFACTURING, JIT, TPM 9

Cellular Manufacturing – Types of Layout, Principles of Cell layout, Implementation. JIT – Principles of JIT and Implementation of Kanban. TPM – Pillars of TPM, Principles and implementation of TPM.

UNIT – III SET UP TIME REDUCTION, TQM, 5S, VSM 10

Set up time reduction – Definition, philosophies and reduction approaches. TQM – Principles and implementation. 5S Principles and implementation - Value stream mapping - Procedure and principles.

UNIT – IV SIX SIGMA 9

Six Sigma – Definition, statistical considerations, variability reduction, design of experiments – Six Sigma implementation.

UNIT – V CASE STUDIES 10

Various case studies of implementation of lean manufacturing at industries.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCES:

1. Design and Analysis of Lean Production Systems, Ronald G. Askin & Jeffrey B. Goldberg, John Wiley & Sons, 2003

2. Rother M. and Shook J, 1999 ‘Learning to See: Value Stream Mapping to Add Value and Eliminate Muda’ , Lean Enterprise Institute, Brookline, MA.

1. Mikell P. Groover (2002) ‘Automation, Production Systems and CIM.

19254E23CP - DESIGN AND ANALYSIS OF EXPERIMENTS 3 1 0 4

1. INTRODUCTION7

Defining Research, Scientific Enquiry, Hypothesis, Scientific Method, Types of Research, Research Process and steps in it. Research Proposals – Types, contents, sponsoring agent's requirements, Ethical, Training, Cooperation and Legal aspects.

2. RESEARCH DESIGN 10

Meaning, Need, Concepts related to it, categories; Literature Survey and Review, Dimensions and issues of Research Design, Research Design Process – Selection of type of research, Measurement and measurement techniques ,Selection of Sample, Selection of Data Collection Procedures, Selection of Methods of Analysis, Errors in Research. Research Problem Solving – Types, Process and Approaches – Logical, Soft System and Creative; Creative problem solving process, Development of Creativity, Group Problem Solving Techniques for Idea Generation – Brain storming and Delphi Method.

3. RESEARCH MODELING 10

Mathematical – Classification of Models, Development of Models, Stages in Model building, Principles of Modeling, Use of Analogy, Models as Approximations, Data consideration and Testing of Models (b) Heuristics and Simulation – Definition, Applications and reasons for using Heuristics, Heuristic Methods and approaches, Meta-Heuristics; Simulation – Meaning, Applications and Classification of Simulation Models, Process of Simulation, Steps and Features of Simulation Experiments and their Validation.

4. EXPERIMENTATION 8

Objective, Strategies, Factorial Experimental Design, Applications of Experimental Design, Basic Principles – Replication, Randomization and Blocking, Guidelines for designing experiments; Laboratory Experiments, Methods of manipulating Variables, Errors in Experiments, Steps in Design of Experiments.

5. PROCESS OPTIMIZATION AND ANALYSIS 10

Factorial Design principles, Two factor Factorial Design, General Factorial Design, Fitting response Curves and Surfaces, Blocking, Taguchi Approach to Parameter Design, Robust Design. Analysis of Variance and Co-variance, Hypothesis Testing – Parametric. Report Writing: Pre-writing Considerations, Principles of Thesis Writing, Format of Report Writing, Format of Publication in Research Journals

REFERENCES FOR BOOKS:

1. Krishnaswamy, K.N., Sivakumar, Appa Iyer & Mathirajan M., (2006) -Management Research Methodology: Integration of Principles, Methods & Techniques (New Delhi, Pearson Education)

2. Montgomery, Douglas C. (2004) – Design & Analysis of Experiments, 5/e. (New York, John Wiley & Sons)

3. Kothari, C.K. (2004) – Research Methodology, Methods & Techniques, 2/e. (New Delhi, New Age International Ltd. Publishers)

4. Ross, Phillip J. (1996) – Taguchi Techniques for Quality Engineering, 2/e. (New York, McGraw Hill)

5. Rao S. S. (2004) – Engineering Optimization Theory & Practices, 3/e (New Delhi, New Age International Ltd., Publishers)

List of Electives - Elective II

19254E33AP MATERIALS MANAGEMENT AND LOGISTICS 4 0 0 4

AIM:

To introduce to the students the various functions of materials management and logistics

OBJECTIVE:

To make the students familiar with the various concepts and functions of material management, so that the students will be in a position to manage the materials management department independently.

UNIT I INTRODUCTION 6

Introduction to materials management – Objectives – Functions – Operating Cycle – Value analysis – Make or buy decisions.

UNIT II MANAGEMENT OF PURCHASE 7

Purchasing policies and procedures – Selection of sources of supply – Vendor development – Vendor evaluation and rating – Methods of purchasing – Imports – Buyer – Seller relationship – Negotiations.

UNIT III MANAGEMENT OF STORES AND LOGISTICS 12

Stores function – Location – Layout – Stock taking – Materials handling – Transportation – Insurance – Codification – Inventory pricing – stores management – safety – warehousing – Distribution linear programming – Traveling Salesman problems – Network analysis – Logistics Management.

UNIT IV MATERIALS PLANNING 10

Forecasting – Materials requirements planning – Quantity – Periodic – Deterministic models – Finite production.

UNIT V INVENTORY MANAGEMENT 10

ABC analysis – Aggregate planning – Lot size under constraints – Just in Time (JIT) system.

TOTAL: 45

BOOKS FOR REFERENCE:

1. Lamer Lee and Donald W.Dobler, Purchasing and Material Management, Text and cases, Tata McGraw Hill, 1996.
2. Gopalakrishnan.P, Handbook of Materials Management, Prentice Hall of India, 1996.
3. Guptha P.K. and Manmohan, Problems in Operations Research, Suttan Chand & Sons, 2003.
4. Dr.R. Kesavan, C.Elanchezian and B.Vijaya Ramnath, Production Planning and Control, Anuratha Publications, Chennai, 2008.

5. G. Reghuram, N. Rangaraj, Logistics and supply chain management – cases and concepts, Macmillan India Ltd., 2006.

19254E33BP FINANCIAL MANAGEMENT 4 0 0 4

AIM:

To introduce the concepts of financial and various functions of financial management so that the students will be able to handle higher level financial decisions.

OBJECTIVES:

To train students in various functions of finance such as working capital management, current assets management so that students will be able to make high investment decisions when they take up senior managerial positions.

UNIT – I FINANCIAL ACCOUNTING 8

Accounting principles - Basic records - Preparation and interpretation of profit and loss statement - balance sheet - Fixed assets - Current assets.

UNIT – II COST ACCOUNTING 12

Elements of cost - cost classification - material cost - labour costs - overheads - cost of a product - costing systems - cost determination - process - costing - Allocation of overheads - Depreciation - methods.

UNIT – III MANAGEMENT OF WORKING CAPITAL 10

Current assets - Estimation of working capital requirements - Management of accounts receivable - Inventory - Cash - Inventory valuation methods.

UNIT – IV CAPITAL BUDGETING 8

Significance of capital budgeting - payback period - present value method – accounting rate of return method - Internal rate of return method.

UNIT – V PROFIT PLANNING AND ANALYSIS 7

Cost - Volume profit relationship relevant costs in decision making profit management analysis - Break even analysis.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCE:

1. Presanna Chandra, Financial Management, Tata McGraw Hill, 1998.
2. G.B.S. Narang, Production and Costing, Khanna Publishers, 1993.
3. R. Kesavan, C.Elanchezian, Sundar Selwyn, Engineering Economics and Financial Accounting, Laxmi Publications, New Delhi, 2005.
4. R Kesavan, C. Elanchezian, B.Vijaramnath, Engineering Economics and Cost Analysis Anuratha Publications, Chennai.

19254E33CP MANUFACTURING INFORMATION SYSTEMS 4 0 0 4

AIM:

To impart the knowledge in manufacturing information system.

OBJECTIVE:

On completion of this course, the students are expected to be conversant with order policies, data base terminologies, designing, manufacturing considerations and information system for manufacturing.

UNIT I INTRODUCTION 5

The Evolution of order policies, from MRP to MRP II, the role of Production organization, Operations control.

UNIT II DATABASE 7

Terminologies – Entities and attributes – Data models, schema and subschema - Data Independence – ER Diagram – Trends in database.

UNIT III DESIGNING DATABASE 13

Hierarchical model – Network approach- Relational Data model concepts, principles, keys, relational operations – functional dependence – Normalization types – Query.

UNIT IV MANUFACTURING CONSIDERATION 10

The product and its structure, inventory and process flow – Shop floor control Data structure and procedure – various model – the order scheduling module, Input/output analysis module the stock status database – the complete IOM database.

UNIT V INFORMATION SYSTEM FOR MANUFACTURING 10

Parts oriented production information system – concepts and structure – Computerized production scheduling, online production control systems; Computer based production management system, computerized manufacturing information system – case study.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCE:

1. Luca G.Sartori, “Manufacturing Information Systems”, Addison-Wesley Publishing Company, 1988.
2. Date.C.J.,”An Introduction to Database Systems” Addison Wesley, 8th Edn,.2003
3. Orlicky.G., “Material Requirements Planning”, McGraw-Hill, 1994.
4. Kerr.R, “Knowledge based Manufacturing Management”, Addison-Wesley,1991.
5. Manufacturing Information & Data Systems Analysis, Design & Practice,CECELJA FRANJO, 2002.

List of Electives - Elective III

19254E43AP ADVANCED METROLOGY AND COMPUTER AIDED INSPECTION 4 0 0 4

AIM:

To give a thorough knowledge of measurement and instrumentation of increasing importance in industry. The student will be knowledgeable in various standards and proliferation of computerized and automated inspecting techniques along with the classical metrology.

OBJECTIVES:

- To teach the students basic concepts in various methods of engineering measurement techniques and applications, understand the importance of measurement and inspection in manufacturing industries.
- Expose the students to various modern metrological instruments and the procedure used to operate these instruments.

UNIT I GENERAL CONCEPTS OF MEASUREMENT 8

Definition – Standards of measurement – Errors in measurement – Interchangeability and Selective assembly – Accuracy and Precision – Calibration of instruments.

UNITII MEASUREMENT OF SURFACE FINISH AND MEASURING MACHINES 9

Definitions – Types of Surface Texture: Surface Roughness Measurement Methods- Comparison, Profilometer, 3D Surface Roughness Measurement – Instruments.

UNIT III INTERFEROMETRY 8

Interferometry – Introduction, Principles of light interference – Interferometers – Measurement and Calibration – Laser Interferometry.

UNIT IV COMPUTER AIDED AND LASER METROLOGY 10

Tool Makers Microscope – Microhite – Co – Ordinate measuring machine – Applications – Laser Micrometer, Laser Scanning gauge, Non contact and in-process inspection, Vision system.

UNIT V IMAGE PROCESSING 10

Overview, Computer imaging systems, Image Analysis, Preprocessing, Human vision system, Image model, Image enhancement, gray scale models, histogram models, Image Transforms.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCE:

1. GUPTA, I.C, "A Text Book of engineering metrology", Dhanpat Rai and Sons, 1996.
2. G.N.GALYER F.W. and C.R.SHOTBOLT, "Metrology for engineers", ELBS, 1990.
3. GRAHAM T.SMITH, "Industrial Metrology", Springer, 2002
4. "ASTE Handbook of Industries Metrology", Prentice Hall of India Ltd., 1992.
5. R.K.RAJPUT, "Engineering Metrology and Instrumentations", Kataria & Sons Publishers, 2001.
6. MILAN SONKA, VACLAV HLAVAC and ROGER BOYLE, "Image Processing, Analysis, and Machine Vision", Cengage-Engineering; 3 edition (March 19, 2007).

19254E43BP MAINTENANCE MANAGEMENT 4 0 0 4

OBJECTIVE:

To understand the concepts of maintenance management and to have knowledge in developing a suitable maintenance system for any type of an organization.

UNIT I: Introduction to Maintenance Management: 7

Maintenance: Its role and scope in total Organizational contexts - role of Maintenance. Centralized and decentralized maintenance organization structures. Maintenance Economics – reliability and Availability – MTBF, MTTR.

UNIT II: Maintenance Categories: 10

Maintenance system– Categories - Design and its selection – Breakdown Maintenance –Routine Maintenance- Predictive Maintenance –Preventive Maintenance- Corrective Maintenance-Total Productive Maintenance –Maintenance Schedule – Repair Cycle.

UNIT III: Spare Parts Management: 8

Pareto's principles for repetitive breakdown analysis, spares management, planning considerations for each type of activities.

UNIT – IV: Condition Monitoring: 10

Condition Monitoring (CM) – Introduction- Economics of CM – On-load and off-load testing – Methods and instruments for CM – Temperature sensitive tapes – Pistol thermometers – wear-debris analysis.

UNIT V: Maintenance Manpower Cost, Performance Management: 10

Maintenance man power planning - Selection training - Scheduling maintenance costs - Budget preparation and budgetary control of maintenance expenditures Maintenance effectiveness various performance indices - evaluation, uses and limitations - Monitoring of Maintenance performance.

BOOKS FOR REFERENCE:

1. Gopalakrishnan P. and Sundarajan 1996. Maintenance Management. New Delhi, Prentice-Hall of India.
2. Srivastava S.K., "Industrial Maintenance Management", - S. Chand & Co.,1981.
3. Higgirs L.T and Morrow L.C., 1997, ``Maintenance Engineering Handbook``, McGraw Hill.
Armstrong, "Condition Monitoring", BSIRSA, 1988.

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19254E43CP OPTIMIZATION TECHNIQUES 3 1 0 4

UNIT I - INTRODUCTION TO OPTIMIZATION 7

Formulation of an optimization problem- Classification of optimization problem – optimization techniques- Classical optimization technique – Single variable optimization – Multi variable optimization algorithms

UNIT II - MINIMIZATION METHODS 8

One dimensional minimization methods: unimodal function – elimination methods: unrestricted search, exhaustive search, Dichotomous search, Fibonacci methods, Golden section methods, Interpolation methods: Quadratic and cubic interpolation methods.

UNIT III - CONSTRAINED OPTIMIZATION TECHNIQUES 10

Optimization with equality and inequality constraints - Direct methods – Indirect methods using penalty functions, Lagrange multipliers - separable programming and Geometric programming.

UNIT IV - UNCONSTRAINED OPTIMIZATION TECHNIQUES 10

Multi variable unconstrained optimization techniques: Direct search methods: Random search method, unvaried method, pattern search method, steepest descent method and Conjugate gradient method.

UNIT V - APPLICATIONS OF HEURISTICS IN OPTIMIZATION 10

Heuristics-Introduction-Multi objective optimization: Genetic algorithms and Simulated Annealing techniques; neural network & Fuzzy logic principles in optimization.

BOOKS FOR REFERENCE:

1. Rao, Singaresu, S., "Engineering Optimization – Theory & Practice", New Age International (P) Limited, New Delhi, 2000.
2. Johnson Ray, C., "Optimum design of mechanical elements", Wiley, John & Sons, 1990.
3. Kalyanamoy Deb, "Optimization for Engineering design algorithms and Examples", Prentice Hall of India Pvt. 1995.
4. Goldberg, D.E., "Genetic algorithms in search, optimization and machine", Barnen, Addison-Wesley, New York, 1989.

List of Electives - Elective IV

19254E51AP MANUFACTURING SYSTEMS AND SIMULATION 4 0 0 4

AIM:
To introduce the various concepts of manufacturing system simulation.

OBJECTIVES:
- To model manufacturing systems of different kinds.
- To make use of simulation languages for manufacturing systems.

UNIT I INTRODUCTION 8
Basic concepts of system – elements of manufacturing system - concept of simulation – simulation as a decision making tool – types of simulation – Monte-Carlo simulation - system modeling – types of modeling – Limitations and Areas of application of simulation.

UNIT II RANDOM NUMBERS 10
Probability and statistical concepts of simulation – Pseudo random numbers – methods of generating random numbers – discrete and continuous distribution – testing of random numbers – kolmogorov-mirnov test, the Chi-Square test - sampling - simple, random and simulated.

UNIT III DESIGN OF SIMULATION EXPERIMENTS 10
Problem formulation – data collection and reduction – time flow mechanical – key variables - logic flow chart starting condition – run size – experimental design consideration – output analysis, interpretation and validation – application of simulation in engineering industry.

UNIT IV SIMULATION LANGUAGE 9
Comparison and selection of simulation languages - Study of GPSS (Basic blocks only) Generate, Queue, Depart, Size, Release, Advance, Terminate, Transfer, Enter and Leave.

UNIT V CASE STUDIES 10
Development of simulation models using GPSS for queuing, production, inventory, maintenance and replacement systems – case studies.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCE:

1. Jerry Banks and John S.Carson, “Discrete event system simulation”, Prentice Hall 1991
2. 1 .John H.Mize and J.Grady Cox, “Essentials of simulation” – Prentice hall 1989.
3. Geoffrey Gordon “System simulation” – Prentice Hall of India, 1992
4. Jeffrey L.Written, Lonnie D, Bentley and V.M. Barice, “System analysis and Design Methods”, Galgotia publication, 1995
5. Averill M.Law and W.David Kelton, “Simulation Modeling and analysis”, McGraw Hill International Editions, 1991
6. Shannon R.E., “System simulation”, Prentice Hall 1993.

19254E51BP INSTRUMENTATION AND CONTROL ENGINEERING 4 0 0 4

UNIT–I: Introduction to Instrumentation: 8
Mechanical Instrumentation- General concepts, General measurement system. Classification of Instruments - indicators, recorders and integrators- working principles, Precision and Accuracy: Measurement Error and calibration.

UNIT–II: Measuring Devices 10
Measurement of speed, frequency, acceleration - Vibrometer, Accelerometer etc. Pressure measurement: Gravitational, Bourdon, elastic transducers, strain gauge, pressure cells, and measurement of high and low pressure. Temperature measurement: Bi-Metallic, Resistance Thermometer, Thermocouples, Pyrometer, thermostats, Magnetic flow meter , Ultrasonic flow meter.

UNIT – III: Transducers: 8
Transducers – Introduction – Types -Variable resistance Transducers-Variable reactive transducers- Piezo Electric transducers- Fibre optic transducers- Laser instrumentation-analogue and digital type -incremental and absolute measurement.

UNIT – IV: Machine Diagnostic and Condition Monitoring: 10

Machine Diagnostics – Basic Concepts - Analysis of failure in machines-Distribution of fault occurrences-Objectives of monitoring-Monitoring techniques applied to Machineries.

UNIT – V: Computer Control System: 9

Data acquisition system-Introduction-Direct Digital control-Programmable Logic Controls (PLC) -Ladder diagrams-Communication used in PLC.

BOOKS FOR REFERENCE:

1. Thomas Beckwith, Lewis Buck N.Ray, D. Maragoni, "Mechabical Measurements", Narosia Publishing House, NewDelhi.
2. M.P.Groover - " Automation, Production Systems and computer Intergrated Manufacturing ", Prentice Hall.
3. A.K. Sawhney, "Elecrical and Electronics Measurements & Instrumentation", Dhanpat Rai & Sons, 1993
4. C.S.Rangan,V.S.V.Mani and G.R.Sarma - " Instrumentation Devices and systems", Tata McGraw Hill,1983

19254E51CP ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS 3 1 0 4

UNIT – I - Neural Networks 8

Introduction to soft Computing-Neural Networks-Supervised Learning Neural Networks – Perceptrons – Adaline – Back propagation Multilayer perceptrons – Radial Basic Function Networks – Unsupervised Learning and Other Neural Networks – Competitive Learning Networks – Kohonen Self – Organizing Networks – Learning Vector Quantization – Habbian Learning.

UNIT – II - Fuzzy Logic: 10

Fuzzy Sets – Basic Definition and Terminology – Set –theoretic operations – Member Function Formulation and parameterization – Fuzzy Rules and Fuzzy Reasoning. Fuzzy Logic: Extension principle and Fuzzy Relations – Fuzzy If – Then Rules – Fuzzy Reasoning – Fuzzy Inference Systems – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models – Input Space Partitioning and Fuzzy Modeling.

UNIT – III Genetic Algorithm: 9

Derivative – based Optimization – Descent Methods – The Method of steepest Descent – Classical Newton's Method – Step Size Determination – Derivative – free Optimization – Genetic Algorithms – Simulated Annealing – Random Search – Downhill Simplex Search.

UNIT – IV Neuro Fuzzy Modeling: 10

Adaptive Neuro – Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm – learning Methods that Cross – Fertilize ANFIS and RBFN – Coactive Neuro – Fuzzy Modeling – Framework – Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum.

UNIT – V Applications: 8

Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency prediction – Soft Computing for Color Recipe Prediction – Single MLP approaches –CANFIS modeling for color recipe prediction

BOOKS FOR REFERENCE:

1. Jang, J.S.R., C.T. Sun and E. Mizutani., "Neuro – Fuzzy and Soft Computing", PHI, Person Education, 2004.

2. Eberhart, R., simpson, P. and Dobbins, R., " Computatuonal Intelligence PC Tools", AP Professional, Boston 1996.

3. Goldberg, Davis E., "Optimization and Machine Learning" Addison Wesley, New York, 1989.

4. S. Rajasekaran and Pai, G.A.V., "Neural Networks, Fuzzy Logic and Genetic Algorithms",Prentice Hall of India, New Delhi, 2003.

List of Electives - Elective V

19254E52AP PRODUCT DESIGN AND DEVELOPMENT 4 0 0 4

UNIT I - INTRODUCTION 7

Significance of product design, product design and development process, sequential engineering design method, the challenges of product development.

UNIT II - PRODUCT PLANNING AND PROJECT SELECTION 8

Identifying opportunities evaluate and prioritize projects, allocation of resources Identifying Customer Needs, Interpret raw data in terms of customers need, organize needs in hierarchy and establish the relative importance of needs.

UNIT III - PRODUCT SPECIFICATIONS 8

Establish target specifications, setting final specifications, Concept Generation: Activities of concept generation, clarifying problem, search both internally and externally.

UNIT IV - INDUSTRIAL DESIGN AND CONCEPT SELECTION10

Assessing need for industrial design, industrial design process, management, assessing quality of industrial design, Overview, concept screening and concept scoring, methods of selection.

UNIT V - THEORY OF INVENTIVE PROBLEM SOLVING (TRIZ) AND CONCEPT TESTING 12

Fundamentals, methods and techniques, General Theory of Innovation and TRIZ, Value engineering Applications in Product development and design, Model-based technology for generating innovative ideas Elements of testing: qualitative and quantitative methods including survey, measurement of customers' response, Intellectual Property: Elements and outline, patenting procedures.

BOOKS FOR REFERENCE:

1. Ulrich K. T, and Eppinger S.D, Product Design and Development, Tata McGraw Hill
2. Otto K, and Wood K, Product Design, Pearson
3. Engineering of creativity: introduction to TRIZ methodology of inventive Problem Solving, By Semyon D. Savransky, CRC Press.
4. Inventive thinking through TRIZ: a practical guide, By Michael A. Orloff, Springer.
5. Systematic innovation: an introduction to TRIZ ; (theory of inventive Problem Solving), By John Terninko, Alla Zusman, CRC Press.

19254E52BP FLUID POWER AUTOMATION 4 0 0 4

AIM:

To impart knowledge in the area of hydraulics, pneumatic and fluid power components and its functions.

OBJECTIVE:

• To make the students to learn the basic concepts of hydraulics and pneumatics and their controlling elements in the area of manufacturing process.

• To train the students in designing the hydraulics and pneumatic circuits using ladder diagram.

UNIT I INTRODUCTION 5

Need for Automation, Hydraulic & Pneumatic Comparison – ISO symbols for fluid power elements, Hydraulic, pneumatics – Selection criteria.

UNIT II FLUID POWER GENERATING/UTILIZING ELEMENTS 8

Hydraulic pumps and motor gears, vane, piston pumps-motors-selection and specification-Drive characteristics – Linear actuator – Types, mounting details, cushioning – power packs – construction. Reservoir capacity, heat dissipation, accumulators – standard circuit symbols, circuit (flow) analysis.

UNIT III CONTROL AND REGULATION ELEMENTS 8

Direction flow and pressure control valves-Methods of actuation, types, sizing of ports pressure and temperature compensation, overlapped and under lapped spool valves operating characteristics-electro hydraulic servo valves-Different types-characteristics and performance.

UNIT IV CIRCUIT DESIGN 10

Typical industrial hydraulic circuits-Design methodology – Ladder diagram-cascade, method-truth table-Karnaugh map method-sequencing circuits-combinational and logic circuit.

UNIT V ELECTRO PNEUMATICS & ELECTRONIC CONTROL OF HYDRAULIC AND PNEUMATIC CIRCUITS 7

Electrical control of pneumatic and hydraulic circuits-use of relays, timers, counters, Ladder diagram. Programmable logic control of Hydraulics Pneumatics circuits, PLC ladder diagram for various circuits, motion controllers, use of field busses in circuits. Electronic drive circuits for various Motors.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCE:

1. Antony Esposito, Fluid Power Systems and control Prentice-Hall, 1988.
2. Peter Rohner, Fluid Power logic circuit design. The Macmillan Press Ltd.,London, 1979
3. E.C.Fitch and J.B.Suryaatmadyn. Introduction to fluid logic, McGraw Hill, 1978.
4. W.Bolton, Mechatronics, Electronic control systems in Mechanical and Electrical Engineering Pearson Education, 2003.
5. Peter Rohner, Fluid Power Logic Circuit Design, Mcmelan Prem, 1994.

List of Electives - Elective VI

19254E53AP ADVANCED MATERIAL TECHNOLOGY 4 0 0 4

AIM:

To impart knowledge on advance concepts of material technology

OBJECTIVE:

- To enlight the PG students on elastic, plastic and fractured behaviour of engineering Materials.
- To train the PG students in selection of metallic and non-metallic materials for the various engineering applications.

UNIT I ELASTIC AND PLASTIC BEHAVIOR 10

Elasticity in metals and polymers Anelastic and visco-elastic behaviour – Mechanism of plastic deformation and non metallic shear strength of perfect and real crystals – Strengthening mechanisms, work hardening, solid solutioning, grain boundary strengthening, poly phase mixture, precipitation, particle, fibre and dispersion strengthening. Effect of temperature, strain and strain rate on plastic behaviour – Super plasticity – Deformation of non crystalline materials.

UNIT II FRACTURE BEHAVIOUR 10

Griffith's theory, stress intensity factor and fracture toughness – Toughening mechanisms – Ductile, brittle transition in steel – High temperature fracture, creep – Larson Miller parameter – Deformation and fracture mechanism maps – Fatigue, low and high cycle fatigue test, crack initiation and propagation mechanisms and Paris law. Effect of surface and metallurgical parameters on fatigue – Fracture of non metallic materials – Failure analysis, sources of failure, procedure of failure analysis.

UNIT III SELECTION OF MATERIALS 10

Motivation for selection, cost basis and service requirements – Selection for mechanical properties, strength, toughness, fatigue and creep – Selection for surface durability corrosion and wear resistance – Relationship between materials selection and processing – Case studies in materials selection with relevance to aero, auto, marine, machinery and nuclear applications – Computer aided materials selection.

UNIT IV MODERN METALLIC MATERIALS 8

Dual phase steels, High strength low alloy (HSLA) steel, Transformation induced plasticity (TRIP) Steel, Maraging steel, Nitrogen steel – Intermetallics, Ni and Ti aluminides – smart materials, shape memory alloys – Metallic glass and nano crystalline materials.

UNIT V NON METALLIC MATERIALS 7

Polymeric materials – Formation of polymer structure – Production techniques of fibers, foams, adhesives and coating – structure, properties and applications of engineering polymers – Advanced structural ceramics, WC, TIC, TaC, Al2O3, SiC, Si3N4 CBN and diamond – properties, processing and applications.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCE:

1. George E.Dieter, Mechanical Metallurgy, McGraw Hill, 1988.
2. Thomas H. Courtney, Mechanical Behaviour of Materials, (2nd edition), McGraw Hill, 2000.
3. Flinn, R.A., and Trojan, P.K., Engineering Materials and their Applications, (4th Edition) Jaico, 1999.
4. ASM Hand book, Vol.11, Failure Analysis and Prevention, (10th Edition), ASM, 2002.
5. Ashby M.F., Material Selection in Mechanical Design, 3rd Edition, Butter Worth 2005.

1.1.2SUPPORTINGDOCUMENTS

1.1.2 Total number of courses having focus on employability/ entrepreneurship/skilldevelopmentoffered bytheUniversityduringthe year.

SCHOOLOFENGINEERINGANDTECHNOLOGY

DEPARTMENTOFELECTRONICSANDCOMMUNICATION ENGINEERING

SkillDevelopment	
Employability	
Entrepreneurship	

PRISTDEEMEDTOBE UNIVERSITY

Vallam,Thanjavur

SCHOOLOFENGINEERINGANDTECHNOLOGY

DEPARTMENTOF

ELECTRONICS&COMMUNICATIONENGINEERING

PROGRAMHANDBOOK

B.TECH-PARTTIME

[REGULATION2022]

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

PROGRAMMEEDUCATIONALOBJECTIVES:

PEO1:To enable graduates to pursue research, or have a successful career in academia or industries associated with Electronics and Communication Engineering, or as entrepreneurs.

PEO2: To provide students with strong foundational concepts and also advanced techniquesand tools in order to enable them to build solutions or systems of varying complexity.

PEO3: To prepare students to critically analyze existing literature in an area of specialization and ethically develop innovative and research oriented methodologies to solve the problems identified.

PROGRAMMEOUTCOMES:

EngineeringGraduateswillbeableto:

A. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

B. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

C. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

D. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data,and synthesis of the information to provide valid conclusions.

E. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

F. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legalandculturalissuesandtheconsequent responsibilities relevant to the professional engineering practice.

G. **Environment and sustainability**: Understandtheimpact of theprofessional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

H. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

I. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

J. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

K. **Project management and finance**: Demonstrate knowledge and understanding of the engineeringand management principles andapplytheseto one's ownwork, asa member and leader in a team, to manage projects and in multidisciplinary environments.

L. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the programmeobjective and theoutcomesisgiven in the following table

PROGRAMME EDUCATIONAL OBJECTIVES	**PROGRAMMEOUTCOMES**												
	A	B	C	D	E	F	G	H	I	J	K	L	M
1	3	3	2	3	2	1	1	2	1	1	3	1	3
2	3	3	3	3	3	1	1	1	1	1	1	2	2
3	3	3	3	3	3	2	2	3	1	2	2	2	2

Contribution **1:Reasonable** **2:Significant** **3:Strong**

B.TECH(PARTTIME)–ECE–R-2022

SEMESTER I – VII CURRICULUM

SEMESTER-I

S.NO	SUB CODE	SUBJECTNAME	PeriodsPerWeek			C
			L	T	P	
1	22148S11P	TransformsandPartialDifferential Equations	3	1	0	4
2	22152C12P	ElectromagneticFields	3	1	0	4
3	22152C13P	DigitalElectronics	3	1	0	4
4	22152C14P	ElectronicCircuits-I	3	0	0	3
5	22152C15P	SignalsandSystems	4	0	0	4
TOTALCREDITS						**19**

SEMESTER-II

S.NO	SUBCODE	SUBJECTNAME	PeriodsPerWeek			C
			L	T	P	
1	22148S21BP	ProbabilityandRandomProcesses	3	1	0	4
2	22152C22P	CommunicationTheory	3	0	0	3
3	22152C23P	LinearIntegratedCircuits	3	1	0	4
4	22152C24P	ElectronicCircuits–II	3	1	0	4
5	22152C25P	TransmissionLinesandWaveguides	4	0	0	4
TOTALCREDITS						**19**

SEMESTER-III

S.NO	SUBCODE	SUBJECTNAME	PeriodsPerWeek			C
			L	T	P	
1.	22148S31BP	NumericalMethods	3	1	0	4
2.	22152C32P	Microprocessorand Microcontrollers	3	1	0	4
3.	22152C33P	DigitalSignalProcessing	3	1	0	4
4.	22152C34P	DigitalCommunication	3	1	0	4
5.	22152L35P	Microprocessorand Microcontrollers Lab	0	0	3	2
TOTALCREDITS						**18**

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

SEMESTER-IV

S.NO	SUBCODE	SUBJECTNAME	PeriodsPerWeek			C
			L	T	P	
1	22152C41P	MedicalElectronics	3	1	0	4
2	22152C42P	Antennaand WavePropagation	3	1	0	4
3	22152C43P	ComputerNetworks	4	0	0	4
4	22152E44_P	**Elective-I**	4	0	0	4
5	22152L45P	NetworksandCommunicationLab	0	0	3	2
					TOTALCREDITS	**18**

SEMESTER-V

S.NO	SUBCODE	SUBJECTNAME	PeriodsPerWeek			C
			L	T	P	
1	22152C51P	OpticalCommunicationand Networks	4	0	0	4
2	22152C52P	MicrowaveEngineering	4	0	0	4
3	21160C53P	PrinciplesofManagement	3	1	0	4
4	22152E54_P	**Elective II**	4	0	0	4
5	22152L55P	OpticalCommunicationand Microwave Lab	0	0	3	2
					TOTALCREDITS	**18**

SEMESTER-VI

S.NO	SUBCODE	SUBJECTNAME	PeriodsPerWeek			C
			L	T	P	
1	22152C61P	WirelessCommunication	4	0	0	4
2	22152C62P	VLSIDesign	3	1	0	4
3	22152C63P	EmbeddedandRealTime Systems	3	1	0	4
4	22152E64_P	**Elective III**	4	0	0	4
5	22152L65P	VLSIandEmbeddedSystems Lab	0	0	3	2
					TOTALCREDITS	**18**

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

SEMESTER-VII

S.NO	SUBCODE	SUBJECTNAME	PeriodsPerWeek			C
			L	T	P	
1	21160S71P	TotalQualityManagement	3	0	0	3
2	22152C72P	WirelessNetworks	3	1	0	4
3	22152C73P	TelecommunicationSwitchingand Networks	4	0	0	4
4	22152E74_P	**Elective IV**	3	0	0	3
5	22152P75P	ProjectWork	0	0	12	6
				TOTALCREDITS		**20**

LISTOF ELECTIVES

ELECTIVE-I(SEMESTER-IV)

S.No	SubCode	SubName	PeriodsPerWeek			C
			L	T	P	
1	22152E44AP	HighSpeed Networks	4	0	0	4
2	22152E44BP	AdvancedDigitalSignalProcessing	4	0	0	4
3	22152E44CP	SpeechProcessing	4	0	0	4
4	22152E44DP	FuzzyLogicand NeuralNetworks	4	0	0	4
5	22152E44EP	AdvancedElectronicSystemDesign	4	0	0	4

ELECTIVE-II(SEMESTER-V)

S.No	SubCode	SubName	PeriodsPerWeek			C
			L	T	P	
1	22152E54AP	EnvironmentalScienceand Engineering	4	0	0	4
2	22152E54BP	OptoelectronicDevices	4	0	0	4
3	22152E54CP	RadarandNavigationalAids	4	0	0	4
4	22152E54DP	DigitalImageProcessing	4	0	0	4
5.	22152E54EP	EngineeringAcoustics	4	0	0	4

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE-III(SEMESTER-VI)

S.No	SubCode	SubName	PeriodsPerWeek			C
			L	T	P	
1	22152E64AP	ProfessionalEthicsinEngineering	4	0	0	4
2	22152E64BP	SatelliteCommunication	4	0	0	4
3	22152E64CP	RoboticsandAutomation	4	0	0	4
4	22152E64DP	Remotesensing	4	0	0	4
5.	22152E64EP	NetworkSecurity	4	0	0	4

ELECTIVE-IV(SEMESTER-VII)

S.No	SubCode	SubName	PeriodsPerWeek			C
			L	T	P	
1	22152E74AP	PowerElectronics	3	0	0	3
2	22152E74BP	AdvancedMicroprocessorsand Microcontrollers	3	0	0	3
3	22152E74CP	ElectromagneticInterferenceand Compatibility	3	0	0	3
4	22152E74DP	SolidStateElectronicDrives	3	0	0	3
5	22152E74EP	ComputerHardwareandInterfacing	3	0	0	3

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

B.TECH(PARTTIME) –ECE–R-2022

COURSESTRUCTUREANDCREDITSDISTRIBUTION

Sem.	CoreCourses				Elective Courses		Total Credits
	Theory Courses		Practical Courses				
	Nos.	Credits	Nos.	Credits	Nos.	Credits	
I	05	19	-	-	-	-	19
II	05	19	-	-	-	-	19
III	04	16	01	02	-	-	18
IV	03	12	01	02	01	04	18
V	03	12	01	02	01	04	18
VI	03	12	01	02	01	04	18
VII	03	11	01	06	01	03	20
TotalCredits							130

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

21148S11P **SEMESTERI**

TRANSFORMSANDPARTIALDIFFERENTIALEQUATIONS **3104**

(CommontoCSE,IT,ECE)

AIM

Thecourseaimstodeveloptheskillsofthestudentsintheareasofboundary value problems and transform techniques. This will be necessary for their effective studies in a large number of engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory. The course will also serve as a prerequisite for post graduate and specialized studies and research.

OBJECTIVES

Attheendofthe coursethestudents would

- Be capable of mathematically formulating certain practical problems in terms of partial differential equations, solve them and physically interpret the results.
- Have gained a well founded knowledge of Fourier series, their different possible formsand the frequently needed practicalharmonic analysis that anengineer may have to make from discrete data.
- Haveobtainedcapacitytoformulateand identifycertainboundaryvalueproblems encountered in engineering practices, decide on applicabilityof the Fourier series method of solution, solve them and interpret the results.
- Have grasped the concept ofexpressionofa function, under certainconditions, as a double integral leading to identification of transform pair, and specialization on Fourier transformpair, their properties, thepossiblespecialcaseswithattentionto their applications.

UNITI FOURIERSERIES 9

Fourierseries–Oddandevenfunctions–Halfrangesineseries–Halfrangecosineseries – Complex form of Fourier Series – Parseval's identify – Harmonic Analysis.

UNITII FOURIERTRANSFORM 9

Fourierintegraltheorem(withoutproof)–SineandCosine transforms – Properties (without Proof) – Transforms of simple functions –Convolution theorem – Parseval's identity – Finite Fourier transform – Sine and Cosinetransform.

UNITIII Z-TRANSFORMANDDIFFERENCE EQUATIONS 9

Z-transform - Elementary properties (without proof) – Inverse Z – transform – Convolution theorem -Formation of difference equations – Solution of differenceequations using Z - transform.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

UNITIV PARTIALDIFFERENTIALEQUATIONS 9

Solution of First order partial differential equation reducible to standard forms – Lagrange's linear equation – Linear partial differential equations of second order andhigher order with constant coefficients.

UNITV BOUNDARYVALUEPROBLEMS 9

Solutions of one dimensional wave equation – One dimensional heat equation– Steadystate solution of two-dimensional heat equation (Insulated edges excluded) – Fourierseries solutions in Cartesian coordinates.

TUTORIAL:15 **TOTAL: 60**

TEXTBOOKS

1. Andrews,L.A.,andShivamoggiB.K.,"IntegralTransformsforEngineersand Applied Mathematicians", Macmillen , New York ,1988.
2. Grewal,B.S., "Higher Engineering Mathematics", Thirty Sixth Edition,Khanna Publishers, Delhi, 2001.
3. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Engineering Mathematics Volume III", S. Chand & Company ltd., New Delhi, 1996.

REFERENCES

1. Narayanan, S., Manicavachagom Pillay, T.K. and Ramaniah, G., "Advanced Mathematics for Engineering Students", Volumes II and III, S. Viswanathan (Printers and Publishers) Pvt. Ltd. Chennai, 2002.
2. Churchill,R.V.andBrown,J.W.,"FourierSeriesandBoundaryValueProblems", Fourth Edition, McGraw-Hill Book Co., Singapore, 1987.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

22152C12P **SEMESTERI**

ELECTROMAGNETICFIELDS 3104

AIM

To familiarize the student to the concepts, calculations and pertaining to electric, magnetic and electromagnetic fields so that an in depth understanding of antennas, electronic devices, waveguides is possible.

OBJECTIVES

- Toimpartknowledgeon thebasics of staticelectricandmagneticfieldandthe associated laws.
- TogiveinsightintothepropagationofEMwavesandalsotointroducethe methods in computational electromagnetics.
- Tomakestudentshavedepthunderstandingofantennas,electronicdevices,Waveguides is possible.

UNITI STATICELECTRICFIELD 9

Vector Algebra, Coordinate Systems, Vector differential operator, Gradient, Divergence,Curl, Divergence theorem, Stokestheorem, Coulombs law, Electric field intensity, Point,Line, Surface and Volume charge distributions, Electric flux density, Gauss law and itsapplications, Gaussdivergence theorem, Absolute Electric potential, Potentialdifference,Calculation of potential differences for different configurations. Electric dipole,Electrostatic Energy and Energy density.

UNITII CONDUCTORSANDDIELECTRICS 9

Conductors and dielectrics in Static Electric Field, Current and current density,Continuityequation, Polarization, Boundaryconditions, Methodofimages, Resistance ofa conductor, Capacitance, Parallel plate, Coaxial and Spherical capacitors, Boundaryconditions for perfect dielectric materials, Poisson‟s equation, Laplace's equation,Solution of Laplace equation, Application of Poisson‟s and Laplace‟s equations.

UNITIII STATICMAGNETICFIELDS 9

Biot -Savart Law, Magnetic field Intensity, Estimation of Magnetic field Intensity forstraight and circular conductors, Ampere‟s Circuital Law, Point form of Ampere‟sCircuital Law, Stokes theorem, Magnetic flux and magnetic flux density, The Scalar andVector Magnetic potentials, Derivation of Steady magnetic field Laws.

UNITIV MAGNETICFORCESAND MATERIALS 9

Forceona moving charge, Forceon a differentialcurrent element, Force betweencurrentelements,Forceandtorqueonaclosedcircuit,Thenatureofmagneticmaterials,

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

Magnetization and permeability, Magnetic boundary conditions involving magneticfields, The magnetic circuit, Potential energy and forces on magnetic materials,Inductance, Basic expressions for self and mutual inductances, Inductance evaluation forsolenoid, toroid, coaxial cables and transmission lines, Energystored in Magnetic fields.

UNITV TIMEVARYINGFIELDSANDMAXWELL'SEQUATIONS 9

Fundamental relations for Electrostatic and Magnetostatic fields, Faraday‟s law forElectromagnetic induction, Transformers, Motional Electromotive forces, Differentialformof Maxwell‟s equations, Integral formof Maxwell‟s equations, Potential functions,Electromagnetic boundary conditions, Wave equations and their solutions, Poynting‟stheorem, Time harmonic fields, Electromagnetic Spectrum.

TUTORIAL15 **TOTAL:60**

TEXTBOOKS

1. WilliamHHayt andJrJohnABuck,"Engineering Electromagnetics",TataMc Graw-Hill Publishing Company Ltd, New Delhi, 2008
2. SadikuMH,"PrinciplesofElectromagnetics",OxfordUniversityPressInc,New Delhi, 2009

REFERENCES

1. DavidKCheng,"FieldandWaveElectromagnetics",PearsonEducationInc, Delhi, 2004
2. JohnDKrausandDanielAFleisch, "ElectromagneticswithApplications",Mc Graw Hill Book Co, 2005
3. KarlELongmanandSavaVSavov,"FundamentalsofElectromagnetics", Prentice Hall of India, New Delhi, 2006
4. AshutoshPramanic,"Electromagnetism",PrenticeHallofIndia,NewDelhi, 2006

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

22152C13P **SEMESTERI**

DIGITALELECTRONICS **3104**

AIM

Tolearnthe fundamentalconceptsthoseareusefulfor designingdigitalsystems or circuits.

OBJECTIVES

- Tointroducenumbersystemsandcodes
- TointroducebasicpostulatesofBooleanalgebraandshowsthecorrelationbetween Boolean expressions
- TointroducethemethodsforsimplifyingBoolean expressions
- Tooutlinetheformalproceduresfortheanalysisanddesignofcombinational circuits and sequential circuits
- Tointroducetheconceptofmemoriesdevices.

UNITI: BOOLEANALGEBRAANDMINIMIZATION 9

Basic theorems – Boolean functions – Canonical and Standard forms – Minimizationtechniques – K-map up to five variables – NAND and NOR implementation – ExclusiveOR function - Hardware Description Language (HDL).

UNITII: DIGITALLOGIC FAMILIES 9

Switching operation of PN junction diode – bipolar and MOS devices – Bipolar logicfamilies – RTL – DTL – DCTL – HTL –TTL – ECL – MOS and CMOS – Tristate logic–Interfacing of CMOS and TTL families.

UNITIII: COMBINATIONALLOGICDESIGN 9

Design using gates – BCD arithmetic circuits – Binary adder – Subtractor – Multiplier – Divider–Designusing MSIdevices–MultiplexerandDemultiplexeraslogicelements – Encoder and decoder – Parity checker – Parity generator – Code converter – Magnitudecomparator.

UNITIV: SEQUENTIALLOGICDESIGN 9

Flip Flops and their conversions – Analysis and synthesis of synchronous sequentialcircuits – Excitation table – State table and state diagram – Design of synchronouscounters – Analysis of asynchronous sequential circuits – Reduction of state and flowtable – Race free state assignment – Designof Asynchronous counters – Timing diagram– Shift registers and their applications.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

UNITV: MEMORY DEVICES 9

Classification of memories – ROM organization – PROM – EPROM – EEPROM – EAPROM – RAM organization – Write operation – Read operation – Memory cycleTiming wave forms – Memory decoding – Memory expansion – Static RAM Cell-Bipolar RAM cell – MOSFET RAM cell – Dynamic RAM cell – Programmable LogicDevices – Programmable Logic Array(PLA) – Programmable ArrayLogic (PAL) – FieldProgrammable Gate Arrays (FPGA).

TUTORIAL15 TOTAL:60

TEXTBOOKS

1. MorrisMano M.,“DigitalDesign”,3rdEdition,PearsonEducation,2007.
2. JohnMYarbrough,“DigitalLogicApplicationsandDesign”,ThomsonLearning, 2002.

REFERENCES

1. JohnF.Wakerly,“DigitalDesign”,4thEdition,Pearson/PHI,2006
2. CharlesH.Roth, “FundamentalsofLogicDesign”, ThomsonLearning,2003.
3. Donald P.Leach and Albert Paul Malvino,“Digital Principles and Applications”, 6th Edition, TMH, 2003.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

22152C14P **SEMESTERI**

ELECTRONICCIRCUITS–I **3003**

AIM

The aim of this course is to familiarize the student with the analysis and design of basic transistor Amplifier circuits and power supplies.

OBJECTIVE

Oncompletionofthiscourse the studentwill understand

- Themethodsofbiasingtransistors
- Designofsimpleamplifier circuits
- Mid– bandanalysisofamplifiercircuitsusingsmall -signalequivalent circuitsto determine gain input impedance and output impedance
- Methodofcalculatingcutofffrequenciesandtodetermine bandwidth
- Designofpower amplifiersandheatsinks
- Analysisanddesignofpowersupplies

UNIT– I TRANSISTERBIASING&STABILIZATION 9

BiasingcircuitsforBJT-DCloadline-ACloadline–Stabilityfactor-MethodsofTransistor Biasing- Bias Compensation – Thermal runaway- heat sink- FET Biasing

UNIT-II LOWFREQUENCYAMPLIFIERANALYSIS&DESIGN 9

Transistor- FETamplifiers-LowfrequencySmallsignalhybridparametermodel:C_B,C_E,Cc Amplifier- Analysis of Transistor Amplifier Using h-parameter. JFETasanAmplifier-AnalysisoflowfrequencycommonSource&CommonDrainAmplifier Using h-parameter.

UNIT– III MULTISTAGEAMPLIFIERS 9

Cascading ofBJT Amplifiers- Analysis ofRC coupled Amplifiers Methods ofIncreasingInput impedance using Darlington and Boot strapping- Emitter coupled DifferentialAmplifier, Differential gain, CMRR, Transfer Characteristics – Cascode amplifier.

UNIT– IVHIGHFREQUENCYANALYSIS OFTHEAMPLIFIERS9

Frequencyresponse-Effect ofCoupling and Bypasscapacitor-Effect ofinternaltransistorcapacitance-Miller Effect – High Frequency πmodel for C_E Amplifier- C_E Short circuitCurrent gain- Cut off frequencies f_α, f_β,f_T - Gain Band Width product.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

UNIT– V POWERSUPPLIES 9

Half wave,Full Wave,Rectifiers- Capacitor Filter- Linear Regulator: ShuntRegulator,Series Regulator- Shunt Regulator using Zener Diode- Switch Mode Power Supply.

TUTORIAL15 TOTAL:60

TEXT BOOK

1. MillmanandHalkias.c."IntegratedElectronics"TataMcGraw-Hill,1991

REFERENCEBOOKS

1. DavidA. Bell,"ElectonicDevices AndCircuits "PrenticHallofIndia,1998.
2. DonalL. Schilling,Charles,Belove"ElectronicCircuits"ThirdEdition2002.
3. Salivahanan"ElectonicDevicesAndCircuits"
4. Boylestead,RobertL.andLouisNasheresky-"ElectonicDevicesAndCircuit Theory"-Pearson Education
5. J.B.Gupta-"ElectonicDevicesAndCircuits"-S.K.Katariaandsons2004.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

22152C15P **SEMESTERI**

SIGNALSAND SYSTEMS **4004**

(Commonto ECE& IT)

AIM

Tostudyand analyzethecharacteristicsofcontinuous,discretesignalsand systems.

OBJECTIVES

- Tostudythepropertiesand representationofdiscreteand continuous signals.
- Tostudythesamplingprocessandanalysisofdiscretesystemsusingz- transforms.
- Tostudythe analysisandsynthesisofdiscretetime systems.

UNITI CLASSIFICATIONOFSIGNALSAND SYSTEMS 9

Continuous time signals (CT signals), discrete time signals (DT signals) - step, Ramp,Pulse, Impulse, Exponential, Classification of CT and DT signals - periodic andaperiodic, Random signals,Classification of systems (CT systems and DT systems)Linear time invariant systems.

UNITII ANALYSISOFCTSIGNALS 9

FourierTransformandLaplaceTransforminSignalAnalysis.Fourierseries,FourierTransform and Laplace Transform properties, Parseval's relation.

UNITIII LTI-CTSYSTEMS 9

Differentialequation,Blockdiagramrepresentation,Impulseresponse,ConvolutionIntegral, Frequency response, Fourier Methods and Laplace transforms in analysis.

UNITIVSAMPLINGTHEOREMAND ANALYSIS OFDT-SIGNALS9

Sampling theorem – Reconstruction ofa Signal from its samples, aliasing – discrete timeprocessing of continuous time signals, sampling of band pass signals

Z-transform definition – region of convergence – properties of ROC – Properties of ztransform– Polesand Zeros – inverse z-transform, Relationship betweenz-transformandFourier transform.

UNITV LTI-DTSYSTEMS 9

Differenceequations,Blockdiagramrepresentation,Impulseresponse,ConvolutionSUM, Frequency response, Z-transform analysis.

TUTORIAL15 **TOTAL:60**

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

TEXT BOOK

1. AlanV.Oppenheim, AlanS.WillskywithS.Hamid Nawab, Signals &Systems, 2nd edn., Pearson Education, 1997.

REFERENCES

1. M.J.Roberts,SignalsandSystemsAnalysisusingTransformmethodandMATLAB, TMH 2003.
2. SimonHaykinandBarryVanVeen, SignalsandSystems, JohnWiley, 1999
3. K.Lindner,"SignalsandSystems",McGrawHillInternational,1999.

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

21148S21BP **SEMESTERII**

PROBABILITYANDRANDOMPROCESSES

3104

AIM

This course aims at providing the necessary basic concepts in random processes. A knowledge of fundamentals and applications of phenomena will greatly help in the understanding of topics such a estimation and detection, pattern recognition, voice and image processing networking and queuing.

OBJECTIVES

Atthe endofthe course,the students would

- Haveafundamentalknowledgeofthebasicprobabilityconcepts.
- Have a well – founded knowledge ofstandard distributions which can describe real life phenomena.
- Acquire skills in handling situations involving more than one random variable and functions of random variables.
- Understandandcharacterizephenomenawhichevolvewithrespecttotimeinprobabilistic manner.
- Beabletoanalyzetheresponseofrandominputstolinear timeinvariantsystems.

UNITI PROBABILITYANDRANDOMVARIABLE 9

Axioms of probability - Conditional probability - Baye's theorem- Random variable - Probabilitymassfunction-Probabilitydensityfunction-Properties-Moments-Momentgenerating functions and their properties.

UNITII STANDARDDISTRIBUTIONS 9

Binomial,Poisson,Geometric,Uniform,Exponential,Gamma,WeibullandNormaldistributions and their properties - Functions of a random variable (excluding theorm).

UNITIIITWODIMENSIONALRANDOMVARIABLES 9

Joint distributions - Marginal and conditional distributions – Covariance - Correlationand regression (for distributions only)- Transformation of random variables - Centrallimit theorem.

UNITIVCLASSIFICATION OFRANDOMPROCESSES 9

Definition and examples - first order, second order, strictly stationary, wide – sensestationary and Ergodic processes - Markov process - Binomial, Poisson and Normalprocesses - Sine wave process.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

UNITV CORRELATIONANDSPECTRALDENSITIES 9

Auto correlation - Cross correlation - Properties –Powerspectraldensity– Cross spectraldensity - Properties – Relationship between cross power spectrum and cross correlationfunction– Auto correlation and cross correlation functions of input and output.

TUTORIAL15 TOTAL:60

TEXTBOOKS

1. Ross, S., "AFirst CourseinProbability", Fifthedition, PearsonEducation, Delhi, 2002.
2. Peebles Jr. P.Z., "Probability Random Variables and Random Signal Principles", Tata McGraw-Hill Pubishers, Fourth Edition, New Delhi, 2002. (Chapters 6, 7and 8).

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

22152C22P **SEMESTERII**

COMMUNICATIONTHEORY **3104**

AIM

To study the various analog communication fundamentals viz., Amplitude modulation and demodulation, angle modulation and demodulation. Noise performance of various receivers and information theory with source coding theorem are also dealt.

OBJECTIVE

- ToprovidevariousAmplitude modulationanddemodulationsystems.
- ToprovidevariousAnglemodulationanddemodulationsystems.
- Toprovidesomedepthanalysis innoiseperformanceofvariousreceiver.
- Tostudysomebasicinformationtheorywithsomechannelcoding theorem.

UNIT1 AMPLITUDEMODULATIONSYSTEMS 10

Review of spectral characteristics of periodic and non-periodic signals – Generation anddemodulation of AM, DSBSC, SSB and VSB signals – Comparison of amplitudemodulation systems – Frequency translation – FDM – Non-linear distortion.

UNITII ANGLEMODULATION SYSTEMS 8

Phaseandfrequencymodulation–Singletone–NarrowbandandwidebandFM–Transmission bandwidth – Generation and demodulation of FM signal.

UNITIII NOISETHEORY 8

Review of probability – Random variables and random process – Gaussian process – Noise – Shot noise – Thermal noise and white noise – Narrow band noise – Noisetemperature – Noise figure.

UNITIVPERFORMANCEOFCWMODULATIONSYSTEMS 10

Superheterodyne radio receiver and its characteristic – SNR – Noise in DSBSC systemsusing coherent detection – Noise in AM system using envelope detection FM system –FM threshold effect – Pre-emphasis and de-emphasis in FM – Comparison ofperformances.

UNITV INFORMATIONTHEORY 9

Discrete messages and information content – Concept of amount of information – Average information – Entropy – Information rate – Source coding to increase averageinformation per bit – Shannon-fano coding – Huffman coding – Lempel-Ziv (LZ) coding– Shannon's theorem – Channel capacity – Bandwidth – S/N trade-off – Mutualinformation and channel capacity – Rate distortion theory – Lossy source coding.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

TUTORIAL15 **TOTAL:60**

TEXTBOOKS

1. DennisRoddyandJohnCoolen.,“ElectronicCommunication”,4thEdition,PHI,1995.
2. Herbert Taub and Donald L Schilling., “Principles of Communication Systems”, 3rd Edition, TMH, 2008.

REFERENCES

1. Simon Haykin.,“Communication Systems”,4th Edition,JohnWiley andSons, 2001.
2. BruceCarlson.,“CommunicationSystems”,3rdEdition,TMH, 1996.
3. Lathi, B. P., “Modern Digitaland Analog Communication Systems”, 3rd Edition, Oxford Press, 2007.
4. JohnG.Proakis,MasoudSalehi.,“Fundamentalsof CommunicationSystems”, 5th Edition, Pearson Education, 2006.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

22152C23P **SEMESTERII**

LINEARINTEGRATEDCIRCUITS **3104**

AIM

Toteachthebasicconceptsinthedesignofelectroniccircuitsusinglinearintegrated circuits and their applications in the processing of analog signals.

OBJECTIVES

- Tointroducethebasicbuildingblocksoflinearintegratedcircuits.
- Toteachthelinear andnon-linear applicationsofoperationalamplifiers.
- Tointroducethetheoryandapplicationsofanalogmultipliersand PLL.
- Toteachthetheoryof ADC andDAC
- Tointroduceafewspecialfunctionintegratedcircuits.

UNITI OPAMPCHARACTERISTICSANDAPPLICATIONS 9

Ideal op amp, IC op amp, DC characteristics: bias, offset and drift, AC characteristics:bandwidth, slew rate, noise and frequencycompensation, basic opamp application: scalechanger, inverter and non inverter, summer & subtractor, , differentiator & integrator,instrumentation amplifier, V to I and I to V converter, RC active filters: low pass andband pass filtersop amp circuits using diodes: precision rectifier, clipper and clamper,

UNITIICOMPARATORSAND SIGNALGENERATORS 9

Comparator and applications of comparator, regenerative comparator (Schmitt trigger),square wave generator (astable multivibrator), monostable multivibrator Triangular wavegenerator, saw tooth wave generator sine wave generators

UNIT III ANALOGMULTIPLIERANDPLL 9

Multiplier, Applications of multiplier: multiplying DC voltages, frequency doubling,phase angle detection, AM modulation/demodulation. PLL: Basic principles, analog anddigitalphase detector and comparator Voltage controlled Oscillator, Applications ofPLL

UNITIV ADCAND DAC 9

Analog switches, High speed sample and hold circuits, characteristics DAC, Types ofD/A converter, Current driven DAC, Switches for DAC, characteristics ofA/D converterTypes of A/D converter, - Single slope, Successive approximation.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

UNITV SPECIALFUNCTIONICS 9

555 timer functional diagram,Astable and Monostable Multivibrators using 555 Timer,Voltage regulators-linear and switched mode types, Switched capacitor filter, Frequencyto Voltage converters, and Isolation Amplifiers, Fiber optic ICs and Opto-couplers.

TUTORIAL15 **TOTAL:60**

TEXT BOOK

1. Sergio Franco, 'Design with operational amplifiers and analog integrated circuits', McGraw-Hill, 1997.
2. D.Roy Choudhry, Shail Jain,"Linear Integrated Circuits", New Age International Pvt. Ltd., 2000.

REFERENCES

1. J.MichaelJacob,'ApplicationsandDesignwithAnalogIntegratedCircuits', Prentice Hall of India, 2196.
2. RamakantA.Gayakwad,'OP-AMPandLinearIC's',PrenticeHall/Pearson Education, 1994.
3. K.R.Botkar,'IntegratedCircuits'.KhannaPublishers, 1996.
4. Millman.J.andHalkias.C.C.'IntegratedElectronics',McGraw-Hill,1972.
5. WilliamD.Stanely,'OperationalAmplifierswithLinearIntegratedCircuits'Pearson Education, 2004.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

22152C24P **SEMESTERII**

ELECTRONICCIRCUITS-II **3104**

AIM

The aim of this course is to familiarize the student with the analysis and design of feed back amplifiers, oscillators, tuned amplifiers, wave shaping circuits, multivibrators and blocking oscillators.

OBJECTIVES

Oncompletionofthiscoursethe studentwillunderstand

- Theadvantagesandmethodofanalysisoffeed backamplifiers
- AnalysisanddesignofRCandLCoscillators,tunedamplifiers,waveshaping circuits, multivibrators, blocking oscillators and time based generators.

UNITI:POWERAMPLIFIERS **9**

Classification, Efficiency of Class A , RC coupled, Transformer coupled, Class B push pull,Complementary symmetry power amplifier, Power Output, Efficiency and Power Dissipation,cross over distraction & Elimination, Heat sink.

UNITII:FEEDBACKAMPLIFIERS **9**

Feedback concept,Fourbasic typesoffeedback, Equivalent Circuitsofvoltage amplifier,Current Amplifier ,Trans conductance, Trans resistance amplifier, Transfer ratio fornegative feedback,Effect of feedback on noise, distortion gain input & output,impedance of the amplifier. Method of identifying feedback topology, Analysis of fourtypes of feedback amplifier.

UNITIII:OSCILLATORS **9**

Theory of Oscillator, Closed loop gain of the circuits, Barhausen Criterion. Analysis &DesignofRC Phase Shift Oscillators, WienBridge Oscillator, HartleyOscillatorColpittsOscillator, crystal Oscillator, frequency Stability.

UNITIV:TUNED AMPLIFERS **9**

Tuned Circuit, Resonance,Q factor, Classification oftuned amplifier, Analysis ofsingletuned amplifier, Capacitance coupling, Effect of cascading single tuned amplifier onBand width, Double tuned amplifier, instability of tuned amplifiers-stabilizationtechniques, Narrow band neutralization using coil, Class C tuned amplifiers and theirapplications. Efficiency of Class C tuned Amplifier.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

UNITV: WAVESHAPING,SWEEP&MULTIVIBRATOR CIRCUTS 9

RL & RC Integrator and Differentiator circuits. Voltage sweep circuit , Miller sweepgenerator, UJT saw tooth generator, current time base generator, Collector coupledAstable Multivibrator, Collector coupled Monosatble Multivibrator - BistableMultivibrator - Schmitt trigger circuits.

TUTORIAL15 **TOTAL:60**

TextBooks:

1. MillmanJ.andHalkiasC.C.,"IntegratedElectronics", McGrawHill1991
2. SchillingCharlesBelove,"ElectronicCircuits",ThirdEdition,2002.
3. MillmanJ. and TaubH., " Pulse Digitaland Switching waveform", McGraw Hill International.
4. RobertL.BoylestandLouisNasheresky,“ElectronicDevicesandCircuits theory” 8th edn., PHI, 2002.

References:

1. Sedra/Smith,“Micro ElectronicCircuits”OxfordUniversityPress,2004.
2. DavidA.Bell,“SolidStatePulseCircuits”,PrenticeHallofIndia, 1992.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

22152C25P **SEMESTERII**

TRANSMISSIONLINESANDWAVEGUIDES 4004

AIM

Tolayastrongfoundationonthetheoryoftransmissionlinesandwaveguidesby highlighting their applications.

OBJECTIVES

- Tobecomefamiliarwithpropagationofsignalsthroughlines
- UnderstandsignalpropagationatRadiofrequencies
- Understandradiopropagationinguidedsystems
- Tobecomefamiliarwithresonators

UNITI TRANSMISSIONLINETHEORY 9

Different types of transmission lines – Definition of Characteristic impedance andPropagation Constant, General Solution of the transmission line –wavelength andvelocity of propagation. Waveform distortion – distortion less transmission line – Inputimpedance of lossless lines – reflection on a line not terminated by Z_o- reflection factorand reflection loss – Numerical problems.

UNITIITHELINEATRADIOFREQUENCIES 9

Standing waves and standing wave ratio on a line – One-eighth wave line – The quarterwave line and impedance matching – the halfwave line – The SmithChart – Applicationof the Smith Chart – Problems using smith chart (how to use smith chart and markimpedances, finding input impedance, SWR, reflection coefficient, finding loadimpedance) single stub matching - Numerical problems.

UNITIII GUIDEDWAVES 9

Waves betweenparallelplanes ofperfect conductors – Transverse electric and transversemagnetic waves – characteristics of TE and TM Waves – Transverse Electromagneticwaves – Velocities of propagation. – Wave impedances – Numerical problems.

UNITIV RECTANGULARWAVEGUIDES 9

Transverse Magnetic Waves in Rectangular Wave guides – Transverse Electric Waves inRectangular Waveguides – characteristic ofTE and TMWaves – cut-offwavelength andphase velocity - Dominant mode in rectangular waveguide –Wave impedance,Characteristic impedance - Numerical problems.

UNITV CIRCULARWAVEGUIDESANDRESONATORS 9

TM and TE waves in circular guides – wave impedances and characteristic impedance – Dominantmodeincircularwaveguide–excitationofmodes–Microwavecavities,

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

Rectangular cavityresonators, circular cavityresonator – Q factor of cavityresonator forTE101 mode - Numerical problems.

TUTORIAL15 **TOTAL:60**

TEXTBOOKS

1. J.D.Ryder“Networks,LinesandFields”,PHI,NewDelhi,2003.(UnitI&II)
2. E.C.Jordan andK.G.Balmain“ElectroMagneticWavesandRadiatingSystem, PHI, New Delhi, 2003. (Unit III, IV & V)

REFERENCES

1. Ramo,WhineeryandVanDuzer:“FieldsandWavesinCommunicationElectronics” John Wiley, 2003.
2. DavidM.Pozar:MicrowaveEngineering–2ndEdition–John Wiley.
3. DavidK.Cheng,FieldandWavesinElectromagnetism, Pearson

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

22148S31BP **SEMESTERIII**

NUMERICALMETHODS **3104**

AIM

With the present development of the computer technology, it is necessary to develop efficient algorithms for solving problems in science, engineering and technology. This course gives a complete procedure for solving different kinds of problems occur in engineering numerically.

OBJECTIVES

At the end of the course, the students would be acquainted with the basic concepts in numerical methods.

- The roots of nonlinear (algebraic or transcendental) equations, solutions of large system of linear equations and eigenvalue problem of a matrix can be obtained numerically where analytical methods fail to give solution.
- When huge amounts ofexperimentaldata are involved, the methods discussed on interpolation will be useful in constructing approximate polynomial to represent the data and to find the intermediate values.
- The numerical differentiation and integration find application when the functionin the analytical form is too complicated or the huge amounts of data are given such as series of measurements, observations or some other empiricalinformation.
- Since many physical laws are couched in terms of rate of change of one/two or more independent variables, most of the engineering problems are characterizedin the form of either nonlinear ordinary differential equations or partialdifferential equations. The methods introduced in the solution of ordinary differential equations and partial differential equations will be useful inattempting any engineering problem.

UNITISOLUTIONOFEQUATIONS AND EIGENVALUEPROBLEMS9

Newton Raphson's method – Iteration method – Solution of linear system by Gaussianelimination and Gauss-Jordon methods- Iterative methods: Gauss Jacobi and Gauss-Seidel methods- Inverse of a matrix byGauss Jordon method– Eigenvalue of a matrixby power method.

UNITII INTERPOLATION 9

Newton'sforwardandbackwarddifferenceformulas–Centraldifferenceformula:Bessels and Stirling's formula - Lagrangian Polynomials – Divided difference method .

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENEUERSHIP**

UNITIIINUMERICAL DIFFERENTIATION AND INTEGRATION9

Derivatives from difference tables – Divided differences and finite differences – Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg'smethod – Double integrals using trapezoidal and Simpson's rules.

UNITIV INITIALVALUEPROBLEMSFORORDINARY DIFFERENTIAL EQUATIONS 9

Single step methods: Taylor series method – Euler and modified Euler methods – Fourthorder Runge – Kutta method for solving first and second order equations – Multistepmethods: Milne's and Adam's predictor and corrector methods.

UNITV BOUNDARYVALUEPROBLEMSINORDINARYANDPARTIAL DIFFERENTIALEQUATIONS 9

Finite difference solution of second order ordinary differential equation – Finitedifference solution of one dimensional heat equation by explicit and implicit methods –One dimensional wave equation and two dimensional Laplace and Poisson equations.

TUTORIAL15 **TOTAL:60**

TEXTBOOKS

1. Gerald,C.F,andWheatley,P.O,"AppliedNumericalAnalysis",SixthEdition, Pearson Education Asia, New Delhi, 2002.
2. Kandasamy,P.,Thilagavathy,K.andGunavathy,K.,"NumericalMethods", S.Chand Co. Ltd., New Delhi, 2003.

REFERENCES

1. Burden, R.L and Faires, T.D., "Numerical Analysis", Seventh Edition, Thomson Asia Pvt. Ltd., Singapore, 2002.
2. Balagurusamy,E.,"NumericalMethods",TataMcGraw-HillPub.Co.Ltd,New Delhi, 1999.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

22152C32P **SEMESTERIII**

MICROPROCESSORSAND MICROCONTROLLERS

3104

OBJECTIVES:

Thestudent shouldbemadeto:

- StudytheArchitectureof8086microprocessor.
- Learnthe designaspectsofI/Oand MemoryInterfacingcircuits.
- Studyaboutcommunicationandbus interfacing.
- StudytheArchitectureof8051microcontroller.

UNITI THE8086MICROPROCESSOR 9

Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction setand assembler directives – Assembly language programming – Modular Programming -Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt serviceroutines – Byte and String Manipulation.

UNITII 8086SYSTEM BUSSTRUCTURE 9

8086signals–Basicconfigurations–Systembustiming –Systemdesignusing8086 – IOprogramming – Introduction to Multiprogramming – System Bus Structure - Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupledconfigurations – Introduction to advanced processors.

UNITIII I/OINTERFACING 9

Memory Interfacing and I/O interfacing - Parallel communication interface – Serialcommunicationinterface –D/Aand A/DInterface - Timer – Keyboard/displaycontroller– Interrupt controller – DMA controller – Programming and applications Case studies:Traffic Light control, LED display, LCD display, Keyboard display interface and AlarmController.

UNITIV MICROCONTROLLER 9

Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

UNITVINTERFACINGMICROCONTROLLER 9

Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD&Keyboard Interfacing -ADC, DAC &SensorInterfacing - ExternalMemoryInterface-Stepper Motor and Waveform generation.

TUTORIAL: 15 Hrs **TOTAL:45PERIODS**

OUTCOMES:

Attheendofthecourse, thestudent shouldbeableto:

- Designandimplementprogramson8086microprocessor.
- DesignI/Ocircuits.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

- DesignMemoryInterfacing circuits.
- Designandimplement 8051microcontrollerbasedsystems.

TEXTBOOKS:

1. Yu-Cheng Liu, Glenn A.Gibson, “Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design”, Second Edition, Prentice Hall of India, 2007.
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, “The 8051 Microcontroller and Embedded Systems: Using Assembly and C”, Second Edition, Pearson education, 2011.

REFERENCE:

1. Doughlas V.Hall, “Microprocessors and Interfacing, Programming and Hardware”,TMH,2012

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

22152C33P **SEMESTERIII**

DIGITALSIGNALPROCESSING **3104**

AIM

To studythesignalprocessingmethodsandprocessors.

OBJECTIVES

- TostudyDFTandits computation
- Tostudythedesigntechniquesfordigital filters
- Tostudythefiniteword lengtheffectsinsignalprocessing
- Tostudythenon-parametricmethodsofpowerspectrumestimations
- To studythefundamentalsofdigitalsignalprocessors.

UNITI FASTFOURIER TRANSFORM 9

Discrete Time Fourier Transform (DTFT), Introduction to DFT – Efficient computationof DFT Properties of DFT – FFT algorithms – Radix-2 and Radix-4 FFT algorithms – Decimation in Time – Decimation in Frequency algorithms

UNITII IIRFILTERDESIGN 9

StructureofIIR – SystemDesign ofDiscretetime IIR filter fromcontinuous time filter –IIR filter design by Impulse Invariance. Bilinear transformation – Approximationderivatives – Design of IIR filter in the Frequency domain.

UNITIII FIRFILTERDESIGN 9

Symmetric&AntisymtericFIRfilters–Linearphasefilter–Windowingtechnique–Rectangular, Hamming– Frequency sampling techniques

UNITIV FINITEWORDLENGTH EFFECTS 9

Quantization noise – derivation for quantization noise power – Fixed point and binaryfloating point number representation – comparison – over flow error – truncation error –co-efficient quantization error- limit cycle oscillation – signal scaling

UNITV POWERSPECTRUM ESTIMATION 9

Computation of Energy density spectrum – auto correlation and power spectrum ofrandom signals. Periodogram – use of DFT in power spectrum estimation – Nonparametric methods for power spectralestimation: Bartlett methods –Application ofDSP– Model of Speech Wave Form – Vocoder.

TUTORIAL15 **TOTAL:60**

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

TEXT BOOK

1. JohnGProakisandDimtrisGManolakis,“DigitalSignalProcessingPrinciples, Algorithms and Application”, PHI/Pearson Education, 2000, 3rd Edition.

REFERENCES

1. Alan V Oppenheim, Ronald W Schafer and John R Buck, “Discrete Time Signal Processing”, PHI/Pearson Education, 2000, 2nd Edition.
2. JohnyR.Johnson,“IntroductiontoDigitalSignalProcessing”,PrenticeHallof India/Pearson Education, 2002.
3. Sanjit K.Mitra, “DigitalSignalProcessing: AComputer – Based Approach”, Tata McGraw-Hill, 2001, Second Edition.

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

22152C34P **SEMESTERIII**

DIGITALCOMMUNICATION **3104**

AIM

To introduce the basic concepts of Digital Communication modulation to baseband, passband modulation and to give an exposure to error control coding and finally to discuss about the spread spectrum modulation schemes.

OBJECTIVES

- Toknowtheprinciplesofsampling&quantization
- Tostudythevariouswaveformcodingschemes
- Tolearnthevariousbasebandtransmissionschemes
- TounderstandthevariousBandpass signalingschemes
- To knowthe fundamentalsofchannelcoding

UNITI SAMPLING&QUANTIZATION 9

Low pass sampling – Aliasing- Signal Reconstruction-Quantization - Uniform & non-uniform quantization - quantization noise - Logarithmic Companding of speech signal- PCM - TDM

UNITII WAVEFORMCODING 9

Prediction filtering and DPCM - Delta Modulation - ADPCM & ADM principles-LinearPredictive Coding

UNITIII BASEBANDTRANSMISSION 9

Properties of Line codes- Power Spectral Density of Unipolar / Polar RZ & NRZ – Bipolar NRZ- Manchester-ISI –Nyquist criterionfor distortionlesstransmission – Pulseshaping – Correlative coding - Mary schemes – Eye pattern - Equalization

UNITIV DIGITALMODULATIONSCHEME 9

Geometric Representation of signals - Generation, detection, PSD & BER of CoherentBPSK, BFSK & QPSK - QAM - Carrier Synchronization - structure of Non-coherentReceivers - Principle of DPSK.

UNITV ERRORCONTROL CODING 9

Channelcodingtheorem-LinearBlockcodes-Hammingcodes-Cycliccodes-Convolutional codes - Vitterbi Decoder

TUTORIAL15 **TOTAL:60**

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

Textbook:

1. S.Haykin,“DigitalCommunications”,JohnWiley, 2005.

Reference:

1. B.Sklar,“DigitalCommunicationFundamentalsandApplications”,2ndEdition, Pearson Education, 2009
2. B.P.Lathi,“ModernDigitalandAnalogCommunicationSystems”3rdEdition, Oxford University Press 2007.
3. HPHsu,SchaumOutlineSeries-“AnalogandDigitalCommunications”,TMH 2006
4. J.GProakis,“DigitalCommunication”,4thEdition,TataMcGrawHill Company, 2001.

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

22152L35P **SEMESTERIII**

LT PC

0032

MICROPROCESSORANDMICROCONTROLLERLABORATORY

OBJECTIVES:

Thestudent shouldbemadeto:

- IntroduceALPconceptsandfeatures
- WriteALPforarithmeticandlogicaloperations in8086and8051
- DifferentiateSerialandParallelInterface
- InterfacedifferentI/OswithMicroprocessors
- BefamiliarwithMASM

LISTOF EXPERIMENTS:

8086ProgramsusingkitsandMASM

1. BasicarithmeticandLogicaloperations
2. Moveadatablockwithoutoverlap
3. Codeconversion,decimalarithmeticandMatrixoperations.
4. Floatingpointoperations,stringmanipulations,sortingandsearching
5. Passwordchecking, PrintRAMsizeandsystemdate
6. CountersandTimeDelay

PeripheralsandInterfacingExperiments

7. Trafficlight control
8. Stepper motor control
9. Digitalclock
10. KeyboardandDisplay
11. Printerstatus
12. SerialinterfaceandParallelinterface
13. A/DandD/AinterfaceandWaveformGeneration

8051Experimentsusingkitsand MASM

14. BasicarithmeticandLogicaloperations
15. SquareandCubeprogram,Find2‟scomplementofanumber
16. UnpackedBCDtoASCII

TOTAL:45PERIODS

OUTCOMES:Attheendofthecourse,thestudentshouldbeableto:

- WriteALPProgrammesforfixedandFloatingPointandArithmetic
- InterfacedifferentI/Oswithprocessor
- Generatewaveformsusing Microprocessors
- ExecuteProgramsin8051
- ExplainthedifferencebetweensimulatorandEmulator

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

22152C41P **SEMESTERIV**

MEDICALELECTRONICS **3104**

AIM

Tomakestudentstounderstandtheapplicationsofelectronicsindiagnosticand therapeutic area.

OBJECTIVE

- To studythemethodsofrecordingvariousbiopotentials
- Tostudyhowtomeasurebiochemicalandvariousphysiologicalinformation
- Tounderstand theworking ofunitswhichwillhelptorestorenormalfunctioning
- Tounderstandtheuseofradiationfor diagnosticandtherapy
- Tounderstandtheneed andtechniqueofelectricalsafetyinHospitals

UNITIELECTRO– PHYSIOLOGYANDBIO– POTENTIALRECORDING 9

The origin of bio-potentials – Bio-potential electrodes – Biological amplifiers – ECG – EEG –EMG –PCG –EOG –Lead systems and recording methods – Typicalwaveformsand signal characteristics.

UNITII BIO–CHEMICALANDNONELECTRICALPARAMETER MEASUREMENT 9

PH – PO2 – PCO2 – PHCO3 – Electrophoresis – Colorimeter – Photometer – Autoanalyzer – Blood flow meter – Cardiac output – Respiratory measurement – Bloodpressure – Temperature – Pulse – Blood cell counters.

UNITIII ASSISTDEVICESANDBIO–TELEMETRY 9

Cardiac pacemakers–DC defibrillator– Telemetry principles–Frequency selection–Bio-telemetry – Radio – Pill and tele-stimulation.

UNITIV RADIOLOGICALEQUIPMENTS 9

Ionosing radiation – Diagnostic X-ray equipments – Use of radio isotope in diagnosis – Radiation therapy.

UNITV RECENTTRENDSINMEDICALINSTRUMENTATION 9

Thermograph–Endoscopyunit–Laserinmedicine–Diathermyunits–Electricalsafety in medical equipment.

TUTORIAL15 **TOTAL:60**

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

TEXTBOOK

1.LeislieCromwell,“BiomedicalInstrumentationandMeasurement”,PHI,2002.

REFERENCES

1.Khandpur R.S., “Handbook of Biomedical Instrumentation”, TATA McGraw-Hill, 1997.

2. JosephJ.CarrandJohnM.Brown,“IntroductiontoBiomedicalEquipment Technology”, John Wiley and Sons, 1997.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

22152C42P **SEMESTERIV**

ANTENNAANDWAVE PROPAGATION **3104**

AIM

Toenablethestudent tostudythevarioustypesofantennasand wave propagation.

OBJECTIVES

- To studyradiationfroma currentelement.
- To studyantenna arrays
- Tostudyapertureantennas
- Tolearnspecialantennassuchasfrequencyindependentandbroadbandantennas.
- Tostudyradiowavepropagation.

UNITI: RADIATION 9

Concept of Vector potentials- Modification for Time varying , retarded case- Fields andradiation resistance of an alternating current element--Radiation resistance – Effectivelength –Radiation intensity-Gain and Directivity-Field patterns- Beamwidth – Effectivearea-Relation between gain, effective length and radiation resistance.

UNITII: ANTENNAARRRAYS 9

Arrays of two point sources- Broadside array and End fire arrays – Binomial arrays - Pattern multiplication- Uniform linear array-

UNITIII: SPECIALPURPOSEANTENNAS 9

Radiationfromtravelingwaveonwire-Rhombicantenna–Loopantennas-Threeelement Yagi antenna- Log periodic antenna-Horn antenna -

UNITIV: PROPAGATION 9

Ground wave propagation: Attenuation characteristics – Calculation of field strength – Sky wave Propagation: Structure of Ionosphere – Effective dielectric constant of ionizedregion-Mechanism of Refraction and Refractive index- Critical Frequeny- Skip distance-Maximum usable frequency –Fading and Diversity Techniques.
SpaceWavePropagation:CalculationofFieldstrength–-Ductpropagation.

UNITV: MEASUREMENTS 9

Impedance – Field Pattern and Gain of Antennas- Radiation Pattern – Ionosphericmeasurements-Vertical incidence measurements of the ionosphere- Relation betweenoblique and vertical incidence transmission.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

TUTORIAL15 **TOTAL:60**

TextBooks:

1. EDWARDC.JORDAN-ElectromagneticwavesandRadiationsystems–Asia Publication House, PHI, 1978, Reprint 2003.

ReferenceBooks:

1. Jhon.D.KrausandRonalatoryMarhefka-Antenna-TMcGrawHill– 2002
2. R.E.Collins-AntennasandRadio Propagation-McGrawhill-1987
3. Ballany–AntennaTheory-Jhonwiley&sons– 2nd edition2003.

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

22152C43P **SEMESTERIV**

COMPUTERNETWORKS **4004**

AIM

Tointroducetheconcept,terminologies,andtechnologiesusedinmoderndatacommunication and computer networking.

OBJECTIVES

- Tointroducethestudentsthefunctionsofdifferentlayers.
- TointroduceIEEEstandardemployedincomputer networking.
- Tomakestudentstogetfamiliarizedwithdifferentprotocolsandnetwork components.

UNITI DATA COMMUNICATIONS 8

Components – Direction of Data flow – networks – Components and Categories – typesof Connections – Topologies –Protocols and Standards – ISO / OSI model –Transmission Media – Coaxial Cable – Fiber Optics – Line Coding – Modems – RS232Interfacing sequences.

UNITII DATALINKLAYER 12

Error – detection and correction – Parity– LRC – CRC – Hamming code – Flow Controland Error control: stop and wait – go back N ARQ – selective repeat ARQ-slidingwindow techniques– HDLC.

LAN:EthernetIEEE802.3,IEEE802.4,andIEEE802.5–IEEE802.11–FDDI,SONET – Bridges.

UNITIII NETWORKLAYER 10

Internetworks-PacketSwitchingandDatagramapproach–IPaddressingmethods–Subnetting – Routing – Distance Vector Routing – Link State Routing – Routers.

UNITIV TRANSPORTLAYER 8

Duties of transport layer – Multiplexing – Demultiplexing – Sockets – User DatagramProtocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control – Qualityof services (QOS) – Integrated Services.

UNITV APPLICATIONLAYER 7

DomainNameSpace(DNS)–SMTP,FDP,HTTP,WWW– Security– Cryptography.

TOTAL:45

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

TEXTBOOKS

1. BehrouzA. Foruzan, “Datacommunicationand Networking”, TataMcGraw-Hill, 2004.

REFERENCES

1. James .F. Kurouse & W. Rouse, “Computer Networking: A Topdown Approach Featuring”, Pearson Education.
2. LarryL.Peterson & Peter S. Davie, “COMPUTER NETWORKS”, Harcourt Asia Pvt. Ltd., Second Edition.
3. AndrewS.Tannenbaum,“ComputerNetworks”,PHI,FourthEdition,2003.
4. William Stallings, “Data and Computer Communication”, Sixth Edition, Pearson Education, 2000.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

22152L45P **SEMESTERIV**

NETWORKSANDCOMMUNICATIONLAB **0 0 3 2**

PartI:NETWORKS

1. PC toPC Communication
   ParallelCommunicationusing8bitparallelcableSerial
   communication using RS 232C
2. Ethernet LANprotocol
   TocreatescenarioandstudytheperformanceofCSMA/CDprotocolethrol
   simulation
3. Tokenbusandtokenringprotocols
   Tocreatescenarioandstudytheperformanceoftokenbusandtokenringprotocols
   through simulation
4. WirelessLANprotocols
   TocreatescenarioandstudytheperformanceofnetworkwithCSMA/CAprotocol and
   compare with CSMA/CD protocols.
5. Implementationand studyofstop and waitprotocol

PartII: COMMUNICATION

1. Modulation
   andDemodulationCharacteristicsofAM/FMTransmitterAndReciev
   er.
2. Pulsemodulation-PAM/PWM/PPM
3. Pulsecodemodulation
4. Digitalmodulation–ASK, PSK,QPSK, FSK
5. ExperimentsonAntenna:
   Toplotandanalysetheradiationpatternsofthefollowingantennas.
   - Dipole
   - HalfWaveDipole
   - Monopole
   - YagiAntenna
6. ExperimentsonCoaxialLine Section:
   - MeasurementofVSWR
   - Stubmatching

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE -I

22152E44AP **SEMESTERIV**

HIGHSPEEDNETWORKS **4004**

AIM

To highlight the features of different technologiesinvolvedin High Speed Networking and their performance.

OBJECTIVES

- StudentswillgetanintroductionaboutATMandFrame relay.
- Studentswillbeprovidedwithanup-to-datesurveyofdevelopmentsinHigh Speed Networks.
- Enable the students to know techniques involved to support real-time traffic and congestion control.

Studentswillbeprovidedwithdifferentlevelsofqualityofservice(Q.S)todifferent applications.

UNITI HIGHSPEEDNETWORKS 9

FrameRelayNetworks–Asynchronoustransfermode–ATMProtocolArchitecture,ATM Cell – ATM Service Categories – AAL.

HighSpeedLANs:FastEthernet,GigabitEthernet,WirelessLANs:applications,requirements – Architecture of 802.11

UNITII LANSWITCHINGTECHNOLOGY 9

Switching concepts, switch forwarding techniques, switch path control, LAN switching,cut through forwarding, store and forward, Virtual LANs

UNITIII TCPANDATMCONGESTIONCONTROL 9

TCP Flow control – TCP Congestion Control – Retransmission – Timer Management – Exponential RTO backoff – KARN's Algorithm –– Performance of TCP over ATM.TrafficandCongestioncontrolinATM–Requirements–Attributes–TrafficManagementFramework,TrafficControl–ABRtrafficManagement–ABRratecontrol, RM cell formats,– GFR traffic management.

UNITIV INTEGRATEDANDDIFFERENTIATEDSERVICES 9

IntegratedServicesArchitecture–Approach,Components,Services-QueuingDiscipline,FQ, PS, BRFQ, GPS, WFQ – Random Early Detection, Differentiated Services

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

UNITV IPSWITCHING 9

Addressingmodel,IPSwitchingtypes-flowdrivenandtopologydrivensolutions,IPOver ATM address and next hop resolution, multicasting,

TOTAL:45

TEXT BOOK

1.WilliamStallings,“HIGHSPEEDNETWORKSANDINTERNET”,Pearson Education, Second Edition, 2002.

REFERENCES

1. Warland&PravinVaraiya,“HIGHPERFORMANCECOMMUNICATION NETWORKS”, Jean Harcourt Asia Pvt. Ltd., II Edition, 2001.
2. IrvanPepelnjk,JimGuichardandJeffApcar,“MPLSandVPNarchitecture”, Cisco Press, Volume 1 and 2, 2003

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE -I

22152E44BP **SEMESTERIV**

ADVANCEDDIGITALSIGNALPROCESSING **4004**

AIM

Tointroducethestudenttoadvanceddigitalsignalprocessing techniques.

OBJECTIVES

- Tostudytheparametricmethodsfor power spectrumestimation.
- TostudyadaptivefilteringtechniquesusingLMSalgorithmandtostudythe applications of adaptive filtering.
- Tostudymultiratesignalprocessingfundamentals.
- Tostudytheanalysis ofspeechsignals.
- Tointroducethestudenttowavelettransforms.

UNITI DISCRETERANDOMSIGNALPROCESSING

Discrete Random Processes-, Autocorrelation and Auto covariance matrices. Parseval'sTheorem, Wiener - Khintchine Relation- Power Spectral Density-Periodogram -Parameter estimation: Bias and consistency.

UNITIISPECTRUMESTIMATION

Non-Parametric Methods-Correlation Method, Periodogram Estimator, PerformanceAnalysis of Estimators –Unbiased Consistent Estimators-; Bartlett, Blackman –Tukeymethod.

ParametricMethods-AR, MA,andARMAmodelbasedspectralestimation.

UNITIIILINEARESTIMATIONANDPREDICTION

Linear prediction- Forward and backward predictions, - Levinson-Durbin algorithms.Least meansquared error criterion -Wiener filter for filtering and prediction, FIRWienerfilter and Wiener IIR filters, Discrete Kalman filter

UNITIVADAPTIVE FILTERS

FIRadaptive filters -adaptive filter basedonsteepest descent method-Widrow-HoffLMSadaptive algorithm Adaptive recursive filters (IIR). RLS adaptive filters-Exponentiallyweighted RLS-sliding window RLS.

UNITVMULTIRATEDIGITALSIGNALPROCESSING

Mathematicaldescriptionofchangeofsamplingrate-InterpolationandDecimation,Decimationbyanintegerfactor-Interpolationbyanintegerfactor,Filterimplementation

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

forsamplingrateconversion-ApplicationtosubbandcodingandFilterbankimplementation of wavelet expansion of signals.

REFERENCES:

1. Monson H.Hayes,Statistical Digital Signal Processing and Modeling,John Wiley and Sons, Inc., Singapore, 2002.
2. JohnG.Proakis,DimitrisG.Manolakis,DigitalSignalProcessingPearsonEducation, 2002.
3. JohnG.Proakiset.al.,'AlgorithmsforStatisticalSignalProcessing',Pearson Education, 2002.
4. DimitrisG.Manolakiset.al.,'StatisticalandadaptivesignalProcessing',McGraw Hill, Newyork,2000.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE -I

22152E44CP **SEMESTERIV**

SPEECHPROCESSING **4004**

AIM

TointroducethecharacteristicsofSpeechsignalsandtherelatedtimeandfrequency domain methods for speech analysis and speech compression

OBJECTIVE

- Tointroducethemodelsforspeechproduction
- Todeveloptimeandfrequencydomaintechniques forestimatingspeechparameters
- Tointroduceapredictivetechniqueforspeechcompression
- Tounderstandspeechrecognition, synthesisandspeakeridentification.

UNITI: NATUREOFSPEECHSIGNAL 9

Speechproduction mechanism– Classificationofspeech– Sounds– Natureofspeechsignal – Models of speech production

SpeechSignalProcessing: Purposeofspeechprocessing –Digitalmodelsforspeechsignal – Digital processing of speech signals – Significance – Short time analysis.

UNITII: TIMEDOMAINMETHODSFORSPEECHPROCESSING 9

Timedomainparametersofspeech–Methodsforextractingtheparameters –Zerocrossings – Auto correlation function – Pitch estimation.

UNITIII:FREQUENCYDOMAINMETHODSFORSPEECHPROCESSING9

Shorttimefourieranalysis–Filter bankanalysis–Spectrographicanalysis–Formatextraction – Pitch extraction – Analysis – Synthesis systems.

UNITIV: LINEARPREDICTIVECODINGOFSPEECH 9

Formulationoflinear predictionproblemintimedomain –Solutionofnormalequations– Interpretation of linear prediction in auto correlation and spectral domains.

UNITV: HOMOMORPHICSPEECHANALYSIS 9

Centralanalysisofspeech– Format andpitchestimation–Applicationsofspeechprocessing – Speech recognition – Speech synthesis and speaker verification.

Total:45

TEXTBOOK

1. RabinerL.R.andSchaferR.E,“DigitalProcessingofSpeechSignals”,Prentice Hall, 1978.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

REFERENCES

1. Flanagan J.L, “Speech Analysis Synthesis and Perception”, 2nd Edition, Springer Vertag, 1972.
2. WittenI.H.,“PrinciplesofComputerSpeech”, AcademicPress, 1983.

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

ELECTIVE -I

22152E44DP **SEMESTERIV**

FUZZYLOGICANDNEURALNETWORKS **4004**

AIM

To introduce the techniques of soft computing and adaptive neuro-fuzzy inferencing systems which differ from conventional AI and computing in terms of its tolerance to imprecision and uncertainty.

OBJECTIVES

- Tointroducetheideasof fuzzy sets,fuzzylogicanduseof heuristicsbasedon human experience
- To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems
- Toprovidethemathematicalbackgroundforcarryingouttheoptimization associated with neural network learning
- To familiarize withgenetic algorithmsand other randomsearchproceduresuseful while seeking global optimum in self-learning situations
- Tointroducecasestudiesutilizingtheaboveand illustratethe intelligent behavior of programs based on soft computing

UNITI: PrimeronFuzzySets **9**

Crisp sets, from crisp sets to fuzzy sets , Linguistic variables,Membership functionsSome terminology , Set theoretic operations for crisp sets , Set theoretic operations forfuzzy sets , membership functions

UNITII: FuzzyLogicSystems **9**

Introduction , Rules , Fuzzy Inference Engine , Fuzzification and Its Effect on InferenceFuzzifier,Fuzzyinferenceengine,Defuzzification,Centroiddefuzzifier,Center-of-sumsdefuzzifier

UNITIII:NeuralNetsIntroduction andOverview **9**

Perceptrons,LeastMean SquareLearning Systems ,Multilayer Neural Networks Back-Propagation The Practical Application of Back-Propagation ErrorRateandComplexityFitEstimationImprovingonStandardBack-Propagation

UNITIV:RadialBasisFunctionNetworks **9**

Ill-Posed Problems and the Regularization Technique , Stabilizers and Basis Functions,GeneralizedRadialBasisFunctionNetworks,MovingCentersLearning,Regularization

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

with Nonradial Basis Functions, Orthogonal Least Squares, Optimal Subset Selection byLinear

UNITV:ANFIS:AdaptiveNeuro-FuzzyInferenceSystems 9

Introduction , ANFIS Architecture , Hybrid Learning Algorithm, Learning Methods thatCross-fertilize ANFIS and RBFN , ANFIS as a Universal Approximator

TOTAL:45

Textbook:

1. Bart Kosko, Neural networks and fuzzy systems: a dynamical systems approach to machine intelligence, Prentice-Hall, Inc., Upper Saddle River, NJ, 1991

Reference:

1. Kin,S.(1999),NeuralNetworks:AComprehensiveFoundation,2nded.,Upper Saddle River, NJ: Prentice Hall, ISBN 0-13-273350-1.
2. Jyh-ShingRogerJang,Chuen-TsaiSun,EijiMizutani(1997)”Neuro-Fuzzyand Soft Computing:AComputationalApproachtoLearningand MachineIntelligence, |Prentice Hall

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE -I

22152E44EP **SEMESTERIV**

ADVANCEDELECTRONICSYSTEMDESIGN **4004**

AIM

To get knowledge about usage of electronic devices in Communication Engineering and Power supplies.

OBJECTIVE

- TostudyRFcomponentsuchasresonator,filter,transmissionlines,etc…
- To learndesignofRFamplifiersusingtransistors.
- TostudymodernPower Suppliesusing SCRand SMPStechnology
- Tolearnaboutsignalshielding&groundingtechniquesandstudyofA/Dand D/A Converters.
- TolearnknowledgeaboutfabricationofPCBsusing CAD.

UNITI: INTRODUCTIONTORFDESIGN 9

RFbehaviourofpassivecomponents –Chipcomponentsandcircuit boardconsiderations–Reviewoftransmissionlines –Impedanceandadmittancetransformation–Parallelandseries connectionof networks – ABCD and scattering parameters – Analysis of amplifierusing scattering parameter – RF filter – Basic resonator and filter configurations –Butterworth and chebyshev filters – Implementation of microstrip filter design – Bandpass filter and cascading of band pass filter elements.

UNITII: RFTRANSISTORAMPLIFIERDESIGN 9

Impedance matching using discrete components – Microstrip line matching networks – Amplifier classes of operation and biasing networks – Amplifier power gain–Unilateraldesign(S_{12}=0) –Simple input andoutput matching networks–Bilateraldesign–Stabilitycircle and conditional stability – Simultaneous conjugate matching for unconditionallystable transistors – Broadband amplifiers – High power amplifiers and multistageamplifiers.

UNITIII: DESIGNOFPOWER SUPPLIES 9

DC power supplydesignusing transistors and SCR's – Designofcrowbar and foldbackprotectioncircuits–SwitchedModePowerSupplies(SMPS) –Forward–Flyback-buckand boost converters – Design of transformers and control circuits for SMPS.

UNITIV: DESIGNOFDATAACQUISITIONSYSTEMS 9

Amplification of lowlevel signals– Grounding– Shielding and guarding techniques–Dualslope–QuadslopeandhighspeedA/Dconverters–Microprocessorscompatible

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

A/D converters – Multiplying A/D converters and logarithmic A/D converters – Sampleand hold – Design of two and four wire transmitters.

UNITV: DESIGNOFPRINTEDCIRCUITBOARDS 9

Introduction to technology of Printed Circuit Boards (PCB) – General lay out and rulesand parameters – PCB design rules for digital – High frequency – Analog – Powerelectronics and microwave circuits – Computer Aided Design(CAD) of PCB's.

Total:45

TEXTBOOKS:

1. ReinholdLuduigandPavelBretchko,"RFCircuitDesign–Theoryand Applications", Pearson Education, 2000.
2. SydneySoclof, "ApplicationsofAnalogIntegratedCircuits",PHI,1990.
3. WalterC.Bosshart,"PrintedCircuitBoards–Design andTechnology",TMH, 1983.

REFERENCES

1. KeithH.Billings, "HandbookofSwitched ModeSupplies", TMHPublishingCo., 1989.
2. MichaelJaacob, "Applicationsand Designwith Analog Integrated Circuits", PHI, 1991.
3. Otmar Kigenstein, "Switched Mode Power Supplies in Practice", John Wileyand Sons, 1989.
4. MuhammadH.Rashid,"PowerElectronics–Circuits,Devicesand Applications",

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

22152C51P **SEMESTERV**

OPTICALCOMMUNICATIONAND NEWORKS **4004**

AIM

- To introduce the various optical fiber modes, configurations and various signal degradation factors associated with optical fiber.
- To study about various optical sources and optical detectors and their use in the optical communication system. Finally to discuss about digital transmission and its associated parameters on system performance.

OBJECTIVES

- To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures.
- To understandthe different kind oflosses, signaldistortion inopticalwave guides and other signaldegradation factors. DesignoptimizationofSM fibers, RI profile and cut-off wave length.
- Tolearnthevariousopticalsource materials, LEDstructures,quantumefficiency, Laser diodes and different fiber amplifiers.
- To learnthe fiberopticalreceivers suchasPIN APDdiodes, noiseperformance in photo detector, receiver operation and configuration.
- To learn fiber slicing and connectors, noise effects on system performance, operational principles WDM and solutions.

UNITI INTRODUCTIONTOOPTICALFIBERS 9

Evolution of fiber optic system- Element of an Optical Fiber Transmission link-RayOptics-Optical Fiber Modes and Configurations –fiber types Mode theory of CircularWave guides- Overview of Modes- Key model concepts- Linearly Polarized Modes –Single Mode Fibers-

UNITIISIGNALDEGRADATIONOPTICALFIBERS 9

Attenuation – Absorption losses, Scattering losses, Bending Losses, Core and Claddinglosses, Signal Distortion in Optical Wave guides-Information Capacity determination –GroupDelay-MaterialDispersion, Wave guide Dispersion, Signaldistortion inSM fibers
-ModeCoupling

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

UNITIII FIBEROPTICALSOURCESAND COUPLING 9

Direct and indirect Band gap materials-LED structures –Quantum efficiency Modulationofa LED, lasers Diodes-Modes and Threshold condition Fiber amplifiers-Power Fibre –to- Fibre joints, Fibre splicing.

UNITIV FIBEROPTICALRECEIVERS 9

PIN and APD diodes –Photo detector noise, SNR, Detector Response time, AvalancheMultiplication Noise –Comparison of Photo detectors –Fundamental Receiver Operation– preamplifiers, Error Sources –Receiver Configuration –Probability of Error

UNITV DIGITALTRANSMISSION SYSTEM 9

Point-to-Point links System considerations –Link Power budget –Rise - time budget –Noise Effects on System Performance-Operational Principles of WDM, Solitons-. Basicon concepts of SONET/SDH Network.

TOTAL:45

TEXT BOOK

1. GerdKeiser,“OpticalFiberCommunication”McGraw–HillInternational, Singapore, 3rd ed., 2000

REFERENCES

1. J.Senior,“OpticalCommunication,PrinciplesandPractice”,PrenticeHallof India, 1994.
2. J.Gower,“OpticalCommunicationSystem”, PrenticeHallofIndia,2001.

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

22152C52P **SEMESTERV**

MICROWAVEENGINEERING **4004**

Aim

Toenablethestudenttobecomefamiliarwithactive&passivemicrowavedevices& components used in Microwave communication systems.

Objectives

- TostudypassivemicrowavecomponentsandtheirS-Parameters.
- TostudyMicrowavesemiconductor devices&applications.
- To studyMicrowave sourcesandamplifiers.

Unit–I:Introduction **9**

Radio Spectrum–MicrowaveFrequencyand itscharacteristics –Transmissionmedia formicrowave signals – Waveguides – Scattering Parameters for microwave network (twoports)

Unit –II:PassiveMicrowaveDevices **9**

Isolators, Attenuators, Directional Couplers – Waveguide Tees – E- plane, H-Plane andMagic Tee –- Matched Terminators – S – parameters for all the components

Unit –III: MicrowaveSources **9**

KlystronOscillator–MagnetronOscillator–TWTAAmplifier–Poweroutputandefficiency equations for all the devices

Unit–IV:SemiconductorMicrowave Devices **9**

PIN Diode – Varactor Diode (Manley – Rowe Power Relation) – Tunnel Diode – GunnDiode – Applications of all the diodes –

Unit–VMicrowaveMeasurements **9**

PowerMeasurements–FrequencyMeasurements–VSWRMeasurements(HighandLow VSWR) – Attenuation Measurements – Insertion Loss Measurements

TOTAL:45

TextBook:

1. SamuelY.LIAO:MicrowaveDevicesandCircuits–PrenticeHallof India – 3rd Edition (2003)
2. AnnapurnaDasandSisirK.Das:MicrowaveEngineering–TataMcGraw-Hill (2000) (UNIT V)

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

Reference:

1. R.E.Collin:FoundationsforMicrowaveEngg.–IEEEPressSecondEdition (2002)
2. DavidM.POZAR:MicrowaveEngg.–JohnWiley&Sons– 2^{nd}Edition(2003)
3. P.A.RIZZI–MicrowaveEngg.(Passive)

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

21160C53P **SEMESTERV**

PRINCIPLESOFMANAGEMENT

4004

UNITI-Natureof Management 9

Definitions, meaning,scope,administrationandmanagement -Scienceandart Mgmt asaprofession, University of management Hierarchy (Top, middle and supervisory, Levels),Principles of Management

UNITII-DevelopmentofManagement Thought 9

Taylor andScientificManagement,PrinciplesofScientificManagement Contributionsoffayol,Barnardandsocialsystemtheory, ContributionsofHerbert Simon, ContributionsofPeter Drucker, Contributions of behavioral scientists ,Contribution of system scientists

UNITIII-Planning and organizing 9

Definitionandfeaturesofplanning,Natureofplanning,Importanceofplanning

Types ofplanning, Steps inplanning. Management byobjectives, Strategies and policies,Definition of organization, Importance of organization, Principles of organization, Spanof management

UNITIV-Direction and Coordination 9

Meaning, definition, principles of direction, Techniques of direction - Meaning ofsupervision, Functions of supervisor, Meaning of coordination Element and features ofcoordination, Importance of coordination Cooperation and coordination systemsapproach Steps for effective coordination Meaning and causes of conflicts, Managementof conflicts

UNITV–Controlling 9

Definition, Meaning .elements, steps in establishing control procedure ControlTechniques, Requirements of good control systems Budget –meaning, definitions, typesZero based budgeting, responsibility accounting, budgetary control, Report –meaningtypes PERT and CPMManagement by Exception

TOTAL:45

Textbooks:

1. Prasad L.M ., Principles and practice of Management ,New Delhi Sultan Chand and sons ,1998

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

References:

1. Saxena,S.Cprinciplesandpracticeofmanagement Agra:sahityabhawan1998
2. KoontzHaroldandothers,ManagementNewYork:McGrawHill1980
3. StonerJamesandothers,Management,NewDelhi:PHI,1997
4. DaleYoder:Personnel Managementandindustrial Relations,NewDelhi,PHI 1974

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22152L55P **SEMESTERV**

OPTICALCOMMUNICATION ANDMICROWAVELAB

0032

PartI:ExperimentspertainingtoFiberoptics

1. Numericalaperturedeterminationfor fibersandAttenuationMeasurementin Fibers.
2. ModeCharacteristicsofFibers– SM Fibers.
3. CouplingFibersto Semi-ConductorSources – Connectors&Splices.
4. Fiberopticcommunicationlinks.
5. LED&Photo DiodeCharacteristics.

PartII:ExperimentspertainingtoMicrowave

1. VSWRMeasurements– Determinationofterminatedimpedance
2. Determinationofguidewavelength,frequencymeasurement.
3. RadiationPatternofHorns,Paraboloids.
4. MicrowavePower Measurement.
5. CharacteristicsofGunndiodeOscillator.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE-II

22152E54AP **SEMESTERV**

ENVIRONMENTALSCIENCEAND ENGINEERING 4004

UNIT:I INTRODUCTIONTOENVIRONMENTALSTUDIESAND NATURALRESOURCES 9

Definition,Scopeandimportance–Needforpublicawareness– Forestresources –Waterresources–Energyresources–Landresources–Roleofanindividualinconservation of natural resources –Equitable use of resource for sustainable life styles.

UNIT:II ECOSYSTEMAND BIODIVERSITY 9

Concept of an ecosystem – structure and Function of An ecosystem-Producers,consumers and decomposers – Energy flow in the ecosystem – Ecological succession –Food chainsFoodweband ecologicalpyramids.Introductionto Biodiversity–ValueofBiodiversity – Biodiversity at global, National and local levels – India as a mega –diversity nation Hot spots ofBiodiversity – Threats to Biodiversity Endangeredandendemic species ofIndia – Insitu and Excitu conservation of Biodiversity.

UNIT:III ENVIRONMENTALPOLLUTION 9

Definition – Causes, effects and control measure of **: -** Air pollution **-** Water Pollution-SoilPollution-MarinePollution-NoisePollution-ThermalPollution-Nuclearhazard – SolidWastemanagement– Role ofIndividual in prevention of pollution – Disastermanagement.

UNIT:IVSOCIAL ISSUESANDTHEENVIRONMENT 9

From Un sustainable to sustainable development – water conservation,Rain waterharvesting, water shed Management – Global warming – Ozone layer Depletion –Acidrain –Nuclear Accidents and holocaust –Environment Protection Act, Issues involvedin enforcement legislation.

UNIT:VHUMAN POPULATIONAND THEENVIRONMENT 9

Populationgrowth– Populationexplosion– Familywelfare programme–Environmentand human health – Human rights –value education –HIV/AIDS–Role ofInformation Technology in Environment and human health.

Total=45

TEXT BOOK

1. GilbertMMasters,"IntroductiontoEnvironmentalEngineeringandscience, "SecondEdition , Pearson Education Pvt, Ltd, 2007.
2. MillerT.G.Jr."Environmentalscience,", WadworthPublishingCo.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

REFERENCES

1. KurianJoseph,"EssentialsofEnvironmental studies",Firstedition,Pearson Education, 2004.
2. BharuchaErach,"TheBiodiversityofIndia,"MapinPublishing Pvt,Ltd.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE-II

22152E54BP **SEMESTERV**

OPTOELECTRONICDEVICES **4004**

AIM

Tolearn differenttypesof optical emission,detection,modulation andoptoelectronic integrated circuits and their applications.

OBJECTIVE

- Toknowthebasicsofsolidstatephysicsandunderstandthenatureand characteristics of light.
- Tounderstanddifferent methodsofluminescence, displaydevicesand laser typesand their applications.
- Tolearntheprincipleofopticaldetection mechanismindifferentdetectiondevices.
- Tounderstanddifferent light modulationtechniquesandtheconceptsandapplications of optical switching.
- To studythe integrationprocess and applicationofopto electronic integrated circuits in transmitters and receivers.

UNITI: ELEMENTSOFLIGHTANDSOLIDSTATEPHYSICS 9

Wave nature of light – Polarization – Interference – Diffraction – Light source – Reviewof quantum mechanical concept – Review of solid state physics – Review ofsemiconductor physics and semiconductor junction device.

UNITII: DISPLAYDEVICESANDLASERS 9

Introduction – Photo luminescence – Cathode luminescence – Electro luminescence – Injection luminescence – Injection luminescence – LED – Plasma display – LiquidCrystal Display (LCD) – Numeric displays – Laser emission – Absorption – Radiation –Population inversion – Optical feedback – Threshold condition – Laser modes – Classesof lasers – Mode locking – Laser applications.

UNITIII: OPTICALDETECTIONDEVICES 9

Photo detector – Thermal detector – Photo devices – Photo conductors – Photo diodes – Detector performance.

UNITIV: OPTOELECTRONICMODULATOR 9

Introduction– Analoganddigitalmodulation–Electro-optic modulators– Magnetoopticdevices – Acoustoptic devices – Optical – Switching and logic devices.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

UNITV: OPTOELECTRONICINTEGRATEDCIRCUITS 9

Introduction–Hybridandmonolithicintegration–Applicationofoptoelectronicintegrated circuits – Integrated transmitters and receivers – Guided wave devices.

Total:45

TEXTBOOK

1. WilsonJandHaukesJ.,"OptoElectronics–AnIntroduction",PHI Pvt.Ltd.,1995.

REFERENCES

1. Bhattacharya, "SemiconductorOptoElectronicDevices",PHIPvtLtd.,1995.
2. Jasprit Singh, "OptoElectronics – AsIntroductionto MaterialsandDevices", TMH International Edition, 1998.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE-II

22152E54CP **SEMESTERV**

RADARANDNAVIGATIONALAIDS **4004**

AIM

Tomakethestudentunderstandtheprinciplesof Radaranditsuseinmilitaryand civilian environment

Alsotomakethestudentfamiliarwithnavigationalaidsavailablefornavigationof aircrafts and ships.

OBJECTIVES

- Toderiveand discussthe Rangeequationand the natureofdetection.
- To apply doppler principle to radars and hence detect moving targets, cluster, alsoto understand tracking radars
- To refresh principles ofantennas and propagation as related to radars, also studyof transmitters and receivers.
- To understand principles of navigation, in addition to approach and landing aids as related to navigation
- To understandnavigationofshipsfromshoretoshore.

UNITI INTRODUCTIONTORADAR 9

Basic radar – The simple form of the radar equation – Radar block diagram – Radarfrequencies – Applications of radar – The origins of radar – The radar equation – Introduction – Detectionofsignals in noise – Receiver noise and the signal-to-noise ratio– Probability density functions – Probabilities of detection and false alarm – Integrationof radar pulses – Radar cross section of targets – Radar cross section fluctuations – Transmitter power – Pulse repetition frequency – Antenna parameters – System losses – Other radar equation considerations

UNITII: MTIAND PULSEDOPPLER RADAR 9

Introduction to Doppler and MTI radar – Delay-line cancellers – Staggered pulserepetition frequencies – Doppler filter banks – Digital MTI processing – Moving targetdetector – Limitations to MTI performance – MTI from a moving platform (AMIT) –Pulse Doppler radar – Other Doppler radar topics – Tracking with radar – Mono pulsetracking – Conicalscanand sequentiallobing – Limitations to tracking accuracy – Low –Angle tracking – Tracking in range – Other tracking radar topics – Comparison oftrackers – Automatic tracking with surveillance radars (ADT).

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UNITIII **9**

Detection of signals in noise – Introduction – Matched – Filter receiver – Detection – Detectors – Automatic detector – Integrators – Constant – False – Alarmrate receivers – The radar operator – Signal management – Propagation radar waves – Atmospheric – Standard propagation – Nonstandard propagation – The radar antenna – Reflectorantennas – Electronically steered phased array antennas – Phase shifters – Frequency –Scan arrays – Radar transmitters – Introduction – Linear beam power tubes – Solid stateRF power sources – Magnetron – Crossed field amplifiers – Other RF power sources –Other aspectsofradar transmitter –Radar receivers–Theradar receiver –Receiver noisefigure – Super heterodyne receiver – Duplexers and receiver protectors – Radar displays.

UNITIV **9**

Introduction – Four methods of navigation – Radio direction finding – The loop antenna– Loop input circuits – An aural null direction finder – The goniometer – Errors indirection finding – Adcock direction finders – Direction finding at very high frequencies– Automatic direction finders – The commutated aerial direction finder – Range andaccuracy of direction finders – Radio ranges – The Lf/Mf four course radio range – Vhfomni directional range (Vor) – Vor receiving equipment – Range and accuracy of Vor –Recent developments – Hyperbolic systems of navigation (loran and decca) – Loran-Aequipment – Range and precision of standard loran – Loran-C – The decca navigationsystem – Decca receivers – Range and accuracy of decca – The omega system

UNITV **9**

DME and TACAN – Distance measuring equipment – Operation of DME – TACAN – TACAN equipment – Aids to approach and landing – Instrument landing system – Ground controlled approach system – Microwave Landing System (MLS) – Dopplernavigation – The Doppler effect – Beamconfigurations – Doppler frequency equations –Trackstabilization–Dopplerspectrum– ComponentsoftheDopplernavigationsystem – Dopplerrangeequation–Accuracyof Dopplernavigationsystems–Inertialnavigation – Principles of operation – Navigation over the earth – Components of an inertialnavigation system – Earth co-ordinate mechanization – Strapped – Down systems –Accuracyofinertialnavigationsystems –Satellite navigationsystem–Thetransit system – Navstar GlobalPositioning System(GPS)

Total:45

TEXTBOOK

1. MerrillI.Skolnik,“IntroductiontoRadarSystems”, 3rdEdition, TMH, 2003.

REFERENCES

1. PeytonZ.Peebles,“RadarPrinciples”,Johnwiley,2004

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

2. ToomayJ.C, “PrinciplesofRadar”, 2ndEdition, PHI, 2004

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE-II

22152E54DP **SEMESTERV**

DIGITALIMAGEPROCESSING 4004

AIM

Tointroducethestudenttovarious imageprocessing techniques.

OBJECTIVES

- To studythe image fundamentals and mathematicaltransforms necessaryfor image processing.
- Tostudytheimageenhancementtechniques
- Tostudyimagerestorationprocedures.
- Tostudytheimagecompressionprocedures.
- Tostudytheimagesegmentationandrepresentationtechniques.

UNIT-I: DIGITALIMAGE FUNDAMENTALS 9

Elementsofvisualperception–Imagesampling,Quantization–Basicrelationshipbetween pixels-monochrome vision model- color space model-convolution.

UNIT– IIIMAGETRANSFORM 9

Basic geometric transforms-Introduction to Fourier transform and DFT – properties of2D Fourier transform– FFT- Separable image transforms – Walsh – Hadamard-Discretecosine and Haar Transfroms

UNIT-III: IMAGEENHANCEMENTANDRESTORATIONTECHNIQUES9

Spatial domain methods- Basic gray level transformation-Histogram equalization-Spatialfiltering-Laplacian filtering- Frequency Domain filters- homomorphic filtering-Model ofimage degradation/Restoration process- Noise models.

UNITIV:IMAGECOMPRESSION 9

Losslesscompression-: Variable lengthcoding- LZWcoding- -Predictive coding-DPCM.Lossy compression- Transform coding-– Image compression standards-JPEG,MPEG.

UNIT–V:IMAGESEGMENTATION&REPRESENTATION 9

Edge detection – Thresholding- region based segmentation- Boundary representation – chair codes- Boundary segments – boundarydescriptors-: simple descriptors-Fourierdescriptors- Regional descriptors- Texture.

TOTAL:45

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

TextBook:

2. RafeelC.Gonzalez,RichardEwoods2nd edition–Digital Image processing–Pearson education 2003.

Referencebooks:

1. WilliamK.Pratt,DigitalImageprocessing, JohnWiley(2001)
2. ImageprocessingAnalysisandMachineVision -MillmanSonka ,Vaclav hlavac,Roger Boyle,Broos/Colic,Thompson Learnfy(1999)
3. A.K.JainPHI,(1995)–FundamentalsofDigitalImageprocessing

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

ELECTIVE-II

22152E54EP **SEMESTERV**

ENGINEERINGACOUSTICS **4004**

AIM

Thiscourseaimsatprovidinganoverviewofengineeringacoustics.

OBJECTIVE

- Toprovide mathematicalbasisforacousticswaves
- Tointroducetheconceptofradiationreceptionabsorptionandattenuationof acoustic waves.
- Topresentthecharacteristicbehaviourofsoundinpipes, resonatorsand filters.
- Tointroducethepropertiesofhearing and speech
- Todescribethearchitectureandenvironmentalinclusiveofreverberationand noise.
- Togiveadetailed studyonloud speakersandmicrophones.

UNITI:

Acoustics waves – Linear wave equation – Sound in fluids – Harmonic plane waves – Energy density – Acoustics intensity – Specific acoustic impedance – Spherical waves – Describer scales.

Reflection and Transmission: Transmission from one fluid to another normal andoblique incidence – Method of images.

UNITII: RADIATIONANDRECEPTION OFACOUSTICWAVES 9

Radiationfrompulsatingsphere–Acousticreciprocity–Continuouslinesource–Radiation impedance – Fundamental properties of transducers.

Absorptionandattenuationofsound: Absorptionfromviscosity–Complexsoundspeed and absorption – Classical absorption co-efficient

UNITIII: PIPERESONATORSANDFILTERS 9

Resonance in pipes – Standing wave pattern absorption of sound in pipes – Longwavelength limit – Helmoltz resonator – Acoustic impedance – Reflection andtransmission of waves in pipe – Acoustic filters – Low pass, high pass and band pass.

Noise, Signal detection, Hearing and speech: Noise, spectrum level and band level – Combing band levels and tones – Detecting signals in noise – Detection threshold – Theear – Fundamental properties of hearing – Loudness level and loudness – Pitch andfrequency – Voice.

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UNITIV: ARCHITECTURALACOUSTICS 9

Sound in endosure – A simple model for the growth of sound in a room – Reverberationtime – Sabine, sound absorption materials – Measurement ofthe acoustic outputofsoundsources in live rooms – Acoustics factor in architectural design.

Environmental Acoustics: Weighted sound levels speech interference – Highway noiseNoise induced hearing loss – Noise and architectural design specification andmeasurement of some isolation design of portions.

UNITV: TRANSDUCTION 9

Transducer as an electives network – Canonical equation for the two simple transducerstransmitters – Moving coil loud speaker – Loudspeaker cabinets – Horn loud speaker,receivers – Condenser – Microphone – Moving coil electrodynamics microphonePiezoelectric microphone – Calibration of receivers.

Total:45

TEXT BOOK

1.LawerenceE.Kinsler,AustinR.Frey,AlanB.CoppensandJamesV.Sanders, “Fundamentals of Acoustics”, 4th Edition, Wiley, 2000.

REFERENCE

1.BerarekL.,“Acoustics”, TMH, 2002.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

22152C61P **SEMESTERVI**

WIRELESSCOMMUNICATION **4004**

Objectives

- Knowthecharacteristicofwirelesschannel
- Learnthevariouscellular architectures
- Understandtheconceptsbehindvariousdigitalsignalingschemesforfading channels
- Befamiliarthevariousmultipathmitigationtechniques
- Understandthevariousmultipleantennasystems

UNITIWIRELESSCHANNELS9

Large scale path loss – Path loss models: Free Space and Two-Ray models -Link Budgetdesign – Small scale fading- Parameters of mobile multipath channels – Time dispersionparameters-Coherence bandwidth – Doppler spread & Coherence time, Fading due toMultipath time delay spread – flat fading – frequency selective fading – Fading due toDoppler spread – fast fading – slow fading.

UNITIICELLULARARCHITECTURE9

Multiple Access techniques - FDMA, TDMA, CDMA – Capacity calculations–Cellularconcept- Frequency reuse - channel assignment- hand off- interference & systemcapacity- trunking & grade of service – Coverage and capacity improvement.

UNITIIIDIGITALSIGNALINGFORFADINGCHANNELS 9

Structure of a wireless communication link, Principles of Offset-QPSK, p/4-DQPSK,Minimum Shift Keying, Gaussian Minimum Shift Keying, Error performance in fadingchannels, OFDM principle – Cyclic prefix, Windowing, PAPR.

UNITIVMULTIPATHMITIGATIONTECHNIQUES9

Equalisation – Adaptive equalization, Linear and Non-Linear equalization, Zero forcingand LMS Algorithms. Diversity – Micro and Macrodiversity, Diversity combiningtechniques, Error probability in fading channels with diversity reception, Rake receiver.

UNITVMULTIPLEANTENNATECHNIQUES9

MIMO systems – spatial multiplexing -System model -Pre-coding - Beam forming - transmitter diversity, receiver diversity- Channelstateinformation-capacityin fading andnon-fading channels.

Total:45

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

TEXTBOOKS:

1. Rappaport,T.S., “Wireless communications”, Second Edition, Pearson Education, 2010.
2. Andreas.F.Molisch,“WirelessCommunications”,JohnWiley–India, 2006.

REFERENCES:

1. David Tse and Pramod Viswanath, “Fundamentals of Wireless Communication”, Cambridge University Press, 2005.
2. UpenaDalal, “WirelessCommunication”,OxfordUniversityPress, 2009.
3. Van Nee, R. and Ramji Prasad, “OFDM for wireless multimedia communications”, Artech House, 2000.

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

22152C62P **SEMESTERVI**

VLSIDESIGN **3104**

AIM

To introduce the technology, design concepts and testing of Very Large Scale Integrated Circuits.

OBJECTIVES

- In this course, the MOS circuit realization of the various building blocks that is common to any microprocessor or digital VLSI circuit is studied.
- Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed.
- The main focus in this course is on the transistor circuit level design and realization for digital operation and the issues involved as well as the topics covered are quite distinct fromthose encountered incoursesonCMOS Analog IC design.

UNITIMOS TRANSISTORPRINCIPLE9

NMOS and PMOS transistors, Process parameters for MOS and CMOS, Electricalproperties of CMOS circuits and device modeling, Scaling principles and fundamentallimits, CMOS inverter scaling, propagation delays, Stick diagram, Layout diagrams

UNITIICOMBINATIONALLOGICCIRCUITS9

Examples of Combinational Logic Design, Elmore‟s constant, Pass transistor Logic,Transmission gates, static and dynamic CMOS design, Power dissipation – Low powerdesign principles

UNITIIISEQUENTIALLOGICCIRCUITS9

Static and Dynamic Latches and Registers, Timing issues, pipelines, clock strategies,Memory architecture and memory control circuits, Low power memory circuits,Synchronous and Asynchronous design

UNITIVDESIGNINGARITHMETICBUILDINGBLOCKS 9

Data path circuits,Architectures for ripple carry adders,carry look ahead adders,Highspeed adders, accumulators, Multipliers, dividers, Barrelshifters, speed and area tradeoff

UNITVIMPLEMENTATIONSTRATEGIES9

FullcustomandSemicustomdesign,Standardcelldesignandcelllibraries,FPGAbuilding block architectures, FPGA interconnect routing procedures.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

TUTORIAL15 **TOTAL:60**

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TEXTBOOKS:

1. JanRabaey,AnanthaChandrakasan,B.Nikolic,“DigitalIntegratedCircuits:A Design Perspective”, Second Edition, Prentice Hall of India, 2003.
2. M.J.Smith,“ApplicationSpecificIntegratedCircuits”, AddissonWesley, 1997

REFERENCES:

1. N.Weste,K.Eshraghian,“PrinciplesofCMOSVLSIDesign”,SecondEdition, Addision Wesley 1993
3. R.JacobBaker, HarryW.LI., DavidE.Boyee, “CMOSCircuit Design, Layoutand Simulation”, Prentice Hall of India 2005
4. A.Pucknell, Kamran Eshraghian, “BASIC VLSI Design”, Third Edition, Prentice Hall of India, 2007.

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

22152C63P SEMESTERVI

3104

EMBEDDEDANDREALTIME SYSTEMS

OBJECTIVES:

Thestudent shouldbemadeto:

- Understandthe conceptsofembeddedsystemdesignandanalysis
- LearnthearchitectureandprogrammingofARMprocessor
- Beexposedtothebasicconceptsofembedded programming
- Learntherealtimeoperatingsystems

UNITI INTRODUCTIONTOEMBEDDEDSYSTEMDESIGN 9

Complex systems and micro processors– Embedded system design process – Designexample: Model train controller- Design methodologies- Design flows - RequirementAnalysis – Specifications-System analysis and architecture design – Quality Assurancetechniques - Designing with computing platforms – consumer electronics architecture –platform-level performance analysis.

UNITII ARM PROCESSORANDPERIPHERALS 9

ARM Architecture Versions – ARM Architecture – Instruction Set – Stacks andSubroutines – Features of the LPC 214X Family – Peripherals – The Timer Unit – PulseWidth Modulation Unit– UART – Block Diagram of ARM9 and ARM Cortex M3MCU.

UNITIIIEMBEDDED PROGRAMMING 9

Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing.

UNITIV REALTIME SYSTEMS 9

Structure of a Real Time System — Estimating program run times – Task Assignmentand Scheduling – Fault Tolerance Techniques – Reliability, Evaluation – ClockSynchronisation.

UNITVPROCESSES AND OPERATINGSYSTEMS 9

Introduction– Multipletasksand multipleprocesses – Multiratesystems-Preemptiverealtime operating systems- Priority based scheduling- Interprocess communicationmechanisms – Evaluating operating system performance- power optimization strategiesfor processes – Example Realtime operating systems-POSIX-Windows CE. - Distributedembedded systems – MPSoCs and shared memory multiprocessors. – Design Example -Audio player, Engine control unit – Video accelerator.

Tutorial:15Hrs **TOTAL:45PERIODS**

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OUTCOMES:

Attheendofthecourse,thestudent shouldbeableto:

- Describethearchitectureandprogrammingof ARMprocessor
- Outlinethe conceptsofembeddedsystems
- Explainthebasic conceptsofrealtime operating systemdesign
- Modelreal-time applicationsusingembedded-systemconcepts

TEXTBOOKS:

1. MarilynWolf,―ComputersasComponents-PrinciplesofEmbeddedComputing System
2. Design‖,ThirdEdition―MorganKaufmannPublisher(AnimprintfromElsevier), 2012. (UNIT I, II, III, V)
3. JaneW.S.Liu,‖RealTimeSystems‖,PearsonEducation,ThirdIndianReprint, 2003. (UNIT IV)

REFERENCES:

1. Lyla B.Das, ―Embedded Systems : An Integrated Approach‖ Pearson Education, 2013.
2. JonathanW.Valvano, ―Embedded Microcomputer Systems Real Time Interfacing‖,Third Edition Cengage Learning, 2012.
3. David.E.Simon,―AnEmbeddedSoftwarePrimer‖,1stEdition,Fifth Impression, Addison Wesley Professional, 2007.
4. Raymond J.A. Buhr, Donald L.Bailey, ―An Introduction to Real-Time Systems-From Design to Networking with C/C++‖, Prentice Hall, 1999.
5. C.M. Krishna, Kang G. Shin, ―Real-Time Systems‖, International Editions, Mc Graw Hill 1997
6. K.V.K.K.Prasad,―EmbeddedReal-TimeSystems: Concepts, Design &Programming‖, Dream Tech Press, 2005.
7. SriramVIyer,Pankaj Gupta,―EmbeddedRealTimeSystemsProgramming‖, Tata Mc Graw Hill, 2004.

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

22152L65P **SEMESTERVI**

VLSIANDEMBEDDEDSYSTEMSLAB **0 0 3 2**

PART–I: VLSILAB

1. StudyofSimulationusingtoolsusingDigitalLogic Circuits.
2. StudyofSynthesistoolsusingDigitalLogic Circuits.
3. Studyofdevelopment toolfor FPGAusing Verilogand SchematicEntry.
4. DesignandSimulationof8bitSignedMultiplier.
5. PlaceandRootandbackannotationfor FPGA.

PART-II:EMBEDDEDLAB

1. ProgrammingusingArithmetic,instructionof8051microcontroller.
2. ProgrammingandverifyingTimeroperationsin8051 microcontroller.
3. ARM-7basedOnboardLEDtesting
4. ARM7BasedADCtesting
5. ARM7basedDAC testing

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE-III

22152E64AP **SEMESTERVI**

PROFESSIONALETHICSINENGINEERING **4004**

OBJECTIVES:

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instillMoraland SocialValuesand Loyaltyand to appreciatetherights of others.

UNITI HUMANVALUES 10

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage –Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character –Spirituality – Introduction to Yoga and meditation for professional excellence and stressmanagement.

UNITII ENGINEERINGETHICS 9

Senses of „Engineering Ethics" – Variety of moral issues – Types of inquiry – Moraldilemmas – Moral Autonomy – Kohlberg"s theory – Gilligan"s theory – Consensus andControversy– Models ofprofessional roles - Theories about right action – Self-interest –Customs and Religion – Uses of Ethical Theories

UNITIII ENGINEERINGASSOCIALEXPERIMENTATION 9

EngineeringasExperimentation–EngineersasresponsibleExperimenters–Codes ofEthics – A Balanced Outlook on Law.

UNITIVSAFETY, RESPONSIBILITIES ANDRIGHTS 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and ReducingRisk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts ofInterest – Occupational Crime – Professional Rights – Employee Rights – IntellectualProperty Rights (IPR) – Discrimination.

UNITV GLOBALISSUES 8

Multinational Corporations – Environmental Ethics – Computer Ethics – WeaponsDevelopment – Engineers as Managers – Consulting Engineers – Engineers as ExpertWitnesses and Advisors – Moral Leadership –Code of Conduct – Corporate SocialResponsibility

TOTAL:45PERIODS

OUTCOMES:

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society

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TEXTBOOKS:

1. Mike W. Martinand Roland Schinzinger, “EthicsinEngineering”, TataMc Graw Hill, New Delhi, 2003.
2. GovindarajanM,NatarajanS,SenthilKumar V.S,“EngineeringEthics”,Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1.CharlesB.Fleddermann,“EngineeringEthics”,PearsonPrenticeHall,New Jersey, 2004.

3. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, “Engineering Ethics – Concepts and Cases”, Cengage Learning, 2009
4. JohnR Boatright, “Ethicsand the Conduct ofBusiness”, PearsonEducation, New Delhi, 2003
5. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2001
6. Laura P. Hartman and Joe Desjardins, “Business Ethics: Decision Making for Personal Integrity and Social Responsibility” Mc Graw Hill education, India Pvt. Ltd.,New Delhi 2013.
7. World Community Service Centre, “Value Education”, Vethathiri publications, Erode, 2011

Web sources:

www.onlineethics.orgwww.nspe.or
gwww.globalethics.orgwww.ethics.
org

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE-III

22152E64BP **SEMESTERVI**

SATELLITECOMMUNICATION **4004**

AIM

Toenablethestudenttobecomefamiliarwithsatellitesandsatelliteservices.

OBJECTIVES

- Overviewofsatellitesystemsinrelationtootherterrestrialsystems.
- Studyofsatellite orbits andlaunching.
- Studyofearthsegmentand space segmentcomponents
- Studyofsatellite access byvarious users.
- StudyofDTHandcompressionstandards.

UNITI: ELEMENTSOFORBITAL MECHANICS **9**

Equationofmotion–Orbitalelements–Orbitalperturbation–Trackingandorbitdetermination – orbit control.

SatelliteLaunchsystems:FundamentalsofRocketpropulsion–Multistagerockets–Huffman transfer orbit circularization

UNITII:ELEMETSOFCOMMUNICATIONSATELLITEDESIGN **9**

Space environment – Spacecraft configuration – Spacecraft subsystems – Payload – Reliability consideration – Spacecraft integration – Testing facilities – Spacecraftoperations.

UNIT–III: SATELLITECOMMUNICATION SYSTEMS **9**

Typesofsystems–FSS,BSS-Noiseinterference,intermodulation–CDMA-Packetsatellite networks – The INSAT system -The INTELSAT/INMARSAT system.

UNIT–IV:EARTHSTATIONDESIGN **9**

Earthstationconfigurationoption – Site selection – Antenna systems – Tracking systems– Receiver subsystems – Low noise amplifiers – Down converters – Transmittersubsystems – Up converters- High power amplifiers- Terminal equipment .

UNIT-V: PERFORMANCE MEASUREMENTS **9**

Spacecraftcheckout–Groundstationmeasurements–Systemcoordinationandcontrol .Elements of Frequency coordination andmanagement: The ITU/IFRB requirements– Satellite system characterization – Ground system characteristics .

TOTAL:45

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

Textbook:

1.B.N.AGARWAL:DeignofGeosynchronousspacecraft,PrenticeHall

ReferenceBooks:

1. R.F.FILIPOWASKYand E.K.MUCHIDORF:SpacecommunicationSystems Mcgraw Hill
2. DENNISRODDY–Satellite communication
3. K.MIYA:Satellitecommunicationtechnology– Latticeand company

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

ELECTIVE-III

22152E64CP **SEMESTERVI**

ROBOTICSAND AUTOMATION **4004**

AIM

Robots are slowly and steadily replacing human beings in many fields. The aim of this course is to introduce the students into this area so that they could use the same whenthey enter the industries.

OBJECTIVES

- Tostudythevarious partsofrobotsandfields ofrobotics.
- Tostudythevariouskinematicsandinversekinematicsofrobots.
- TostudytheEuler,LagrangianformulationofRobotdynamics.
- To studythe trajectoryplanningforrobot.
- Tostudythe controlofrobotsforsome specific applications.

UNITI BASICCONCEPTS 9

Definitionandoriginofrobotics–differenttypesofrobotics–variousgenerationsof robots–degreesoffreedom–Asimov‟slawsofrobotics–dynamicstabilizationofrobots.

UNITII POWERSOURCESANDSENSORS 9

Hydraulic, pneumatic and electric drives – determination of HP of motor and gearingratio – variable speed arrangements – path determination – micro machines in robotics – machine vision – ranging – laser – acoustic – magnetic, fiber optic and tactile sensors.

UNITIIIMANIPULATORS,ACTUATORS AND GRIPPERS 9

Construction of manipulators – manipulator dynamics and force control – electronic andpneumatic manipulator control circuits – end effectors – U various types of grippers – design considerations.

UNITIVKINEMATICS AND PATHPLANNING 9

Solution of inverse kinematics problem – multiple solution jacobian work envelop – hillClimbing Techniques – robot programming languages

UNITV CASESTUDIES 9

Mutiplerobots– machineinterface–robotsin manufacturingandnon-manufacturingapplications – robot cell design – selection of robot.

Total:45

TEXTBOOKS:

1. Mikell P. Weiss G.M., NagelR.N., OdrajN.G., “Industrial Robotics”, Mc Graw-Hill Singapore, 1996.
2. Ghosh,ControlinRoboticsandAutomation:SensorBasedIntegration, Allied Publishers, Chennai, 1998.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

REFERENCES:

1. Deb.S.R.,“RoboticsTechnologyandflexibleAutomation”,JohnWiley,USA 1992.
2. 2.Klafter R.D., ChimielewskiT.A., Negin M., “Robotic Engineering – An integrated approach”, Prentice Hall of India, New Delhi, 1994.
3. McKerrowP.J.“IntroductiontoRobotics”,AddisonWesley,USA, 1991.
4. IssacAsimov“Robot”, BallantineBooks, NewYork, 1986.
5. Barry Leatham - Jones,"Elements of industrial Robotics" PITMAN Publishing, 1987.
6. Mikell P.Groover, Mitchell Weiss, Roger N.Nagel Nicholas G.Odrey, "Industrial Robotics Technology, Programming and Applications ", McGraw Hill Book Company 1986.
7. Fu K.S. Gonzaleaz R.C. and Lee C.S.G., "Robotics Control Sensing, Vision and Intelligence" McGraw Hill International Editions, 1987.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE-III

22152E64DP **SEMESTERVI**

REMOTE SENSING **4004**

AIM:

Tounderstandthebasicsforremotesensing.

OBJECTIVES:

- Introduce the principles of remote sensing and fundamental knowledge on the physics of remote sensing, aerial photographic techniques, photogrammetry, multispectral, hyperspectral and thermal imaging, and RADAR and LIDAR image analysis.
- Thenewesttechnologyinthefieldwillalsobe discussed.
- The course will be taught with an emphasis on the geographical applications of remotesensing;however, incertain instancesother disciplineswillbe introducedas well.

UNITI: REMOTESENSING 9

Definition – Components of Remote Sensing -Energy, Sensor, Interacting Body –Active and Passive Remote Sensing – Platforms – Aerial and Space Platforms –Balloons, Helicopters, Aircraft and Satellites – Synoptivity and Repetivity – ElectroMagnetic Radiation (EMR) – EMR spectrum – Visible, Infra Red (IR), Near IR, MiddleIR, Thermal IR and Microwave – Black Body Radiation – Planck's law – Stefan-Boltzman law.

UNITII: EMRINTERACTIONWITHATMOSPHEREAND EARTH MATERIALS 9

Atmospheric characteristics – Scattering of EMR – Raleigh, Mie, Non-selective andRaman Scattering – EMR Interaction with Water vapour and ozone – AtmosphericWindows – Significance ofAtmospheric windows – EMR interaction with Earth SurfaceMaterial– Radiance, Irradiance, Incident, Reflected, AbsorbedandTransmittedEnergy –Reflectance – Specular and Diffuse Reflection Surfaces – Spectral Signature – SpectralSignature curves – EMR interaction with water, soil and Earth Surface: Imagingspectrometry and spectral characteristics.

UNIT– III:OPTICALAND MICROWAVEREMOTESENSING 9

Satellites – Classification – Based onOrbits and purpose –Satellite Sensors – Resolution– Description of Multi Spectral Scanning – Along and Across Track Scanners – DescriptionofSensorsinLandsat,SPOT,IRSseries–CurrentSatellites–Radar

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

Speckle – Back Scattering – Side Looking Airbome Radar – Synthetic Aperture Radar – Radiometer – Geometrical characteristics ; Sonar remote sensing systems.

UNIT– IV: GEOGRAPHICINFORMATIONSYSTEM 9

GIS – Components of GIS – Hardware, Software and Organisational Context – Data – Spatial and Non-Spatial – Maps – Types of Maps – Projection – Types of Projection – Data Input – Digitizer, Scanner – Editing – Raster and Vector data structures – Comparition of Raster and Vector data structure – Analysis using Raster and Vector data–Retrieval, Reclassification, Overlaying, Buffering – Data Output – Printers and Plotters.

UNIT-V: MISCELLANEOUSTOPICS 9

Visual Interpretation of Satellite Images – Elements of Interpretation – InterpretationKeys Characteristics of Digital Satellite Image –Image enhancement – Filtering –Classification– IntegrationofGIS and Remote Sensing – ApplicationofRemote Sensingand GIS – UrbanApplications – IntegrationofGIS and RemoteSensing – ApplicationofRemote Sensing and GIS – Water resources – Urban Analysis – Watershed Management– Resources Information Systems.Global positioning system – an introduction.

TOTAL:45PERIODS

TEXTBOOK:

1. M.G. Srinivas(EditedBy),RemoteSensingApplications,NarosaPublishingHouse, 2001. (Units 1& 2).
2. AnjiReddy,RemoteSensingandGeographicalInformationSystems,BS Publications, 2001 (Units 3, 4, & 5).

REFERENCEBOOKS:

1. Jensen,J.R.,RemoteSensingoftheenvironment,PrenticeHall, 2000.
2. Kang-TsungChang,“IntroductiontoGeographicInformationSystems”,TMH, 2002.
3. Lillesand T.M. and Kiefer R.W., “Remote Sensing and Image Interpretation”, John Wiley and Sons, Inc, New York, 1987.
4. BurroughPA, “PriciplesofGISfor landresourceassessment”,Oxford.
5. Mischael Hord, “Remote Sensing and Methods and Applications” , John Wiley & Sons, New York, 1986.
6. Signal,“RemoteSensing”,TataMcGraw-Hill,NewDelhi,1990.
7. Floyd F. Sabins, RemoteSensing, “Priciples and interpretation”, WHFreemanand Company 1996.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE-III

22150E64EP **SEMESTERVI**

NETWORKSECURITY **4004**

AIM

To understand the principles of encryption algorithms; conventional and public keycryptography. To have a detailed knowledge about authentication, hash functions and application level security mechanisms.

OBJECTIVES

- Toknowthe methodsofconventionalencryption.
- Tounderstandthe conceptsofpublic keyencryptionandnumbertheory
- Tounderstand authenticationandHashfunctions
- Toknowthenetwork securitytoolsand applications.
- Tounderstandthesystemlevelsecurityused.

UNITI: SYMMETRICCIPHERS 9

Overview–Classicalencryptiontechniques –Blockciphers anddataencryptionstandard–Finite fields – Advanced encryption standard – Contemporary symmetric ciphers – Confidentiality using symmetric encryption.

UNITII:PUBLIC-KEYENCRYPTION AND HASH FUNCTIONS9

Number theory – Public-key cryptography and RSA – Keym – Diffie-hellman keyexchange – Elliptic curve cryptography – Message authentication and hash functions –Hash algorithms – Digital signatures and authentication protocols.

UNITIII: NETWORKSECURITYPRACTICE 9

Authentication applications – Kerberos-X.509 authentication service – Electronic mailsecurity – Pretty good privacy – S/MIME – IP security – IP security architecture – Authentication header – Encapsulating security payload – Key management.

UNITIV: SYSTEMSECURITY 9

Intruders–Intrusiondetection–Passwordmanagement –Malicioussoftware–Firewalls–Firewall design principles – Trusted systems.

UNITV: WIRELESSSECURITY 9

WirelessLANsecuritystandards –WirelessLANsecurityfactorsandissues.

Total:45

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

TEXT BOOK

1. WilliamStallings, “CryptographyandNetworkSecurity–PrinciplesandPractices”, 3rd Edition, Pearson Education, 2003.

REFERENCES

1. AtulKahate,“Cryptographyand NetworkSecurity”,2ndEdition,TMH,2007.
2. Bruce Schneier,“Applied Cryptography”,2nd Edition,John Wiley and SonsInc, 2001.
3. StewartS.Miller,“Wi-FiSecurity”,TMH,2003.
4. CharlesB.PfleegerandShariLawrencePfleeger,“SecurityinComputing”,3rd Edition,PearsonEducation, 2003.

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

22160S71P **SEMESTERVII**

TOTALQUALITYMANAGEMENT **3003**

OBJECTIVE

- TounderstandtheTotalQualityManagementconceptandprinciplesandthevarious tools available to achieve Total Quality Management.
- Tounderstandthestatisticalapproachforqualitycontrol.
- To create an awareness about the ISO and QS certification process and its need for the industries.

1. INTRODUCTION 9

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - AnalysisTechniques for Quality Costs, Basic concepts of Total Quality Management, HistoricalReview, Principles of TQM, Leadership – Concepts, Role of Senior Management,Quality Council, QualityStatements, Strategic Planning, Deming Philosophy, Barriers toTQM Implementation.

2. TQMPRINCIPLES 9

Customer satisfaction – Customer Perception of Quality, Customer Complaints, ServiceQuality, Customer Retention, Employee Involvement – Motivation, Empowerment,Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous ProcessImprovement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership –Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development,Performance Measures – Basic Concepts, Strategy, Performance Measure.

3. STATISTICALPROCESSCONTROL(SPC) 9

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency andDispersion, Population and Sample, Normal Curve, Control Charts for variables andattributes, Process capability, Concept of six sigma, New seven Management tools.

4. TQMTOOLS 9

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality FunctionDeployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality LossFunction, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA– Stages of FMEA.

5. QUALITYSYSTEMS 9

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, TS16949, ISO 14000 – Concept, Requirements and Benefits.

TOTAL:45

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

TEXT BOOK

1. DaleH.Besterfiled,etal.,TotalQualityManagement,PearsonEducation,Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6.

REFERENCES

1. JamesR.Evans&William M.Lidsay,TheManagementandControlofQuality,(5th Edition),South-Western(ThomsonLearning),2002(ISBN0-324-06680-5).
2. Feigenbaum.A.V.“TotalQualityManagement, McGraw-Hill,1991.
3. Oakland.J.S.“Total Quality ManagementButterworth– Hcinemann Ltd.,Oxford. 1989.
4. NarayanaV.andSreenivasan,N.S.QualityManagement–ConceptsandTasks, New Age International 1996.
5. Zeiri. “TotalQualityManagementforEngineersWoodHeadPublishers,1991

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

22152C72P **SEMESTERVII**

WIRELESSNETWORKS 3104

OBJECTIVES

- Tostudyabout Wirelessnetworks,protocolstackand standards.
- Tostudyaboutfundamentalsof3GServices,itsprotocolsand applications.
- Tostudyaboutevolutionof4GNetworks,itsarchitectureandapplications.

UNITI WIRELESSLAN 9

Introduction-WLAN technologies: Infrared, UHF narrowband, spread spectrum - IEEE802.11: System architecture, protocol architecture, physical layer, MAC layer,802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture,Radio Layer, Baseband layer, Link manager Protocol, security - IEEE802.16-WIMAX:Physical layer, MAC, Spectrum allocation for WIMAX

UNITII MOBILENETWORKLAYER 9

Introduction - Mobile IP: IP packet delivery, Agent discovery, tunneling andencapsulation, IPV6-Network layer inthe internet-Mobile IP session initiationprotocol-mobile ad-hoc network: Routing, Destination Sequence distance vector, Dynamic sourcerouting

UNITIII MOBILETRANSPORTLAYER 9

TCP enhancements for wireless protocols - Traditional TCP: Congestion control, fastretransmit/fast recovery, Implicationsofmobility- ClassicalTCP improvements:IndirectTCP, Snooping TCP, Mobile TCP, Time out freezing, Selective retransmission,Transaction oriented TCP - TCP over 3G wireless networks.

UNITIV WIRELESSWIDEAREANETWORK 9

Overview ofUTMS TerrestrialRadio access network-UMTS Core network Architecture:3G-MSC,3G-SGSN,3G-GGSN,SMS-GMSC/SMS-IWMSC,Firewall,DNS/DHCP-HighspeedDownlinkpacketaccess (HSDPA)-LTE networkarchitectureandprotocol.

UNITV 4GNETWORKS 9

Introduction – 4G vision – 4G features and challenges - Applications of 4G – 4GTechnologies: Multicarrier Modulation, Smart antenna techniques, OFDM-MIMOsystems, Adaptive Modulation and coding with time slot scheduler, Cognitive Radio.

TOTAL:45

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

TEXTBOOKS:

1. Jochen Schiller,"Mobile Communications",Second Edition,Pearson Education 2012.(Unit I,II,III)
2. VijayGarg , "Wireless Communications and networking", First Edition, Elsevier 2007.(Unit IV,V)

REFERENCES:

1. ErikDahlman,StefanParkvall,JohanSkoldandPerBeming,"3GEvolution HSPA and LTE for Mobile Broadband", Second Edition, Academic Press, 2008.
2. AnuragKumar,D.Manjunath,Joykuri,"WirelessNetworking",FirstEdition, Elsevier 2011.
3. Simon Haykin , Michael Moher, David Koilpillai, "Modern Wireless Communications", First Edition, Pearson Education 2013

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

22152C73P **SEMESTERVII**

TELECOMMUNICATIONSWITCHINGAND NETWORKS

4004

AIM

- To introduce fundamentals functions of a telecom switching office, namely, digital multiplexing, digital switching and digital subscriber access.
- Tointroduceamathematicalmodelfortheanalysisoftelecommunicationtraffic.

OBJECTIVES

- Tointroducethe conceptsofFrequencyandTimedivisionmultiplexing.
- TointroducedigitalmultiplexinganddigitalhierarchynamelySONET/SDH
- Tointroducetheconceptsofspaceswitching,timeswitchingandcombination switching, example of a switch namely No.4 ESS Toll switch.
- Tointroducetheneedfornetworksynchronizationandstudysynchronizationissues. To outline network control and management issues.
- Tostudytheenhancedlocalloopsystemsindigitalenvironment.Tointroduce ISDN, DSL / ADSL, and fiber optic systems in subscriber loop.
- Tointroducestatisticalmodelingoftelephonetraffic.Tostudyblockingsystem characteristics and queuing system characteristics.
- Tocharacterize blockingprobabilityholdingservicetimedistributionsfor inspeech and data networks.

UNITI EVOLUTIONOFTELECOMMUNICATION SWITCHINGAND CIRCUITS 9

Evolution of Public Switched Telecommunication Networks Strowger exchange,Crossbar exchange,– Basic Tele communicationequipments – Telephone handset, , Echosuppressors and cancellors, PCM coders, Modems and Relays.

UNITII ELECTRONICSWITCHING 9

CircuitSwitching,Messageswitching,Centralizedstoredprogrammeswitching,Timeswitching, Space switching – Digital switching system hardware configuration,

UNITIIITELECOMMUNICATIONSIGNALLINGANDTRAFFIC9

Channel associated signaling, Common channel signaling, SS7 signaling protocol, SS7protocol architecture, Grade of service, Modeling switching systems, Blocking modelsand Delay systems.

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UNITIV INTEGRATEDDIGITALNETWORKS 9

Subscriber loop characteristics, Local access wire line and wire less PCM / TDM carrierstandards transmission line codes, Synchronous, Asynchronous, SONET / SDH,Integrated DigitalNetwork(IDN)environment –PrinciplesofIntegrated ServicesDigitalNetwork (ISDN)

UNITV DATANET WORKS 9

DatatransmissioninPSTN – ConnectionorientedandConnectionlessprotocols – packetswitching – ISO-OSIarchitecture-Satellitebaseddatanetworks –LAN, WAN – standards– TCP / IP – Internet

TOTAL:45

TEXTBOOKS:

1. Viswanathan. T, “TelecommunicationSwitchingSystemandNetworks”, Prentice Hall of India Ltd., 1994.
2. BehrouzForouzan,“IntroductiontoDataCommunicationandNetworking”,McGraw-Hill, 1998.

REFERENCES

1. L.S.Lawton,“Integrated Digital Networks,Galgotta Publication Pvt.,Ltd.,New Delhi,1996.
2. SyedR. Ali,“DigitalSwitchingSystems”, McGraw-HillInc., NewYork,1998.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE–IV

22152E74AP **SEMESTERVII**

POWERELECTRONICS **3003**

AIM

ApplicationofElectronicknowledgeinindustryforrectificationofpolyphasesupply voltage and for control of motor speed and for thermal heating.

OBJECTIVES

- Tostudyaboutpowerelectroniccircuitsforvoltageandcurrentcontroland protection.
- To learn the switching characteristics of transistors and SCRs. Series and parallel functions of SCRs, Programmable triggering methods of SCR.
- TolearncontrolledrectificationACsupplies.
- Tostudyofconverters andinverters.
- Tolearnaboutmotorcontrol,charges,SMPSandUPS.

UNITI POWERSEMICONDUCTORDEVICES 9

Powertransistors,Thyristors,PowerTRIAC,MOSFET,IGBT,GTOcharacteristics,rating, Protection circuits.

UNITII POWERSUPPLIES 9

Single Phase and Three Phase Controlled rectifiers, DesignofTrigger circuits, Switchingmode regulators – Boost, Buck, Buck-Boost and Cuk regulators, AC voltage regulator.

UNITIII INVERTERS 9

Voltageandcurrentsourceinverters,Resonant,Series inverter,PWM inverter.

UNITIV CHOPPERS 9

TypeA, B,CandDchoppers,Pulsewidthmodulation-Gating requirements.

UNITV MOTORCONTROL&Applications 9

Single Phase DC series motor drives, Inductionand Synchronous motor drives, Switchedreluctance motor Drive, SMPS and UPS

TOTAL:45

TEXTBOOK:

1. M.D.Singh,K.B.Khanchandani,"PowerElectronics",TataMcGraw-Hill,1998.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

REFERENCES:

1. Ned Mohan, Tore M.Undeland, William P.Robbins, “Power Electronics, Converters, Applications and Design”, John Wiley & Sons, 1994.
2. MuhamedH.Roshid,“PowerElectronicsCircuits,Devicesand Application”,Prentice Hall of India, 1995.
3. B.K.Bose,“ModernPowerElectronics”,Jaico PublishingHouse,1999.
4. Sen,PowerElectronics”,TataMcGraw-Hill,1987

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

ELECTIVE–IV

22152E74BP **SEMESTERVII**

ADVANCEDMICROPROCESSORSANDMICROCONTROLLERS

3003

OBJECTIVES

- Toexposethestudentstothe fundamentalsofmicroprocessor architecture.
- Tointroducetheadvancedfeaturesinmicroprocessorsandmicrocontrollers.
- Toenablethestudentstounderstandvariousmicrocontrollerarchitectures.

UNITI HIGHPERFORMANCECISCARCHITECTURE–PENTIUM9

CPUArchitecture-Bus Operations–Pipelining–Brachpredication–floatingpointunit-Operating Modes –Paging – Multitasking – Exception and Interrupts – Instruction set – addressing modes – Programming the Pentium processor.

UNITIIHIGH PERFORMANCERISC ARCHITECTURE–ARM9

Arcon RISC Machine – Architectural Inheritance – Core & Architectures - Registers – Pipeline - Interrupts – ARM organization - ARM processor family – Co-processors - ARM instruction set- Thumb Instruction set - Instruction cycle timings - The ARMProgrammer‟s model – ARM Development tools – ARM Assembly LanguageProgramming - C programming – Optimizing ARM Assembly Code – OptimizedPrimitives.

UNITIIIARMAPPLICATIONDEVELOPMENT 9

Introduction to DSP on ARM –FIR filter – IIR filter – Discrete fourier transform – Exception handling – Interrupts – Interrupt handling schemes- Firmware and bootloader–Embedded Operating systems – Integrated Development Environment- STDIOLibraries – Peripheral Interface – Application of ARM Processor - Caches – Memoryprotection Units – Memory Management units – Future ARM Technologies.

UNITIV MOTOROLA 68HC11MICROCONTROLLERS 9

Instructionsetaddressingmodes–operatingmodes-Interruptsystem-RTC-SerialCommunication Interface – A/D Converter PWM and UART.

UNITV PICMICROCONTROLLER 9

CPU Architecture – Instruction set– interrupts- Timers- I2C Interfacing–UART-A/DConverter –PWM and introduction to C-Compilers.

TOTAL:45

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TEXTBOOK:

1. Andrew N.Sloss, Dominic Symes and Chris Wright " ARM System Developer's Guide : Designing and Optimizing System Software" , First edition, Morgan Kaufmann Publishers, 2004.

REFERENCES:

1. SteveFurber, "ARMSystem–On–Chiparchitecture",AddisionWesley, 2000.
2. DanielTabak,"AdvancedMicroprocessors", McGrawHill.Inc., 1995
3. JamesL. Antonakos,"ThePentiumMicroprocessor",PearsonEducation, 1997.
4. Gene.H.Miller,"MicroComputerEngineering", PearsonEducation, 2003.
5. John.B.Peatman, "DesignwithPICMicrocontroller", PrenticeHall,1997.
6. JamesL.Antonakos,"AnIntroductiontotheIntelfamilyofMicroprocessors", Pearson Education, 1999.
7. Barry.B.Brey,"The Intel Microprocessors Architecture, Programming and Interfacing", PHI,2002.
8. Valvano,"EmbeddedMicrocomputerSystems",ThomsonAsiaPVTLTDfirst reprint 2001. Readings: Web links www.ocw.nit.eduwww.arm.com

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

ELECTIVE–IV

22152E74CP **SEMESTERVII**

ELECTROMAGNETICINTERFERENCEANDCOMPATIBILITY

3003

AIM

To understand different electromagnetic Interference problems occurring in Intersystem and in inter system and their possible mitigation techniques in Electronic design

OBJECTIVES

- To understand EMI Sources,EMI problems andtheir solution methodsin PCB level / Subsystem and system level design.
- To measure the emission.immunity level from different systems to couple with the prescribed EMC standards

UNITI BASICCONCEPTS 9

Definition of EMI and EMC with examples – Classification of EMI/EMC – CE – RE – CS – RS – Unitsofparameters – SourcesofEMI –EMI coupling modes – CMand DM–ESD phenomena and effects – Transient phenomena and suppression.

UNITII EMIMEASUREMENTS 9

Basic principles of RE, CE, RS and CS measurements – EMI measuring instruments – Antennas – LISN – Feed through capacitor – Current probe – EMC analyzer anddetection technique open area site – Shielded anechoic chamber – TEM cell.

UNITIII EMCSTANDARDAND REGULATIONS 8

National and intentional standardizing organizations – FCC – CISPR – ANSI – DOD – IEC – CENEEC – FCC – CE and RE standards – CISPR – CE and RE standards – IEC/EN – CS standards – Frequency assignment – Spectrum conversion.

UNITIV EMICONTROLMETHODS ANDFIXES 10

Shielding–Grounding–Bonding–Filtering–EMIgasket–Isolationtransformer–Opto-isolator.

UNITV EMCDESIGNANDINTERCONNECTION TECHNIQUES 9

Cableroutingandconnection–Componentselectionandmounting–PCBdesign–Trace routing – Impedance control – Decoupling – Zoning and grounding

TOTAL:45

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

TEXTBOOKS

1. Prasad Kodali V., “Engineering Electromagnetic Compatibility”, S. Chand and Co, 2000.
2. ClaytonR.Paul,“IntroductiontoElectromagneticCompatibility”,Wileyand Sons, 1992.

REFERENCES

1. Keiser, “Principles of Electromagnetic Compatibility”, 3rd Edition, Artech House, 1994.
2. DonwhiteConsultantIncorporate,“Handbook OfEMI/EMC”,VolI,1985

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE–IV

22152E74DP **SEMESTERVII**

SOLIDSTATEELECTRONICDRIVES **3003**

AIM

To have fundamentalknowledge about structure of devices, VI characteristics of devices like PN Junction diode, Zener diode, MOSFET, BJT and Opto electronic.

OBJECTIVES:

- Tolearncrystalstructuresofelementsusedforfabricationofsemiconductordevices.
- Tostudyenergybandstructureofsemiconductordevices.
- To understand fermi levels, movement ofcharge carriers, Diffusion current and Drift current.
- To study behavior of semiconductor junction under different biasing conditions. Fabrication of different semiconductor devices, Varactor diode, Zener diode, Schottky diode, BJT, MOSFET, etc.
- To study the VI Characteristics of devices and their limitations in factors like current, power frequency.
- Tolearnphotoelectriceffectandfabricationofoptoelectronic devices.

UNITI:CRYYSTALPROPERTIES ANDGROWTH SEMICONDUCTORS9

Semiconductormaterials –periodicStructures –CrystalLattices–Cubic lattices–Planesand Directions – Diamond lattice – Bulk Crystal Growth – Starting Material – Growth ofSingle Crystal Ingots – Wafers – Doping – Epitaxial Growth – Lattice Matching inEpitaxial Growth – Vapor – Phase Epitaxy – Atoms and Electronics – Introduction toPhysical Models – Experimental Observations – Photoelectric Effect – Atomic spectra –Bhr model – Quantum Mechanics – Probability and Uncertainty Principle – SchrodingerWave Equation – Potential Well Equation – Potential well Problem – Tunneling.

UNITII: ENERGYBANDSANDCHARGECARRIERSINSEMICONDUCTORS AND JUNCTIONS 9

Energybands inSolids, EnergyBands inMetals, Semiconductors,andInsulators –Directand Indirect Semiconductors – Variation of Energy Bands with Alloy Composition -Charge Carriers in Semiconductors – Electrons and Holes – Electrons and holes inQuantum Wells – Carrier Concentrations –Femi Level – Electron and HoleConcentrations at Equilibrium – Temperature Dependence of Carrier Concentrations –Compensation and Space Charge Neutrality – Drift of Carrier in Electric and MagneticFields conductivity and Mobility – Drift and Resistance – Effects of Temperature andDoping on Mobility – High Field effects – Hall Effect – invariance of Fermi level atequilibrium – Fabrication of p-n junctions, Metal semiconductor junctions.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

UNITIII: METALOXIDESEMICONDUCTOR FET 9

GaAS MESFET – High Electron Mobility Transistor – Short channel Effects – MetalInsulator Semiconductor FET – Basic Operation and Fabrication – Effects of RealSurfaces – Threshold Voltage – MOS capacitance Measurements – Current – VoltageCharacteristics of MOS Gate Oxides – MOS Field Effect Transistor – OutputCharacteristics – Transfer characteristics - Short Channel MOSFET V-I characteristics –Control of Threshold Voltage – Substrate Bias Effects -Sub threshold characteristics –Equivalent Circuit for MOSFET –MOSFET Scaling and Hot Electron Effects – Drain –InducedBarrierLowering –short channelandNarrowwidthEffect – GateInducedDrainLeakage.

UNITIV: OPTOELECTRONDEVICES 9

Photodiodes – Current and Voltage in illuminated Junction – Solar Cells – Photodetectors – Noise and Bandwidth of Photo detectors – Light Emitting Diodes – LightEmitting Material – Fiber Optic Communication Multilayer Heterojunctions for LEDS –Lasers – Semiconductor lasers – Population Inversion at a Junction Emission Spectra forp-n junction – Basic Semiconductor laser – Materials for Semiconductor laser.

UNITV HIGHFREQUENCYANDHIGHPOWER DEVICES 9

Tunnel Diode, IMPATT Diode, operation of TRAPATT and BARITT Diodes, GunnDiode – transferred – electron mechanism, formation and drift of space charge domains,p-n-p-n diode, Semiconductor Controlled Rectifier, Insulated Gate Bipolar Transistor.

TOTAL:45

TEXTBOOKS

1. Ben. G.Streetman & Sanjan Banerjee, Solid State Electronic Devices, 5th Edition, PHI, 2003.

REFERENCES

1. Donald A.Neaman,SemiconductorPhysicsandDevices,3rdEdition,TMH, 2002.
2. YannisTsividis,Operation & Modelineof MOSTransistor,2ndEdition,Oxford University Press, 1999.
3. NanditaDasGupta&aamitavaDasGupta,SemiconductorDevicesModeling Technology, PHI, 2004.
4. D.K.Bhattacharya&RajinishSharma,SolidStateElectronicDevices,Oxford University Press, 2007.

ELECTIVE–IV

22152E74EP **SEMESTERVII**

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

COMPUTERHARDWAREANDINTERFACING 3003

AIM

To enable the student to get a detailed knowledge of all the hardware components that make up a computer and to understand the different interfaces required for connecting these hardware devices.

OBJECTIVES

- TointroduceissuesrelatedtoCPUandmemory.
- To understand the componentsonthe motherboard
- Tounderstanddifferentstorage media
- TointroducethefeaturesofdifferentI/Operipheraldevicesandtheirinterfaces.

UNITI CPUANDMEMORY 9

CPU essentials – processor modes – modern CPU concepts – Architectural performancefeatures – the Intel's CPU – CPU over clocking – over clocking requirements – overclocking the system – over clocking the Intel processors – Essential memory concepts –memory organizations – memory packages – modules –memory.

UNITII MOTHERBOARDS 9

Pentium4 mother board -form factor – upgrading a mother board – chipsets – northbridge – south bridge –motherboard BIOS – POST – BIOS features – BIOS and Bootsequences – BIOS shortcomings and compatibility issues – power supplies and powermanagement – concepts of switching regulation – potential power problems – powermanagement.

UNITIII STORAGE DEVICES 9

The floppy drive – magnetic storage – magnetic recording principles – data and diskorganization – floppy drive – hard drive – data organization and hard drive – sectorlayout –CDROM electronics – DVD-ROM – DVD media – DVD drive and decoder.

UNITIV I/OPERIPHERALS 9

Parallel port – signals and timing diagram – IEEE1284 modes – asynchronouscommunication- serialport signals – video adapters – graphic accelerators – 3D graphicsaccelerator issues

UNITV BUSARCHITECTURE 9

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

Buses – Industrystandard architecture (ISA), peripheral component Interconnect (PCI) – Accelerated Graphics port (AGP) – plug-and-play devices – SCSI concepts – USBarchitecture.

TOTAL:45

TEXT BOOK

1. StephenJ.Bigelow,"TroubleShooting,maintainingandRepairingPCs",TataMcGraw-Hill, New Delhi, 2001.

REFERENCES

1. CraigZacker&JohnRourke,"Thecompletereference:PChardware",Tata McGraw-Hill, New Delhi, 2001.
2. Mike Meyers, "Introductionto PCHardware andTrouble shooting", Tata McGraw-Hill, New Delhi, 2003.
3. B.Govindarajulu, "IBM PC and Clones hardware trouble shooting and maintenance", Tata McGraw-Hill, New Delhi, 2002.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

PRIST DEEMED TO BE UNIVERSITY
NAAC ACCREDITED
THANJAVUR – 613 403 - TAMILNADU

DEPARTMENTOFELECTRONICSAND COMMUNICATION

PROGRAMMEHANDBOOK

M.TECH.–COMMUNICATIONSYSTEMS

FULLTIMEPROGRAMME
Regulation2022

(ForcandidatesadmittedtoM.TechManufacturingTechnologyProgrammefromJune2022onwards)

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENTOFELECTRONICS&COMMUNICATIONENGINEERING

M.TECH.COMMUNICATIONSYSTEMS-FULLTIME-R-2022 SEMESTER I

– IV CURRICULUM

SEMESTERI

S.N	SUBCODE	SUBJECT	L	T	P	C
Theory						
1	**22248S11B**	**AppliedMathematicsforElectronicsEngineering**	3	1	0	4
2	22271C12	AdvancedDigitalSignalProcessing	3	1	0	4
3	22271C13	AdvancedDigitalCommunicationTechniques	3	1	0	4
4	22271C14	OpticalNetworks	4	0	0	4
5	22271C15	AdvancedRadiationSystems	4	0	0	4
6	22271E16_	Elective-I	3	0	0	3
Practical						
7	22271L17	CommunicationSystemsLab– I	0	0	3	3
		Total	20	3	3	26

SEMESTERII

S.N	SUBCODE	SUBJECT	L	T	P	C
Theory						
1	22271C21	MobileCommunicationNetworks	4	0	0	4
2	22271C22	AdvancedMicrowaveSystems	4	0	0	4
3	22271C23	ElectromagneticInterferenceand Compatibility	4	0	0	4
4	22271E24_	Elective-II	3	0	0	3
5	22271E25_	Elective-III	3	0	0	3
Practical						
6	**22271L26**	**CommunicationSystemsLab–II**	0	0	3	3

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

7	222TECWR	TechnicalWriting/Seminars	0	0	3	3
		Total	18	0	6	24

SEMESTERIII

S.N	SUBCODE	SUBJECT	L	T	P	C
	Theory					
1	22271C31	WirelessSensor Networks	4	0	0	4
2	22271E32_	Elective–IV	3	0	0	3
3	22271E33_	Elective–V	3	0	0	3
4	22271E34_	Elective–VI	3	0	0	3
Project						
5	22271P35	ProjectPhase–I	0	0	10	10
		Total	13	0	10	23

SEMESTERIV

S.N	SUBCODE	SUBJECT	L	T	P	C
1	22271P41	ProjectPhase–II	0	0	15	15
		Total	0	0	15	15
		TOTALNO.OF CREDITS				88

LISTOFELECTIVES

Elective-I(SEMESTER–I)

S.N	SUBCODE	SUBJECT	L	T	P	C
1.	22271E16A	InternetworkingandMultimedia	3	0	0	3
2.	22271E16B	DigitalImageProcessing	3	0	0	3
3.	22271E16C	LASERCommunication	3	0	0	3

Elective-II(SEMESTER–II)

S.N	SUBCODE	SUBJECT	L	T	P	C
1.	22271E24A	HighSpeedSwitchingArchitecture	3	0	0	3
2.	22271E24B	DSPProcessorArchitectureand Programming	3	0	0	3
3.	22271E24C	DigitalSpeech Processing	3	0	0	3

Elective-III(SEMESTER–II)

S.N	SUBCODE	SUBJECT	L	T	P	C
1.	22271E25A	DigitalCommunicationReceivers	3	0	0	3
2.	22271E25B	SoftComputingTechniques	3	0	0	3
3.	22271E25C	CommunicationNetworkSecurity	3	0	0	3

Elective-IV(SEMESTER– III)

S.N	SUBCODE	SUBJECT	L	T	P	C
1.	22271E32A	SoftwareDefinedRadio	3	0	0	3
2.	22271E32B	SatelliteCommunication	3	0	0	3
3.	22271E32C	CDMASystems	3	0	0	3

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

Elective-V(SEMESTER –III)

S.N	SUBCODE	SUBJECT	L	T	P	C
1.	22271E33A	Waveletsand MultiResolution Processing	3	0	0	3
2.	22271E33B	HighPerformance Communication Networks	3	0	0	3
3.	22271E33C	AdvancedMicroprocessorsand Microcontrollers	3	0	0	3

Elective-VI(SEMESTER–III)

S.N	SUBCODE	SUBJECT	L	T	P	C
1.	22271E34A	SpaceTime WirelessCommunication	3	0	0	3
2.	22271E34B	MedicalImaging	3	0	0	3
3.	22271E34C	MobileADHOCNetworks	3	0	0	3

M.TECH.COMMUNICATIONSYSTEMS- FULLTIME-R-2022

CourseStructureandCredit Distribution

Sem.	**CoreCourses**						**Elective Courses**		**Foundation Courses**		**Total Credits**
	Theory Courses		**Practical Courses**		**Courseson *RSD**						
	Nos.	**Credits**	**Nos.**	**Credits**	**Nos.**	**Credits**	**Nos.**	**Credits**	**Nos.**	**Credits**	
I	04	16	01	03	-	-	01	03	01	04	26
II	03	12	02	06	-	-	02	06	-	-	24
III	01	04	01	10	-	-	03	09	-	-	23
IV	-	-	01	15	-	-	-	-	-	-	15
										TotalCredits	**88**

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

SEMESTERI

22248S11B APPLIEDMATHEMATICS FORELECTRONICSENGINEERING

LTPC 3 1 0 4

AIM:

Theprimaryaimofthiscourseistodemonstratevariousanalyticalskillsinapplied mathematics and extensive experience with the tactics of problem solving and logical thinkingapplicable in communication engineering.

OBJECTIVES:

The primary objective of this coursewill help the students to identify, formulate, abstract, and solve poblems using mathematical tools from a variety of mathematical areas, including fuzzy logic, matrix linear programming, probability, numerical solution of ordinary differential equations and queuing models.

UNITICALCULUS OFVARIATIONS 9

Functional – Euler's equation-Variational problems involving one unknown function-severalunknown functions-functional dependent on higher order derivatives-several independentvariables-isoperimetric problems.

UNITIIINTEGRALTRANSFORMSANDWAVE EQUATIONS 9

Fourier transformpairs, Properties – Fourier Sine and Cosine transforms, Convolution integrals,Evaluation of integrals using Fourier Transform.Discrete Fourier Transform - properties.Application of Fourier transform to wave equation.Z-transform-properties-inverse transform-solution to difference equation.

UNITIIILINEARPROGRAMMING 9

Simplexalgorithm-twophasemethod-duality-transportationandassignmentproblems-inventory-scheduling.

UNITIVRANDOMPROCESSANDQUEUINGTHEORY 9

Classification – auto correlation-cross correlation-ergodicity-power spectral density function-Poisson process.Single and multiple server Markovian queuing models- customer impatience-queuing applications.

UNITVTESTINGOF HYPOTHESIS 9

Sampling distributions-Testing of hypothesis of normal, t, chi square, F distributions for testingmean and variance- large sample test. Analysis of variance – one way classification.

Tutorial :15 **Total:60**

OUTCOMES:

Aftercompletingthiscourse,studentsshoulddemonstratecompetencyinthefollowing skills:

- Concepts on vector spaces, linear transformation, inner product spaces, eigenvalues and generalized eigenvectors.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

- Applyvarious methodsinlinearalgebratosolvesystemsoflinearequations.
- Could develop a fundamental understanding of linear programming models, able to develop a linear programming model from problem description, apply the simplex method for solving linear programming problems.
- Numericalsolutionofdifferentialequations bysingleandmultistepmethods.
- Computationofprobability,randomvariablesandtheirassociateddistributions, correlations and regression.
- Conceptualizetheprincipleofoptimalityandsub-optimization,formulationand computational procedure of dynamic programming.
- Exposingthebasiccharacteristicfeaturesof aqueuingsystemandacquiringskillsin analyzing queuing models.
- Usingdiscrete time Markovchainstomodelcomputer systems.

BOOKSFORREFERENCES:

1. Grewal.B.S."HigherEngineeringMathematics",KhannaPublications,2005.
2. Kapoor.J.N.&Saxena.H.C.,MathematicalStatistics,S.Chand&Co.,NewDelhi.
3. Taha.H.A. "OperationResearch–AnIntroduction",6thEdition,PHI,2297.
4. M.K.Venkataraman,"HigherMathematicsforEngineering&Science",National Publishing Company, 2000.
5. Kandasamy,"EngineeringMathematicsVolumeII,S.Chand&Co.
6. P.K.Guptha,D.S.Hira,OperationsResearch,S.Chand&Co.,2299
7. T.Veerarajan,Probability,StatisticsandRandomProcesses,TMH,2002

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

SEMESTERI

22271C12 STATISTICALSIGNALPROCESSING LT PC
31 04

AIM:

Thestudentcomprehendsmathematicaldescriptionandmodellingofdiscretetime random signals.

OBJECTIVES:

- Thestudentisconversantwithimportanttheoremsand algorithms.
- Thestudentlearnsrelevantfiguresofmeritsuchaspower,energy,biasand consistency.
- Thestudentisfamiliarwithestimation,predictionandfilteringconceptsandtechniques.

UNITI DISCRETERANDOMSIGNAL PROCESSING 9

Wide sense stationary process – Ergodic process – Mean – Variance - Auto-correlation and Auto-correlation matrix - Properties - Weiner Khitchine relation - Power spectral density – filtering random process, Spectral Factorization Theorem–Finite Data records,Simulation of uniformly distributed/Gaussian distributed white noise – Simulation of Sine wave mixed with Additive White GaussianNoise.

UNITII SPECTRUMESTIMATION 9

Bias and Consistency of estimators - Non-Parametric methods - Correlation method - Co-variance estimator - Performance analysis of estimators – Unbiased consistent estimators – Periodogramestimator - Barlett spectrum estimation - Welch estimation.

UNITIIILINEARESTIMATIONAND PREDICTION 9

Model based approach - AR, MA, ARMA Signal modeling - Parameter estimation using Yule-Walkermethod - Maximum likelihood criterion - Efficiency of estimator - Least mean squared error criterion –Wienerfilter-Discrete WienerHoffequations– Mean squareerror.

UNITIV ADAPTIVEFILTERS 9

Recursive estimators - Kalman filter - Linear prediction –Forward prediction andBackward prediction,Prediction error - Whitening filter, Inverse filter - Levinson recursion, Lattice realization, Levinsonrecursion algorithm for solving Toeplitz system of equations.

l equalization -
Adaptiveechocanceller-Adaptivenoisecancellation-RLSAdaptivefilters-Exponentially weighted RLS – Sliding window RLS - Simplified IIR LMS Adaptive filter.

Total:45Periods

OUTCOMES:

- Formulatetimedomainandfrequencydomaindescriptionof WideSenseStationaryprocessin

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

termsof matrixalgebra andrelatetolinearalgebra concepts.

- State Parseval's theorem, W-K theorem, principle of orthogonality, spectral factorization theorem, Widrow-HoffLMS algorithmandShannon'ssamplingtheorem, anddefinelinear prediction, linear estimation, sample auto-correlation, periodogram, bias and consistency.
- Explain various noise types, Yule-Walker algorithm, parametric and non-parametric methods, Wiener and Kalman filtering, LMS and RMS algorithms, Levinson Durbin algorithm, adaptive noise cancellation and adaptive echo cancellation, speed verses convergence issues, channel equalization, sampling rate change, subband coding and wavelet transform.
- Calculate mean, variance, auto-correlation and PSD for WSS stochastic processes, and derive prediction error criterion, Wiener-Hoff equations, Parseval'stheorem,W-K theorem and normal equations.
- Design AR, MA, ARMA models, Weiner filter, anti aliasing and anti imaging filters, and develop FIR adaptive filter and polyphase filter structures.
- Simulatespectralestimationalgorithmsandbasicmodelsoncomputingplatforms.

BOOKSFORREFERENCES:

1.JohnG.Proakis, DimitrisG. Manolakis, "DigitalSignalProcessing", PrenticeHallofIndia, NewDelhi,2005.

2.MonsonH.Hayes, "StatisticalDigitalSignalProcessingandModeling",JohnWileyandSons Inc.,New York, 2006.

3.P.P.Vaidyanathan,"MultirateSystemsandFilterBanks",PrenticeHall,2292.

4.SimonHaykin,"AdaptiveFilterTheory",PrenticeHall,EnglehoodCliffs, NJ2286.

5.S.Kay,"ModernspectrumEstimationtheoryandapplication",PrenticeHall,Englehood Cliffs, NJ2288.

6.SophonclesJ.Orfanidis,"OptimumSignalProcessing",McGraw-Hill,2000.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

SEMESTERI

22271C13 ADVANCEDDIGITALCOMMUNICATIONTECHNIQUES

LTPC
3104

AIM:

Tounderstandthebasicsofsignal-spaceanalysisanddigital transmission.

OBJECTIVES:

- Tounderstandthebasicsofsignal-spaceanalysisanddigitaltransmission.
- Tounderstandthecoherentandnoncoherentreceiversanditsimpactondifferentchannel characteristics.
- TounderstandthedifferentEqualizers
- Tounderstandthedifferentblockcodedandconvolutionalcodeddigitalcommunication
- TounderstandthebasicsofMulticarrierandMultiuser Communications.

UNITICOHERENTANDNON-COHERENTCOMMUNICATION 9

Coherent receivers – Optimum receivers in WGN – IQ modulation & demodulation – Noncoherent receivers in random phase channels; MFSK receivers – Rayleigh and Ricianchannels – Partially coherent receivers – DPSK; M-PSK; M-DPSK-BER Performance Analysis.Carrier SynchronizationBit synchronization.

–AdaptiveEqualizationalgorithms.

UNITIVCONVOLUTIONALCODEDDIGITALCOMMUNICATION 9

Representation of codes using Polynomial, State diagram, Tree diagram, and Trellis diagram – Decoding techniques using Maximum likelihood, Viterbi algorithm, Sequential and Thresholdmethods – Error probability performance for BPSK and Viterbi algorithm, Turbo Coding.

UNITVMULTICARRIERANDMULTIUSERCOMMUNICATIONS 9

M),

Total:45Periods

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

OUTCOMES:

UponCompletionofthecourse, thestudentswillbeableto:

- Developthe ability to understand the conceptsofsignal space analysisforcoherent and non- coherent receivers.
- ConceptuallyappreciatedifferentEqualizationtechniques
- Possessknowledgeondifferentblockcodesandconvolutionalcodes.
- ComprehendthegenerationofOFDMsignalsandthetechniquesof multiuser detection.

BOOKSFORREFERENCES:

1. BernardSklar,“DigitalCommunications”,secondedition,PearsonEducation,2001.
2. John G. Proakis,“Digital Communication”,Fifth Edition,Mc Graw Hill Publication, 2008.
3. M.K.Simon, S.M.Hinediand W.C.Lindsey, “Digitalcommunication techniques; Signal Design and Detection”, Prentice Hall of India, New Delhi, 2295.
4. Richard Van Nee & Ramjee Prasad, “OFDM for Multimedia Communications” Artech House Publication, 2001.
5. StephenG.Wilson,“DigitalModulationandCoding”,FirstIndianReprint,Pearson Education, 2003.
6. SimonHaykin, “Digitalcommunications”,JohnWileyandsons,2298.
7. TheodoreS.Rappaport,,,WirelessCommunications”,2ndedition,Pearson Education, 2002.

SEMESTERI

22271C14 OPTICALNETWORKS L TPC
4004

AIM:

ToexposethestudentstotheOpticalsystemcomponentslikeopticalamplifiers,wavelength converters.

OBJECTIVES:

Thestudentsshouldbemadetounderstand:

- Up-to-datesurveyofdevelopmentinOpticalNetworkArchitectures.
- Packetswitching.
- Networkdesignperspectives.
- DifferentOpticalNetworkmanagementtechniquesand functions.

UNITIINTRODUCTIONTOOPTICALNETWORKS 9

Introduction to Optical Networks: Telecommunications Networks Architecture, Services, circuit switchingandpacketswitching,OpticalNetworks:MultiplexingTechniques,Second generation Optical Networks, Optical Packet Switching, Transmission Basics: Wavelength, frequencies, andchannel spacing, Wavelength standards, Optical power and loss, Network Evolution,Nonlinear Effects: Self-phase Modulation, Cross-phase Modulation, Four Wave mixing,Solitons.Components:Couplers,IsolatorsandCirculators,MultiplexersandFilters, Optical Amplifiers, Transmitters, Detectors, Switches, Wavelength Converters.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

UNITIITRANSMISSIONSYSTEMENGINEERING 9

SystemModel, Power Penalty, Transmitter, Receiver, OpticalAmplifiers, Crosstalk, Dispersion,Wavelength Stabilization, Overall Design Considerations. Optical Internets: Migration to IPoptical networking, IP and Optical backbone, IP Routing table, MPLS and optical cross connecttable, Protocolstack Alternatives, Internetworking SS7 and Legacy Transport, Internet transportnetwork protocol stack.

UNITIIIOPTICALTRANSPORTNETWORKS 9

SONET, SDH and Optical Transport Networks (OTNs): SONET and SDH: SONETmultiplexing hierarchy, Frame structure, Functional Component, problem detection,concatenation. Architecture of Optical Transport Networks (OTNs): Digital wrapper, in-bandand out-of band control signalling, Importance of Multiplexing and multiplexing hierarchies,SONET multiplexing hierarchies, SDH multiplexing hierarchies, New Optical Transport, OTNlayered Model, Generic Framing Procedure (GFP).

UNITIVNETWORKTOPOLOGIES 9

WDM, Network topologies, MPLS and Optical Networks: WDM: WDM operation, DenseWavelength Division Multiplexing (DWDM), Erbium-doped Fiber (EDF), WDM amplifiers,Add-Drop Multiplexers, Wavelength Continuity Property, Higher dispersion for DWDM,Tunable DWDM Lasers.

UNITVNETWORKTOPOLOGIESANDPROTECTIONSCHEMES 9

Robust networks, Line and path protection switching, Types of topology, Point to pointtopology, bi-directional line-switched ring (BLSR), meshed topology, Passive optical networks,Metro optical networks 28 MPLS and Optical Networks: IS label switching, Forwardingequivalence class (FEC), Types of MPLS nodes, Label distribution and binding, label swappingand traffic forwarding, MPLS support of Virtual Private Networks (VPN), MPLS trafficengineering, Multi protocol Lambda switching (MPIS).

Total:45Periods

OUTCOMES:

Attheendofthecourse,thestudentshouldbeableto:

- **DesignandAnalyzeNetworkComponents**
- **AssessandEvaluateopticalnetworks**

BOOKSFORREFERENCES:

1. RajivRamaswamiandKumarSivarajan,"OpticalNetworks–Practical Perspective", 3rd Edition,Morgan - Kaufmann Publishers.
2. OpticalNetworks,ThirdGenerationTransport Systems,UylessBlack,Pearson

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

SEMESTERI

22271C15 ADVANCEDRADIATIONSYSTEMS LT PC
4004

AIM:

Toenhancethestudent'sknowledgeintheareaofvariousantennadesign.

OBJECTIVES:

- Tounderstandantennaradiationanditsparameters.
- Toenhancethestudent'sknowledgeintheareaofvariousantennadesign.
- To design monopole, dipole and patch antenna and to impart the knowledge about modern antennas.

UNITIANTENNA FUNDAMENTALS 9

Antenna fundamental parameters, Radiation integrals ,Radiation from surface and line currentdistributions – dipole, monopole, loop antenna; Mobile phone antenna- base station, handsetantenna; Image; Induction ,reciprocity theorem, Broadband antennas and matching techniques,Balance to unbalance transformer, Introduction to numerical techniques.

UNITIIRADIATIONFROMAPERTURES 9

Field equivalence principle, Radiation from Rectangular and Circular apertures, Uniformaperture distribution on an infinite ground plane; Slot antenna; Horn antenna; Reflector antenna,aperture blockage, and design consideration.

UNITIIIANTENNASYNTHESIS 9

Synthesis problem-Line source based beam synthesis methods (Fourier transform andWoodward-Lawson sampling method – Linear array shaped beam synthesis method – Low sidelobe, narrow main beam synthesis methods - discretization of continuous sources. Schelkunoffpolynomial method

UNITIVAPERTUREANTENNAS 9

Radiation from apertures - Huygens Principle. Rectangular apertures- techniques for evaluatinggain, Circular apertures and their design considerations- Babinets principle Fraunhofer andFresnel diffraction.Complimentary screens and slot antennas. Slot and dipoles as dual antennas.Fourier transform of aperture antenna theory.

UNITVHORN,MICROSTRIP,REFLECTORANTENNAS. 9

E and H plane sectoral Horns. Pyramidal horns. Conical and corrugated Horns. Multimodehorns. Phasecenter.Microstripantennas –feedingmethods. Rectangular patch- Transmissionlinemodel – Circular patch Parabolic Reflector antennas – Prime focus and cassegrain reflectors.Equivalent focal length of Cassegrain antennas. Spillover and taper efficiencies. Optimumillumination.

Total:45Periods

OUTCOMES:

- Abilitytounderstandantennaconcepts
- Abilitytodesignantennaforvarious applications
- Knowledgeofmodernantennadesign

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

BOOKSFORREFERENCES:

1. Balanis,C.A.,“AntennaTheory” Wiley,2003
2. WarrenL. Stutzmanand GaryA. Thiele,“Antennatheoryand design”John Wileyand sons 2298
3. Jordan,E.C.,“ElectromagneticwavesandRadiatingsystems”.PHI2003
4. Krauss,J.D.,“RadioAstronomy”McGraw-Hill2266, forthelastunit(reprintsavailable)
5. Krauss,J.D.,,Fleisch,D.A.,“Electromagnetics”McGraw-Hill,2299

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

SEMESTERI

22271L17 COMMUNICATIONSYSTEMLAB-I

LTPC
0033

OBJECTIVES:

- ToacquireknowledgeonTransmissionlineandS-parameterestimationofmicrowave devices.
- TointroducethebasicsofMicrostripPatchAntennaandits analysis.
- Tostudy& measuretheperformanceofdigitalcommunicationsystems.
- ToprovideacomprehensiveknowledgeofWirelessCommunication.
- Tolearnaboutthedesignofdigitalfiltersanditsadaptivefiltering algorithms.

LISTOF EXPERIMENTS:

1. AntennaRadiationPatternmeasurement.
2. SimulationofModulationandCodinginaAWGNCommunicationChannelusingSimulation Packages.
3. Implementation of AdaptiveFilters,periodgram andmultistagemultiratesystem inDSPProcessor
4. PerformanceevaluationofDigitalData TransmissionthroughFiberOptic Link.
5. StudyofSpreadSpectrumTechniques.
6. SimulationofQMFusingSimulationPackages.
7. ImplementationofVideoLinkusingOpticalFiber.
8. ImplementationofLinearandCyclic Codes.

TOTAL:45PERIODS

OUTCOMES:

Upon thecompletion ofcourse,studentsareableto

- Measureandanalyzevarioustransmissionlineparameters.
- DesignMicrostrippatchantennas.
- Implementtheadaptivefilteringalgorithms
- Togenerateanddetect digitalcommunicationsignalsofvariousmodulation techniques using MATLAB.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

LISTOF ELECTIVES

ELECTIVE–I(SEMESTERI)

ELECTIVE-I
SEMESTERI

22271E16A INTERNETWORKINGAND MULTIMEDIA LT PC
3003

AIM:

Theaimofthismoduleistoaddressthetechnicalissuesandthesolutionsforthe implementationofmultimediaservicesontheInternet.

OBJECTIVES:

- Recent advances in multimedia and networking technologies have made possible the evolution of the Internet from a text-based environment to a multimedia global communication network.
- The objective of this module is to address the technical issues and the solutions for the implementation of multimedia services on the Internet.
- Afterstudyingthis module, studentsareexpectedto beabletoappreciatethestate-of-the- art in Internet technologies for multimedia services.

UNITIMULTIMEDIA NETWORKING 9

Digital sound, video and graphics, basic multimedia networking, multimedia characteristics,evolution of Internet services model, network requirements for audio/ video transform,multimedia coding and compression for text, image, audio and video.

UNITIIBROADBANDNETWORKTECHNOLOGY 9

Broadband services, ATM and IP, IPV6, High speed switching, resource reservation, Buffermanagement, traffic shaping, caching, scheduling, and policing, throughput, delay and jitterperformance. Storage and media services, voice and video over IP, MPEG-2 over ATM/IP,indexing synchronization of requests, recording and remote control.

UNITIIIRELIABLETRANSPORTPROTOCOLANDAPPLICATIONS9

Multicast over shared media network, multicast routing and addressing, scaling multicast andNBMA networks, Reliable transport protocols, TCP adaptation algorithm, RTP, RTCP. MIME,Peer- to-Peer computing, shared application, video conferencing, centralized and distributedconference control,distributed virtual reality, lightweight session philosophy.

UNITIVMULTIMEDIACOMMUNICATIONSTANDARDS 9

Objective ofMPEG- 7 standard, Functionalities and systems ofMPEG-7, MPEG-21 MultimediaFramework Architecture, - Content representation, Content Management and usage, Intellectualproperty management, Audio visual system- H322: Guaranteed QOS LAN systems; MPEG_4video Transport across internet.

UNITVMULTIMEDIACOMMUNICATIONACROSSNETWORKS 9

PacketAudio/videointhenetworkenvironment,videotransportacrossGenericnetworks- Layeredvideocoding,errorResilientvideocodingtechniques,ScalableRatecontrol,Streaming

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

videoacross Internet,Multimedia transportacross ATMnetworks and IP network,Multimediaacross wireless networks.

Total:45Periods

Outcomes

Uponcompletionofthesubject, studentswillbeableto:

- Understandthestate-of-artdevelopmentsinInternettechnologiesandapplications
- UnderstandthedevelopmentofnextgenerationInternet
- Appreciatetheprinciples usedindesigningInternet protocols for multimedia applications, andso understand why standard protocols are designed the way that they are
- Beabletosolveproblemsfor thedesignof multimediaapplicationsonInternet.

BOOKSFORREFERENCES:

1. Jon Crowcroft, Mark Handley, Ian Wakeman, Internetworking Multimedia, Harcourt Asia Pvt. Ltd.Singapore, 2298.
2. B.O.Szuprowicz,MultimediaNetworking,McGrawHill,Newyork.2295.
3. TayVaughan,Multimedia-Makingittowork,4ed,TataMcGrawHill,NewDelhi, 2000.
4. K.R.Rao,Zoran S.BojkovicandDragorad A.Milovanovic,MultimediaCommunication systems, PHI ,

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE-I
SEMESTERI

22271E16B **DIGITALIMAGEPROCESSING** **L T PC**
3003

AIM:

Theaimofthiscourseistoexplainthefundamentalsofdigitalimageprocessing.

OBJECTIVES:

- Tounderstandtheimagefundamentals.
- Tounderstandthevariousimagesegmentationtechniques.
- Toextractfeaturesforimageanalysis.
- Tointroducetheconceptsofimageregistrationand imagefusion.

UNITIDIGITALIMAGEFUNDAMENTALS 9

Elements of digital image processing systems - Elements of visual perception - Psycho visualmodel- Brightness - Contrast - Hue - Saturation - Mach band effect- Color image fundamentals– RGBHSI models - Image sampling - Quantization - Dither - Two-dimensional mathematicalpreliminaries.

UNITIIIMAGE TRANSFORMS 9

1D DFT - 2Dtransforms - DFT - DCT - DiscreteSine - Walsh- Hadamard - Slant - Haar - KLTSVD - Wavelet Transform.

UNITIIIENHANCEMENTANDRESTORATION 9

Histogram modification and specification techniques - Noise distributions - Spatial averaging - DirectionalSmoothing – Median- Geometric mean- Harmonic mean– Contra harmonic and Ypmean filters - Homomorphic filtering - Color image enhancement - Image Restoration – Degradation model - Unconstrained and Constrained restoration - Inverse filtering - Removal ofblur caused by uniform linear motion - Wiener filtering - Geometric transformations - Spatialtransformations -Gray Level interpolation.

UNITIVIMAGESEGMENTATIONAND RECOGNITION 9

Edge detection - Image segmentation by region growing - Region splitting and merging – Edgelinking - Image Recognition - Patterns and pattern classes - Matching by minimum distanceclassifier - Matching by correlation - Back Propagation Neural Network - Neural Networkapplications in Image Processing.

UNITV IMAGECOMPRESSION 9

Need for datacompression- Huffman- RunLengthEncoding - Shift codes- Arithmeticcoding - VectorQuantization-BlockTruncationCoding-TransformCoding-DCTandWavelet-JPEG -MPEG–Standards-ConceptsofContextbased Compression.

Total:45Periods

OUTCOMES:

UponCompletionofthecourse, thestudentswillbeableto

- Explainthefundamentalsofdigitalimageprocessing.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

- Describeimagevarioussegmentationandfeatureextractiontechniquesforimageanalysis.
- Discusstheconceptsofimageregistrationandfusion.

BOOKSFORREFERENCES:

1. RafaelC.Gonzalez,RichardE.Woods,‘DigitalImageProcessing’,SecondEdition,PearsonEducation Inc., 2004.
2. AnilK.Jain,‘FundamentalsofDigitalImageProcessing’,PrenticeHallofIndia,2002.
3. David Salomon , “Data Compression The Complete Reference”, 2nd Edition, SpringerVerlag , New York Inc., 2001.
4. Rafael C.Gonzalez,Richard E.Woods, Steven Eddins,“Digital Image Processing using MATLAB”, Pearson Education, Inc., 2004.
5. WilliamK. Pratt,“DigitalImageProcessing”, JohnWiley,NewYork, 2002.
6. MilmanSonka,VaclavHlavac,RogerBoyle,“ImageProcessingAnalysisandMachine Vision”, 2nd edition, Brooks/Cole, Vikas Publishing House, 2299.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE-I
SEMESTERI

22271E16C **LASERCOMMUNICATION** **LT PC**
3003

AIM:
Theaimofthiscourseistogainknowledgeabout lightandits propagation

OBJECTIVES:

- Tostudythenonlinearopticdevices.
- To learnaboutholography.
- Tostudythedifferenttypesoflaser andits effects.

UNITI LASERCOMMUNICATIONS 9
Atmospheric low loss windows, opticalsources and detectors forthese windows, Characteristicsof source and detectors. Optical transmitting and receiving antennas.

UNITII SYSTEMDESIGN 9
Link equation, Transmitter terminal, Antenna design, Antenna gain, Beam width, C/N, Opticaldetectors, Optical modulation formats, Deriving error statistics, Signal requirements foracquisition and tracking, Fundamentals of system design.

UNITIIISEMICONDUCTORANDMETALLASERSOURCESFORSATELLITE COMMUNICATIONS 9
PerformanceandGeometries,outputwavelengthcontrol,Semiconductorlaserlifetime,Directand indirect modulation techniques and radiation effects.

UNITIVOPTICALRECEIVERSANDSYSTEMDESIGN 9
Direct detection, coherent detection and demodulation. Gimbals in transceiver design, Receiveroptions and optics; Lasers; antennas / Telescope, Internal optical systems, Transmitter analysis.

UNITVLASERBEAMPOINTINGCONTROL 9
Acquisition andTrackingsystems,System description,Acquisitionmethodology,rackingandpointing control system, RF cross link system design, link equation.

Total:45Periods

Outcomes:
Studentsareableto

- RecognizeandclassifythestructuresofOpticalfiberandtypes.
- Discussthechannelimpairmentslikelossesanddispersion.
- Analyzevariouscouplinglosses.
- ClassifytheOpticalsourcesanddetectorsandtodiscusstheirprinciple.
- FamiliarwithDesignconsiderationsoffiberopticsystems.
- Toperformcharacteristicsofopticalfiber,sourcesanddetectors,designaswellasconduct experiments in software and hardware, analyze the results to provide valid conclusions.

BOOKSFORREFERENCES:

1. MorrisKatzman, “LaserSatelliteCommunications”, PrenticeHallInc, NewYork,2291.
2. J. FranzandV.K.Jain, “OpticalCommunicationSystems”, NarosaPublication, NewDelhi, 2294.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

SEMESTERII

22271C21 MOBILECOMMUNICATIONNETWORKS LT PC 4004

AIM:

Theaimofthiscourseistoprovidethebasiccellular systemconcepts.

OBJECTIVES:

- Tounderstandthebasiccellularsystemconcepts.
- Tohaveaninsightintothevariouspropagationmodelsandthespeechcodersusedin mobile communication.
- Tounderstandthemultipleaccesstechniquesandinterferenceeducation techniquesin mobile communication

UNITIWIRELESSCHANNELPROPAGATION ANDMODEL 9

PropagationofEM signals inwirelesschannel–Reflection, diffractionandScattering-Small scale fading-channel classification-channel models–COST-231 Hata model, Longley-Rice Model,NLOS Multipath Fading Models: Rayleigh, Rician, Nakagami, Composite Fading–shadowingDistributions, Link power budget Analysis

UNITIIOPERATIONANDPROPAGATIONMODELSANDAIRPROTOCOLS9

Operation of first, second, and third generation wireless networks: cellular systems, mediumaccess techniques, Mobile networks Elementary Principles of cellular Telephony ChannelDivision Techniques(TDMA, FDMA, CDMA) Cellular Coverage Methods Network Planningand Resource Allocation,Network Dimensioning ,Mobility Management Procedures

UNITIIIMOBILENETWORKARCHITECTURE 9

GeneralArchitecturedefinition,MobileTerminals(MT,SIM)
RadioSection(BTS, BSC)CoreNetwork(MSC,G-MSC, VLR,HLR,AuC)
User and ControlPlane ProtocolStack, MAP &SS#7, The KeyRole ofSignaling Interfaces andNetworkEntities Relation The Physical Channel, The Logical Channels Terminal, Call andNetwork ManagementProcedures, Network Planning.

UNITIVWIRELESSLOCALAREA NETWORKS 9

Wireless Local Area Networks , General Characteristics of the Hiperlan System, 802.11Standard, BasicDCF access schemeDCF Access Scheme with Handshaking, PCF AccessScheme, The 802.11a Standard, Mobile Ad HocNetworks, Wireless Sensor Networks, RoutingEnergy Efficiency, Localization, Clustering.

UNITVSECURITYISSUESINWIRELESSNETWORKS 9

Security in Wireless Networks, Secure routing, Key Pre-distribution and Management,Encryption andAuthentication, Security in Group Communication, Trust Establishment andManagement, Denial ofService Attacks, Energy-aware security mechanisms, Locationverification, Security on Data fusion.

Total:45Periods

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

Outcomes:

- Discusscellularradio concepts.
- Identifyvariouspropagationeffects.
- Tohaveknowledgeofthemobilesystemspecifications.
- Classifymultipleaccesstechniquesinmobilecommunication.
- Outlinecellular mobilecommunicationstandards.
- Analyzevariousmethodologiesto improvethecellular capacity

BOOKSFORREFERENCES:

1. W.Stallings,"WirelessCommunicationsandNetworks",SecondEditionPrenticeHall, 2007.
2. V.K.Garg,"IS-95CDMAandCDMA2000",PrenticeHallPTR,2000.
3. T.S.Rappaport,"WirelessCommunications:Principles&Practice",SecondEdition, Prentice Hall,2002.
4. Leon-GarciaandI.Widjaja,"CommunicationNetworks,FundamentalConceptsand KeyArchitectures", McGraw-Hill, 2000.
5. J.Schiller,"MobileCommunications",AddisonWesley,2000.
6. FredHalsall,"MultimediaCommunications,Applications,Networks,Protocolsand Standards",Addison Wesley, 2001.
7. UylessBlack,"MobileandWirelessNetworks", PrenticeHallPTR,2296.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

SEMESTERII

22271C22 ADVANCEDMICROWAVE SYSTEMS LTPC
4004

AIM:

Theaimofthiscourseistoexplainfundamentalsofmicrowaveintegratedcircuits.

OBJECTIVES:

- Tounderstandthefundamentalsof Microwaveintegratedcircuits.
- Tounderstandthevariouscomponentsfor WirelessCommunications.
- Toknowthebasictechniques neededforanalysis ofMicrowave systems.

UNITIINTRODUCTIONTOMONOLITHICMICROWAVE INTEGRATED CIRCUITS 9

Introduction to Monolithic Microwave Integrated Circuits (MMICs), their advantages overdiscrete circuits, materials, MMIC fabrication techniques, MOSFET fabrication. Thin filmformation.

UNITIIMICROSTRIPANALYSIS 9

Planar transmission lines for MICs. Methodofconformaltransformation for microstrip analysis,concept of effective dielectric constant, Effective dielectric constant for microstrip, Losses inMicrostrip

UNITIIISLOTLINE ANALYSIS 9

SlotLineApproximateanalysisandfielddistribution,Transverseresonancemethodandevaluation of slot line impedance, comparison with micro strip line.

UNITIVLUMPEDELEMENTSFORMICS 9

Lumped Elements for MICs: Use of Lumped Elements, Capacitive elements, Inductive elementsand Resistive elements.

UNITVMICROWAVESEMICONDUCTORDEVICES& MICROWAVE PASSIVE COMPONENTS 9

Microwave semiconductor Devices & Microwave passive components Parametric amplifiers,tunnel diode, varactor diode, PIN diode, Gunn diode, their principle of operation, performancecharacteristics & applications, scattering parameter calculations of E plane-Tee, Magic Tee,Directional Coupler.

Total:45Periods

OUTCOMES:

- CapabilitytodesignMicrowavecircuits.
- Tobeabletoanalyzemicrowaveintegratedcircuits.

REFERENCES:

1. Gupta,K.C, and Amarjitsingh“Microwave IntegratedCircuits”John Wileyand sons – Wiley EasternReprint, 2278.
2. Hoffmann,R.K“HandbookofMicrowaveIntegratedCircuits”ArtechHouse,2287.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

SEMESTERII

22271C23ELECTROMAGNETICINTERFERENCEANDCOMPATIBILITY **LTPC 4004**

AIM:

Theaimofthecourseistofamiliarizethebasicsof EMIandEMIsources.

OBJECTIVES:

Thestudentsshouldbemadetobefamiliarwith:

- EMIproblems.
- SolutionmethodsinPCB.
- Measurementstechniquesforemission.
- Measurementtechniquesforimmunity.

UNITI BASICTHEORY 9

Introduction to EMI and EMC, Intra and inter system EMI, Elements of Interference, Sourcesand Victims of EMI, Conducted and Radiated EMI emission and susceptibility, Case Histories,Radiation hazards to humans, Various issues of EMC, EMC Testing categories EMCEngineering Application.

UNITII COUPLING MECHANISM 9

Electromagnetic field sources and Coupling paths, Coupling via the supply network, Commonmode coupling, Differential mode coupling, Impedance coupling, Inductive and Capacitivecoupling, Radioactive coupling, Ground loop coupling, Cable related emissions and coupling,Transient sources, Automotive transients.

UNITIII EMIMITIGATION TECHNIQUES 9

Working principle of Shielding and Murphy‟s Law, LF Magnetic shielding, Apertures andshielding effectiveness, Choice of Materials for H, E, and free space fields, Gasketting andsealing, PCBLevelshielding, PrincipleofGrounding, Isolatedgrounds, Groundingstrategies forLarge systems, Grounding for mixed signalsystems, Filter typesand operation, Surge protectiondevices, Transient Protection.

UNITIV STANDARDANDREGULATION 9

NeedforStandards,Generic/GeneralStandardsforResidentialandIndustrialenvironment, BasicStandards, Product Standards, NationalandInternationalEMIStandardizingOrganizations;IEC,ANSI, FCC, AS/NZS, CISPR, BSI, CENELEC, ACEC. Electro Magnetic Emission andsusceptibility standards and specifications, MIL461E Standards.

UNITV EMITESTMETHODSAND INSTRUMENTATION 9

Fundamental considerations, EMI Shielding effectiveness tests, Open field test, TEM cell forimmunity test, Shielded chamber , Shielded anechoic chamber, EMI test receivers, Spectrumanalyzer, EMI test wave simulators, EMI coupling networks, Line impedance stabilizationnetworks, Feed through capacitors, Antennas, Current probes, MIL -STD test methods, CivilianSTD test methods.

Total:45Periods

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

OUTCOMES:

Attheendofthecourse, thestudentshouldbeableto:

- IdentifyStandards
- CompareEMItestmethods
- DiscussEMImitigationtechniques

BOOKSFORREFERENCES:

1. BemhardKeiser,"PrinciplesofElectromagneticCompatibility",3rd Ed,Artech house, Norwood,2286.
2. ClaytonPaul,"IntroductiontoElectromagneticCompatibility",WileyInterscience,2006.
3. Daryl Gerkeand WilliamKimmel,"EDN‟sDesigner‟sGuide toElectromagnetic Compatibility",Elsevier Science & Technology Books, 2002
4. DrKennethLKaiser,"TheElectromagneticCompatibilityHandbook",CRCPress2005.
5. ElectromagneticCompatibilitybyNormanViolette ,PublishedbySpringer,2013
6. Electromagnetic Interference and Compatibility: Electrical noise and EMI specificationsVolume1ofAHandbookSeriesonElectromagneticInterferenceandCompatibility,Donald R. J. White Publisher-Don white consultants Original from the University of Michigan Digitized 6Dec2007.
7. Henry W.Ott,"ElectromagneticCompatibilityEngineering",John Wiley& SonsInc,Newyork,2009
8. VPrasadKodali,"EngineeringElectromagneticCompatibility",IEEEPress,Newyork, 2001.
9. W Scott Bennett, "Control and Measurement of Unintentional Electromagnetic Radiation",JohnWiley & Sons Inc., (Wiley Interscience Series) 2297.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

LISTOF ELECTIVES

ELECTIVE–II(SEMESTERII)

ELECTIVE-II
SEMESTERII

22271E24A HIGHSPEEDSWITCHINGARCHITECTURE LT PC 3003

AIM:

Toexposethestudentto theadvancesin packetswitchingarchitecturesand IP addressing andswitchingsolutionsandapproachestoexploitandintegratethebestfeaturesofdifferent architectures for high speed switching.

OBJECTIVES:

- Toenablethestudenttounderstandthebasicsofswitchingtechnologiesandtheir implementation LANs, ATM networks and IP networks.
- To enable the student to understand the different switching architectures and queuing strategies and their impact on the blocking performances.

UNITIHIGHSPEED NETWORK 9

LANandWANnetworkevolutionthroughISDNtoBISDN-TransfermodeandcontrolofBISDN -SDH multiplexing structure - ATM standard; ATM adaptation layers.

UNITIILANSWITCHINGTECHNOLOGY 9

Switchingconcepts;Switchforwardingtechniques;switchpathcontrol-LANswitching;cutthrough forwarding; store and forward - virtual LANs.

UNITIIIATMSWITCHINGARCHITECTURE 9

Switch models - Blocking networks – basic and enhanced banyan networks - sorting networks – merge sorting – rearrangeable networks - full and partial connection networks – non-blockingnetworks –recursive network – construction and comparison of non-blocking network - switcheswith deflection routing – shuffle switch - tandem banyan.

UNITIVMULTIMEDIACOMMUNICATIONSTANDARDS 9

Objective ofMPEG- 7 standard, Functionalities and systems ofMPEG-7, MPEG-21 MultimediaFramework Architecture, - Content representation, Content Management and usage, Intellectualproperty management, Audio visual system- H322: Guaranteed QOS LAN systems; MPEG_4video Transport across internet.

UNITVIPSWITCHING 9

Addressing mode -IPswitching types-flow driven andtopologydrivensolutions -IPOver ATMaddress and next hop resolution – multicasting - IPv6 over ATM.

Total:45Periods

OUTCOMES:

- Thestudentwouldbeabletoidentifysuitableswitcharchitecturesforaspecifiednetworking scenario and demonstrate its blocking performance.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENEUERSHIP**

- The student would be in a position to apply his knowledge of switching technologies,architectures and buffering strategies for designing high speed communication networks and analyse their performance

BOOKSFORREFERENCES:

1. AchillePatavina,SwitchingTheory:ArchitecturesandperformanceinBroadbandATM Networks.John Wiley & Sons Ltd., New York.2298.
2. ChristopherYMetz,Switchingprotocols&Architectures.McGrawHill,NewYork.2298.
3. RanierHandel,ManfredNHuber,Stefan Schrodder.ATMNetworks-concepts,protocols, applications,3rd Edition, Adisson Wesley, New York,2299.
4. JohnA.Chiong:InternetworkingATMfortheinternetandenterprisenetworks.McGraw Hill, NewYork, 2298.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE-II
SEMESTERII

22271E24B DSPPROCESSORARCHITECTUREAND PROGRAMMING

L T PC
3003

AIM:

Theaimofthiscourseistoprovidein-depthknowledgeondigitalsignalprocessor basics.

OBJECTIVES:

Theobjectiveofthiscourseistoprovidein-depthknowledgeon

- DigitalSignalProcessorbasics
- ThirdgenerationDSPArchitectureandprogrammingskills
- AdvancedDSParchitecturesandsomeapplications.

UNITIFUNDAMENTALSOFPROGRAMMABLEDSPs 9

Multiplier and Multiplier accumulator (MAC) – Modified Bus Structures and Memoryaccess inProgrammable DSPs – Multiple access memory – Multi-port memory – VLIW architecture- Pipelining –Special Addressing modes in P-DSPs – On chip Peripherals.

UNITIIIADSPPROCESSORSI 9

Architecture of ADSP-21XXandADSP-210XXseriesof DSPprocessors-Addressingmodesand assembly language instructions – Application programs –Filter design, FFT calculation.

UNITIVADVANCEDPROCESSORS 9

Architectureof TMS320C54X:Pipelineoperation,Addressingmodesandassemblylanguageinstructions Introduction to Code Composer studio

UNITVADVANCEDPROCESSORSII 9

ArchitectureofTMS320C6X-ArchitectureofMotorolaDSP563XX–Comparisonofthefeatures of DSP family processors.

Total:45Periods

OUTCOMES:

Studentsshouldbeableto:

- BecomeDigitalSignalProcessorspecializedengineer
- DSPbasedSystemDeveloper

BOOKSFORREFERENCES:

1. B.Venkataramani and M.Bhaskar, “Digital SignalProcessors – Architecture, Programming andApplications” – Tata McGraw – Hill Publishing Company Limited. New Delhi, 2003.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

2. UserguidesTexasInstrumentation,AnalogDevices,Motorola.

ELECTIVE-II
SEMESTERII

22271E24C DIGITALSPEECHPROCESSING LT PC
3003

AIM:

Toillustratethe conceptsofspeechsignalrepresentations andcoding.

OBJECTIVES:

- Tointroduce speechproductionandrelatedparametersofspeech.
- Tounderstanddifferentspeechmodelingproceduressuch asMarkov andtheir implementation issues.
- Togainknowledgeabouttext analysisand speechsynthesis.

UNITIMECHANICS OFSPEECH 9

Speech production mechanism – Nature of Speech signal – Discrete time modelling of Speechproduction – Representation of Speech signals – Classification of Speech sounds – Phones –Phonemes – Phonetic and Phonemic alphabets – Articulatory features.
Music production – Auditory perception – Anatomical pathways from the ear to the perceptionof sound – Peripheral auditory system – Psycho acoustics

UNITIVLINEARPREDICTIVEANALYSISOFSPEECH 9

Formulation of Linear Prediction problem in Time Domain – Basic Principle – Auto correlationmethod– Solution of LPC equations –– Durbin's Recursive algorithm – lattice formation andsolutions – Comparison of different methods –– Formant analysis – VELP – CELP.

UNITV APPLICATIONOFSPEECH&AUDIOSIGNALPROCESSING 9

Algorithms: SpectralEstimation, dynamic time warping, hiddenMarkovmodel – Music analysis– Pitch Detection – Feature analysis for recognition – Music synthesis – Automatic SpeechRecognition – Feature Extraction for ASR –– ASR systems– Voice response system – SpeechSynthesis: Text to speech, voice over IP.

Total:45Periods

OUTCOMES:

Studentswillbeableto:

- Modelspeechproductionsystemanddescribethefundamentalsof speech.
- Extractandcomparedifferentspeechparameters.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

- Chooseanappropriatestatisticalspeechmodelforagivenapplication.
- Designaspeechrecognitionsystem.
- Usedifferenttextanalysisandspeechsynthesistechniques.

BOOKSFORREFERENCES :

1. Ben Gold and Nelson Morgan, Speech and Audio SignalProcessing, John Wileyand Sons Inc. , Singapore,2004
2. L.R.RabinerandR.W.Schaffer–DigitalProcessingofSpeechsignals–PrenticeHall- 2278
3. Quatieri– Discrete-timeSpeechSignalProcessing– PrenticeHall–2001.
4. J.L.Flanagan–Speechanalysis:SynthesisandPerception –2nd edition–Berlin–2272
5. I.H.Witten–PrinciplesofComputerSpeech– AcademicPress– 2282

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

LISTOF ELECTIVES

ELECTIVE–III(SEMESTERII)

ELECTIVE-III
SEMESTERII

22271E25A DIGITALCOMMUNICATIONRECEIVERS LT PC
3003

AIM:

Theaimofthiscourseistounderstandthebasicprinciplesofdigitalcommunication techniques.

OBJECTIVES:

- Tounderstandthebasicprinciplesofdigitalcommunicationtechniques.
- Togainknowledgeaboutreceivers forAWGNchannelandFadingchannels.
- Tounderstandtheconceptsofsynchronizationandadaptiveequalizationtechniques.

UNITIREVIEWOFDIGITALCOMMUNICATION TECHNIQUES 9

Basebandandbandpasscommunication,signalspacerepresentation,linearandnon-linearmodulation techniques, and spectral characteristics of digital modulation.

UNITIIOPTIMUMRECEIVERSFORAWGN CHANNEL 9

Correlation demodulator, matched filter, maximum likelihood sequence detector, Optimumreceiver for CPM signals, M-aryorthogonalsignals, envelope detectors for M-aryand correlatedbinary signals.

UNITIIIRECEIVERSFORFADINGCHANNELS 9

Characterizationof fading multiple channels, statistical models, slow fading, frequencyselectivefading, diversity technique, RAKE demodulator, coded waveform for fading channel

UNITIVSYNCHRONIZATIONTECHNIQUES 9

Carrier and symbol synchronization, carrier phase estimation – PLL, Decision directed loops,symbol timing estimation, maximum likelihood and non-decision directed timing estimation,joint estimation.

UNITVADAPTIVEEQUALIZATION 9

Zero forcing algorithm, LMS algorithm, Adaptive decision – feedback equalizer, andequalizationofTrellis-codedsignals, Kalmanalgorithm, blindequalizers, andstochasticgradientalgorithm, Echo cancellation

Total:45Periods

OUTCOMES:

UponCompletionofthecourse, thestudentswillbeableto

- Applybasicprinciplesofdigitalcommunicationtechniques.
- DiscussonreceiversforAWGN&Fadingchannel
- Describevarioussynchronizationtechniques.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENEUERSHIP**

- Designadaptiveequalizationalgorithmstosatisfytheevolvingdemandsindigitalcommunication.

BOOKSFORREFERENCES:

1. HeinrichMeyer,MareMoeneclacyandStefan.A.Fechtel,“DigitalCommunication Receivers”, VolI&II, John Wiley, New York, 2297
2. John.G.Proakis, “DigitalCommunication”,4thed.,McGrawHill,NewYork, 2001
3. E.A.LeeandD.G.Messerschmitt,“DigitalCommunication”,2ndedition,AlliedPublishers, NewDelhi, 2294
4. SimonMarvin,“DigitalCommunicationOverFadingchannel;Anunifiedapproachto performanceAnalysis”, John Wiley, New York, 2000
5. BernardSklar,“DigitalCommunicationFundamentalsandApplications,PrenticeHall, 2298

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE-III
SEMESTERII

22271E25B **SOFTCOMPUTING TECHNIQUES** **LT PC**
3003

AIM:

Theaimofthiscourse istoknowthe basicsofartificialneuralnetworks.

OBJECTIVES:

- Toprovideadequateknowledgeaboutfeedforward/feedbackneural networks
- Toapplytheconceptoffuzzylogicinvarioussystems.
- Tohavetheideaaboutgeneticalgorithm.
- ToprovideadequateknowledgeabouttheapplicationsofSoftComputing.

UNITIARTIFICIALNEURAL NETWORKS 9

Introduction-Basic concepts ofNeuralNetwork-Modelofan Artificial Neuron-Characteristics ofNeural Network-Learning Methods-Backpropagation Network Architecture-Backpropagation Learning-Counter PropagationNetwork-Hopfield/RecurrentNetwork-AdaptiveResonance Theory.

UNITIIFUZZYLOGIC 9

Basic concepts of Fuzzy Logic-Fuzzy Sets and Crisp Sets-Fuzzy Set Theory and Operations-Properties of Fuzzy Sets-Fuzzy and Crisp relations, Fuzzy to Crisp Conversion-MembershipFunctions-Interference in Fuzzy Logic-Fuzzy if-then Rules, Fuzzy implications and FuzzyAlgorithms,Fuzzification & Defuzzification-Fuzzy Controller.

UNITIVGENETICALGORITHMS 9

Basicconcepts-WorkingPrinciple-InheritanceOperators-CrossOver-Inversion&Deletion-Mutation Operator-Generation Cycle.

Total:45Periods

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

OUTCOMES:

- Knowledgeonconceptsofsoft computationaltechniques.
- Abletoapplysoftcomputationaltechniquestosolvevariousproblems.
- Motivatetosolveresearchorientedproblems.

BOOKSFORREFERENCES:

1. GeorgeJ.KlirandBoYuan,„FuzzySetsandFuzzyLogicTheoryandApplications", Printice Hall of India, 2002.
2. J.S.R.Jang,C.T.SunandE.Mizutani,"Neuro-FuzzyandSoft Computing",PHI,2004,Pearson Education 2004.
3. LaureneFausett,"FundamentalsofNeuralNetworks:Architectures,Algorithmsand Pearson Education India, 2006.
4. S.RajasekaranandG.A.V.Pai."Neural Networks,FuzzyLogicandGeneticAlgorithms", PHI, 2010.
5. TimothyJRoss, "FuzzylogicwithEngineeringApplications", JohnWileyandSons, 2009.
6. Zimmermann H.J."Fuzzy SetTheory and Its Application" SpringerInternational Edition, 2011.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE-III
SEMESTERII

22271E25C **COMMUNICATIONNETWORKSECURITY** **LTPC**
3003

AIM:

Theaimofthiscourseistounderstandtheneedand conceptofsecurity.

OBJECTIVES:
Thestudentsshouldbemadeto:

- Understandtheneedandconceptofsecurity
- Learn cryptosystems

UNITISYMMETRIC CIPHERS 9

Introduction – Services, Mechanisms and Attacks, OSI securityArchitecture, Modelfor networkSecurity; Classical Encryption Techniques- Symmetric Cipher Model, Substitution Techniques,Transposition Techniques, Product ciphers , DataEncryption Standard- Block Cipher Principles,Strength of DES,Differential and Linear CryptAnalysis, Block Cipher Design Principles, BlockCipher Modes of operation, Stegnography.

UNITIIADVANCEDENCRYPTIONSTANDARDANDSTREAMCIPHERS9

Evaluation Criteria for AES, AES Cipher; Contemporary Symmetric Ciphers- Triple DES,Blowfish, RC5-Characteristics of Advanced Symmetric Block Ciphers, Streamciphers based onLFSRs,RC4 Stream Cipher; Random Number Generation. Traffic Confidentiality, KeyDistribution.

UNITIIIPUBLIC-KEYENCRYPTION ANDHASH FUNCTIONS 9

Public Key Cryptography and Key Management- RSA Algorithm and other public keycryptosystems-,Diffie-Hellman Key Exchange, Elliptic Curve arithmetic, Elliptic CurveCryptography; Message Authentication and Hash Functions- Authentication Requirements, -MD5 Message Digest Algorithm; Secure Hash Algorithm, RIPEMD 160, HMAC; DigitalSignatures and Authentication Protocols- Digital Signature Standards.

UNITIVNETWORKSECURITYPRACTICE 9

Authentication Applications- Kerberos, X.509 Authentication Service; Electronic MailSecurity-Pretty Good Privacy, S/MIME; IP Security- overview and Architecture, Authentication Header,Encapsulating SecurityPayload, Combining Security Associations; Web Security- Web SecurityConsiderations, Secure Sockets Layer and Transport Layer Security, Secure ElectronicTransaction.

UNITVSYSTEMSECURITY 9

Intruders-IntruderDetection,PasswordManagement;MaliciousSoftware-VirusandRelatedThreats, Virus Countermeasures; Firewalls- Firewall Design Principles, Trusted Systems.

Total:45Periods

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

OUTCOMES:

Attheendofthiscourse, thestudentsshouldbeableto:

- Explaindigitalsignaturestandards
- Discussauthentication
- Explainsecurityatdifferent layers

BOOKSFORREFERENCES:

1. WilliamStallings,“CryptographyandNetworkSecurity”,3rdEdition.PrenticeHallof India, New Delhi,2004
2. WilliamStallings, “Network SecurityEssentials”, 2nd Edition. Prentice HallofIndia, New Delhi, 2004
3. CharlieKaufman,“NetworkSecurity:PrivateCommunicationinPublicWorld”,2nd Edition. PrenticeHall of India, New Delhi ,2004

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

SEMESTERII

22271L26 COMMUNICATIONSYSTEMSLAB-II LT PC
0033

OBJECTIVES:

- To enable the students to verify the basic principles and design aspects involved in high frequency communication systems components
- To expose the student to different high frequency components and conduct the experiments to analyze and interpret data to produce meaningful conclusions and match with theoretical concepts.
- TodesignanddevelopRFcomponentsusingmicrostrip technology

LISTOF EXPERIMENTS:

1. SimulationofAudioandspeechcompressionalgorithms
2. SimulationofEZW/SPIHTImagecoding algorithm.
3. SimulationofMicrostripAntennas
4. S-parameterestimationofMicrowavedevices.
5. StudyofGlobalPositioningSystem.
6. PerformanceevaluationofsimulatedCDMASystem.
7. DesignandtestingofaMicrostripcoupler.
8. Characteristicsofλ/4andλ/2transmissionlines.

TOTAL:45PERIODS

OUTCOMES:

UponCompletionofthecourse, thestudentswillbeableto:

- Applyknowledgetoidentifyasuitablearchitectureandsystematicallydesignan RFsystem.
- Comprehensivelyrecord and report the measured data, and would be capable ofanalyzing, interpreting the experimentally measured data and producing meaningful conclusions.
- Designanddevelopmicrostrip filters.

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

SEMESTERIII

22271C31 WIRELESSSENSOR NETWORKS LT PC
4004

AIM:

Theaimofthiscourseistostudyaboutwireless IParchitecture,PacketDataProtocol and LTEnetworkarchitecture.

OBJECTIVES:

- To study about advanced wireless networks, LTE, 4G and Evolutions from LTE to LTE.
- Tostudyaboutadaptivelinklayer, hybridARQandgraphrouting protocol.
- Tostudyaboutmobilitymanagement,cellularnetwork,andmicrocellularnetworks

UNITI OVERVIEWOFWIRELESSSENSOR NETWORKS 8

ChallengesforWirelessSensorNetworks,EnablingTechnologiesForWirelessSensorNetworks.

UNITII ARCHITECTURES 9

Single-Node Architecture - Hardware Components, Energy Consumption of SensorNodes ,Operating Systems and Execution Environments, Network Architecture -Sensor NetworkScenarios, Optimization Goals and Figures of Merit, GatewayConcepts.

UNITIII NETWORKINGSENSORS 10

Physical Layer and Transceiver Design Considerations, MAC Protocols for WirelessSensorNetworks, Low Duty Cycle Protocols and Wake Up Concepts - S-MAC , TheMediation DeviceProtocol, Wake Up Radio Concepts, Address and Name Management,Assignment of MACAddresses, Routing Protocols- Energy-Efficient Routing,Geographic Routing.

UNITIV INFRASTRUCTUREESTABLISHMENT 9

TopologyControl,Clustering,TimeSynchronization,LocalizationandPositioning,SensorTasking and Control.

UNITVSENSORNETWORKARCHITECTUREANDMACPROTOCOLS9

Single node architecture– Hardware components, energyconsumptionofsensornodes, Networkarchitecture – Sensor network scenarios, types ofsources and sinks, single hop versus multi-hopnetworks, multiple sinks and sources, design principles, Development of wireless sensornetworks. , physical layer and transceiver design consideration in wireless sensor networks,Energy usage profile, choice of modulation, Power Management - MAC protocols – fundamentals of wireless MAC protocols, low duty cycle protocols and wakeup concepts,contention-based protocols, Schedule-based protocols - SMAC, BMAC, Traffic-adaptivemediumaccessprotocol(TRAMA), Link Layer protocols – fundamentalstask and requirements,error control, framing, link management.

TOTAL- 45PERIODS

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

OUTCOMES:

- Familiarwiththelatest4GnetworksandLTE
- UnderstandaboutthewirelessIParchitectureandLTEnetworkarchitecture.
- Familiarwiththeadaptivelinklayerandnetworklayergraphsand protocol.
- Understandaboutthemobilitymanagementandcellular network.
- Understandaboutthewirelesssensornetworkarchitectureanditsconcept.

BOOKSFORREFERENCES:

1. HolgerKarl&AndreasWillig,"ProtocolsAndArchitecturesforWirelessSensor Networks" , John Wiley, 2005.
2. Feng Zhao &LeonidasJ. Guibas, “WirelessSensor Networks- AnInformation Processing Approach", Elsevier, 2007.
3. KazemSohraby, Daniel Minoli, &TaiebZnati, “Wireless Sensor Networks-Technology, Protocols, And Applications”, John Wiley, 2007.
4. Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

LISTOF ELECTIVES

ELECTIVE–IV(SEMESTERIII)

ELECTIVE-IV
SEMESTERIII

22271E32A SOFTWAREDEFINEDRADIO LT PC
3003

AIM:

Theaimofthiscourseistounderstandthe conceptsofsoftwaredefinedradio.

OBJECTIVES:

Thestudentsshould bemadeto be

- Understandtheconceptsofsoftwaredefined radio
- Learnspectrumsensinganddynamic spectrumaccess

UNITI: IntroductiontoSDR 9

The Need for Software Radios-Characteristics and Benefits of a Software Radio. DesignPrinciples of a Software Radio.Radio frequency implementation issues-The Purpose of the RFFront-End. Dynamic Range: The Principal Challenge of Receiver Design. RF Receiver Front-End Topologies. Enhanced Flexibility of the RF Chain with Software Radios. Importance of theComponents -Transmitter Architectures and their Issues. Noise and Distortion in the RF Chain.ADC and DAC Distortion.

UNITII:DirectDigitalSynthesis 9

Introduction. Comparison ofDirect DigitalSynthesis with Analog SignalSynthesis. Approachesto Direct Digital Synthesis. Analysis of Spurious Signals. Spurious Components due to PeriodicJitter. Band pass Signal Generation. Performance of Direct Digital Synthesis Systems. HybridDDS-PLL Systems. Applications of direct Digital Synthesis. Generation of Random Sequences.ROM Compression Techniques.

UNITIIISignalProcessorandMultiRateProcessing Techniques 9

Introduction.SampleRateConversionPrinciples.
PolyphaseFilters.DigitalFilterBanks.TimingRecovery in Digital Receivers Using Multirate Digital Filters.
DSPProcessors;FieldProgrammableGateArrays;Trade-OffsinUsingDSPs,FPGAs,andASICs; Power Management Issues; Using a Combination of DSPs, FPGAs, and ASICs.

UNITIV:Smart Antennas 9

Vector channel modeling; Benefits of smart antennas; Structures for Beam forming Systems;Smart Antenna Algorithms.Diversity and Space-Time Adaptive Signal Processing; Algorithmsfor Transmit STAP; Hardware Implementation of Smart Antennas; Array Calibration.

UNITV: Applications–WirelessAspectsofTele-Health Care 9

The application of advanced telecommunication , the special requirements especially related toreliability, privacy and trust, Regulatory and safety aspects of tele-health care, Cognitive radioand flexible spectrum usage for tele-healthcare, Cooperative Communications for Tele-

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

health.Case studies: JTRS radio system ,Software defined base stations.

TOTAL:45PERIODS

OUTCOMES:

Attheendofthiscourse,thestudentshouldbeableto

- CompareMACandnetworklayer designfor softwaredefinedradio
- DiscusscognitiveradioforInternetofThingsandM2Mtechnologies

BOOKSFORREFERENCES:

1. JeffreyH.Reed-SoftwareRadio:AModernApproachtoRadioEngineeringPublisher: Prentice Hall PTR; May 2002 ISBN: 0170811580.
2. WirelessCommunications:PrinciplesandPractice,2nded,byRappaport,Prentice-Hall 2002. ISBN 0-17-042232-0.
3. Wireless ApplicationDevelopment, bySkelton, Thomson,2003, ISBN0-622-15931-6

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE-IV
SEMESTERIII

22271E32B **SATELLITECOMMUNICATION** **LT PC**
3003

AIM:

Tounderstandthebasicsofsatelliteorbits.Tounderstandthesatellitesegmentandearth segment.

OBJECTIVES:

Thestudentsshould bemadeto be

- LearnM2Mdevelopmentsandsatellite applications
- UnderstandSatelliteCommunicationInIpv6Environment

UNITIORBITAL MECHANICS 9

Kepler's laws of motion, Orbits, Orbit Equations, Orbit Description, Locating the Satellite in theOrbit and with Respect to Earth, Orbital Elements-Look Angle Determination and Visibility - Orbital Perturbations,Orbit Determination, Launch Vehicles, Orbital Effects in CommunicationSystem - Performance Attitude control; Satellite launch vehicles. spectrum allocations forsatellite systems.

UNITIISPACECRAFTSUBSYSTEMSANDEARTH STATION 9

Spacecraft Subsystems, Altitude and Orbit Control, Telemetry and Tracking, PowerSystems,Communication Subsystems, Transponders, Antennas, Equipment Reliability, EarthStations, Example of payloads of operating and planned systems.

UNITIIISPACELINKS 9

The Space Link, Satellite Link Design - Satellite uplink -down link power Budget, BasicTransmission Theory, System Noise Temp, G/T Ratio, Noise Figure, Downlink Design, Designof Satellite Links for Specified C/N - Microwave Propagation on Satellite-Earth Paths.Interference between satellite circuits, EnergyDispersal, propagation characteristics of fixed andmobile satellite links.

UNITIVMULTIPLEACCESSTECHNIQUESANDNETWORKASPECTS 9

Single access vs. multiple access (MA). Classical MA techniques: FDMA, TDMA. Singlechannel per carrier (SCPC) access - Code division multiple access (CDMA). Demandassignment techniques. Examples of MA techniques for existing and planned systems (e.g. thesatellite component of UMTS).Mobile satellite network design, ATM via satellite. TCP/IP viasatellite - Call control, handover and call set up procedures.
Hybridsatellite-terrestrialnetworks

UNITVSERVICESAND APPLICATIONS 9

Fixed and mobile services - Multimedia satellite services - Advanced applications based onsatellite platforms - INTELSAT series - INSAT, VSAT, Remote Sensing - Mobile satelliteservice: GSM. GPS,INMARSAT, Navigation System, Direct to Home service (DTH), Specialservices, E-mail, Videoconferencing and Internet connectivity

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

OUTCOMES:

Attheendofthiscourse, thestudentshouldbeableto:

- Discusssatellitenavigationandglobalpositioningsystem
- Outlinedeepspacenetworksandinterplanetarymissions

BOOKSFORREFERENCES:

1. DennisRoddy,“SatelliteCommunications”,3rdEdition,McGrawHillInternational Editions, 2001
2. BruceR.Elbert,“IntroductiontoSatelliteCommunication”,ArtechHouseInc.,2299.
3. TimothyPratt,CharlesW.Bostian,JeremyAllnutt,“SatelliteCommunications”,2ndEdition, Wiley, John& Sons, 2002
4. WilburL.Pritchard,HendriG.Suyderhood,RobertA.Nelson,“SatelliteCommunication SystemsEngineering”, 2nd Edition, Prentice Hall, New Jersey, 2293
5. TriT.Ha,"Digitalsatellitecommunication",2ndEdition,McGrawHill,Newyork.2290.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE-IV
SEMESTERIII

22271E32C **CDMASYSTEMS** **LT PC**
3003

AIM:

Theaimofthiscourseistodefinethebasicsofcellularcommunicationsandexplainthe ArchitectureOFGSM&itsRadioChannels.

OBJECTIVES:

Thestudentsshould bemadeto be

- understand cellular concept, widelypopular 2G digital, TDMA based mobile systemGSM and modern mobile wireless system CDMA.

UNITIBASICCONCEPTS OFCDMA 9

Spread spectrum communication techniques (DS-CDMA, FH-CDMA),Synchronization inCDMA system, Detection and False alarm probabilities, Early-Late gate measurement statistics,Information capacity of Spread Spectrum Systems.

UNITIIIS-95 CDMA TECHNIQUES 9

SpreadingCodes,Powercontrol,Handovertechniques,Physicalandlogicalchannelsandprocessing (Forward and reverse links)

UNITIIIWCDMA /CDMA 2000 9

IntroductiontoIMT2000,CDMA2000-Physicallayercharacteristics,modulation&demodulationprocess , Handoff and power control in 3G systems.

UNITIVMULTICARRIERCDMA SYSTEMS 9

MulticarrierCDMA,Systemdesign,Performanceparameters–BERlowerbound,Multiuserdetection, UTRA, FDD and TDD systems.

UNITVOPTICALCDMA 9

Prime Codes and it’s properties, Generalized and Extended Prime Codes,Experimentaldemonstration of Optical CDMA, Synchronization of Optical CDMA networks, Multiwavelength Optical CDMA networks.

TOTAL:45PERIODS

OUTCOMES:

At theend ofthecourse,thestudent shouldbeableto:

- AnalyzeMIMOsystem.
- Discussmillimeterwavecommunication.
- Demonstratesoftwaredefined radio andcognitiveradio.

BOOKSFORREFERENCES:

1. JohnG.Proakis,“DigitalCommunications”,McGrawHillInternationalLtd,4thed., Singapore, 2000.
2. AndrewJ.Viterbi,“CDMA:PrinciplesofSpreadSpectrumCommunication”,Addison- Wesley, 1sted. , 2295.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

3. KavethPahlavan,.K.PrashanthKrishnamuorthy,"PrinciplesofWirelessNetworks",Prentice Hall of India, 2006.
4. Vijay Kumar Garg, “IS –95 CDMAand CDMA2000: Cellular/PCS Systems Implementation”, Pearson Education , 2st ed. , 2003.
5. RichardVan Nee,RamjeePrasad,”OFDMfor WirelessMultimediaCommunication”, Artech House , Boston ,London, 2000.
6. AndreasF.Molisch,“WirelessCommunication”,WileyIndia,2006.
7. RaymondSteele,Chin-ChunLee,PeterGould,“GSMCDMAOneand3GSystems”,Wiley India, 2004.
8. Guu-ChangYang,“PrimeCodeswithApplicationtoOpticaland WirelessNetworks”, Artech House, Inc., 2002.

LISTOF ELECTIVES

ELECTIVE–V(SEMESTERIII)

ELECTIVE- V
SEMESTERIII

22271E33A WAVELETSANDMULTIRESOLUTIONPROCESSING

L T PC
3003

AIM:

Tointroducethefundamentalsconceptsofwavelet transforms.

OBJECTIVE:

- Tostudysystemdesignusing Wavelets
- Tolearnthedifferentwaveletfamilies&theirapplications.

UNITI INTRODUCTION 9

Vector Spaces - properties - dot product - basis - dimension, orthogonality and orthonormality - relationship between vectors and signals - Signal spaces - concept of Convergence – GeneralisedFourier Expansion.

UNITIIMULTIRESOLUTIONANALYSIS 9

Definition of Multi Resolution Analysis (MRA) – Haar basis - Construction of generalorthonormal MRA Wavelet basis– Continuous time MRA interpretation for the DTWT – Discrete time MRA- Basis functions for the DTWT – PR-QMF filter banks

UNITIVDISCRETEWAVELETTRANSFORM 9

Filter Bank and sub band coding principles - Wavelet Filters - Inverse DWT computation byFilterbanks -Basic Properties of Filter coefficients - Choice of wavelet function coefficients - Derivations of Daubechies Wavelets - Multi-band Wavelet transforms. Introduction to liftingScheme

UNITVAPPLICATIONS 9

Signal Compression – Image Compression techniques: EZW-SPHIT Coding - Imagedenoisingtechniques:Noise estimation - Shrinkage rules -. Shrinkage Functions - Edge detectionand object Isolation, Image Fusion, and Object Detection.

TOTAL:45PERIODS

OUTCOME:

- Thestudentswillbeabletoapprehendthedetailedknowledgeabout the Wavelettransform & its applications.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

BOOKSFORREFERENCES:

1. Rao.R.MandA.S.Bopardikar,"WaveletTransforms: Introductiontotheoryand Applications”,Pearson Education Asia Pte. Ltd., 2000.
2. StrangG,NguyenT,"WaveletsandFilterBanks,"WellesleyCambridgePress,2296
3. VetterliM, KovacevicJ.,"WaveletsandSub-bandCoding,"PrenticeHall,2295
4. MallatS.,"WavelettourofSignalProcessing”, AcademicPress,2296
5. DavidC.Lay.,“LinearAlgebraand itsapplications”Pearsoneducation,2007.(UnitIonly)

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE- V
SEMESTERIII

22271E33B HIGHPERFORMANCECOMMUNICATION NETWORKS

L T PC
3003

AIM:

Tofamiliarizeconceptsandterminologyassociatedwith ATM,FrameRelay,MPLS, Bluetooth technology**.**

OBJECTIVES:

- Toappreciatetheneedforinteroperablenetworkmanagementasatypical distributed application
- To beaware ofcurrent trendsin networktechnologies

UNITIPACKETSWITCHED NETWORKS 9

OSIandIPmodels,Ethernet(IEEE802.3),Tokenring(IEEE802.5),WirelessLAN(IEEE802.11) FDDI,DQDB, SMDS: Internetworking with SMDS

UNITIIISDNANDBROADBAND ISDN 9

ISDN-overview,interfacesandfunctions,Layersandservices-SignalingSystem7(SS7)-Broadband ISDN architecture and Protocols.

UNITIIIATMANDFRAMERELAY 9

ATM: Main features-addressing, signaling and routing, ATM header structure-adaptation layer,management and control, ATM switching and transmission.

Frame Relay: Protocols and services,Congestion control,Internetworking with ATM,Internetand ATM, Frame relay via ATM.

UNITIVADVANCEDNETWORKARCHITECTURE 9

IP forwarding architectures overlay model, Multi Protocol Label Switching (MPLS), integratedservices in the Internet, Resource Reservation Protocol (RSVP), Differentiated services

UNITVBLUETOOTH TECHNOLOGY 9

The Bluetooth module-Protocol stack Part I: Antennas, Radio interface, Base band, The Linkcontroller, Audio, The Link Manager, The Host controller interface; The Bluetooth module-Protocolstack Part I:Logical link controland adaptation protocol, RFCOMM, Service discoveryprotocol, Wireless access protocol, Telephony control protocol.

TOTAL:45PERIODS

OUTCOMES:

Afterthecompletionofthiscourse,studentswillbeableto

- Diagnoseproblemsandmakeminorrepairstocomputernetworksusingappropriate diagnostics software
- DemonstratehowtocorrectlymaintainLANcomputersystems
- Maintainthenetworkbyperformingroutinemaintenancetasks
- Applynetworkmanagementtools

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

BOOKSFORREFERENCES:

1. William Stallings,”ISDN and Broadband ISDN with Frame Relay and ATM”, 4th edition,Pearsoneducation Asia, 2002.
2. LeonGracia,Widjaja,“Communicationnetworks",TataMcGraw-Hill,NewDelhi,2000.
3. JenniferBrayandCharlesF.Sturman,”BlueTooth”PearsoneducationAsia,2001.
4. SumitKasera,PankajSethi,“ATMNetworks",TataMcGraw-Hill,NewDelhi,2000.
5. RainerHandel,ManfredN.HuberandStefanSchroder,”ATMNetworks”,3rdedition,Pearsoneducation asia,2002.
6. JeanWalrandandPravinVaraiya,”HighPerformanceCommunicationnetworks”,2nd edition,Harcourt and Morgan Kauffman,London,2000.
7. WilliamStallings,”High-speedNetworksandInternets”,2ndedition,Pearsoneducation Asia, 2003.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE- V
SEMESTERIII

22271E33C ADVANCEDMICROPROCESSORSAND MICROCONTROLLERS
L T PC
3003

AIM:

Tointroducetheadvancedfeaturesinmicroprocessorsandmicrocontrollers.

OBJECTIVES:

- Toenablethestudentstounderstandvariousmicrocontrollerarchitectures
- Toexposethe studentstothefundamentalsofmicroprocessor architecture.

UNITIMICROPROCESSORARCHITECTURE 9

Instruction set – Data formats – Instruction formats – Addressing modes – Memory hierarchy – register file – Cache–Virtualmemoryandpaging –Segmentation–Pipelining –The instructionpipeline –pipeline hazards – Instruction level parallelism – reduced instruction set – Computerprinciples – RISC versus CISC – RISC properties – RISC evaluation – On-chip register filesversus cache evaluation

UNITIIHIGHPERFORMANCECISCARCHITECTURE– PENTIUM 9

The software model – functional description – CPU pin descriptions – RISC concepts – busoperations – Super scalar architecture – pipelining – Branch prediction – The instruction andcaches –Floating point unit –protected mode operation – Segmentation – paging – Protection –multitasking –Exception and interrupts – Input /Output – Virtual 8086 model – Interruptprocessing -Instruction types –Addressing modes – Processor flags – Instruction set -programming the Pentium processor.

UNITIVMOTOROLA68HC11MICROCONTROLLERS 9

Instructions and addressing modes – operating modes – Hardware reset – Interrupt system – ParallelI/O ports – Flags – Real time clock – Programmable timer – pulse accumulator – serialcommunication interface – A/D converter – hardware expansion – Assembly languageProgramming

UNITVPICMICROCONTROLLER 9

CPUarchitecture–Instructionset-Interrupts–Timers–I/Oportexpansion–I2Cbusforperipheral chip access – A/D converter – UART

TOTAL:45PERIODS

OUTCOMES:

- The studentwill be able to workwith a suitable microprocessor/ microcontrollerfora specific real world application.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENEUERSHIP**

BOOKSFORREFERENCES:

1. DanielTabak,‘’AdvancedMicroprocessors”McGrawHill.Inc.,2295
2. JamesL.Antonakos, “ThePentiumMicroprocessor‘’PearsonEducation,2297.
3. SteveFurber, ‘’ARMSystem–On–Chiparchitecture“AddisonWesley,2000.
4. Gene.H.Miller.”Micro ComputerEngineering,”PearsonEducation,2003.
5. John.B.Peatman,“DesignwithPICMicrocontroller,Prenticehall, 2297.
6. James L.Antonakos, An Introduction to the Intel family of Microprocessors”, PearsonEducation 2299.
7. Barry.B.Breg,”TheIntelMicroprocessorsArchitecture,ProgrammingandInterfacing“, PHI, 2002.
8. Valvano"EmbeddedMicrocomputerSystems"ThomsonAsiaPVTLTDfirstreprint2001

Readings : Web links: www.ocw.nit.edu,www.arm.com,

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

LISTOF ELECTIVES

ELECTIVE–VI(SEMESTERIII)

ELECTIVE- VI
SEMESTERIII

22271E34A SPACETIMEWIRELESSCOMMUNICATION LT PC
3003

AIM:

Theaimofthiscourseistoacquiretheknowledgeonvarious modulationand coding schemes for space-time WirelessCommunications.

OBJECTIVES:

Thestudentsshould bemadeto be

1. Tounderstandtransmissionanddecodingtechniquesassociated with WirelessCommunications.
2. Tounderstandmultiple-antennasystemssuchasmultiple-input multiple-output (MIMO)and Space-Time Codes.

UNITIMULTIPLEANTENNAPROPAGATION ANDSTCHANNEL CHARACTERIZATION 9

Model of speech and picture signals, Pseudo noise sequences, Non-linear sequences, Analogchannel model, Noise and fading, Digital channel model-Gilbert model of bursty channels, HF,Troposcatter and satellite channels, Switched telephone channels, Analog and Digitalcommunication system models, Light wave system models.

UNITIICAPACITYOFMULTIPLEANTENNACHANNELS 9

Capacity of frequency flat deterministic MIMO channel: Channel unknown to the transmitter,Channel known to the transmitter, capacity of random MIMO channels, Influence of riceanfading, fading correlation, XPD and degeneracy on MIMO capacity, Capacity of frequencyselective MIMO channels.

UNITIIISPATIAL DIVERSITY 9

Diversity gain, Receive antenna diversity, Transmit antenna diversity, Diversity order andchannel variability, Diversity performance in extended channels, Combined space and pathdiversity, Indirect transmit diversity, Diversity of a space-time- frequency selective fadingchannel.

UNITIV MULTIPLEANTENNACODING ANDRECEIVERS 9

Coding and interleaving architecture, ST coding for frequency flat channels, ST coding forfrequency selective channels, Receivers(SISO,SIMO,MIMO),Iterative MIMO receivers,Exploiting channel knowledge at the transmitter: linear pre-filtering, optimal pre-filtering formaximum rate, optimal pre-filtering for error rate minimization, selection at the transmitter,Exploiting imperfect channel knowledge.

UNITVSTOFDM,SPREADSPECTRUMANDMIMOMULTIUSERDETECTION 9

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

SISO-OFDM modulation, MIMO-OFDM modulation, Signaling and receivers for MIMOOFDM,SISO-SSmodulation,MIMO-SSmodulation,SignalingandreceiversforMIMO-SS.MIMOMAC,MIMO-BC,OutageperformanceforMIMO-MU,MIMO-MUwithOFDM, CDMAand multipleantennas.

TOTAL:45PERIODS

OUTCOMES:

At theend ofthiscourse,thestudent should beableto

- Tobeabletodesignandevaluatereceiverandtransmitterdiversitytechniques.
- TobeabletodesignanddevelopOFDMbasedMIMOsystems.
- TobeabletocalculatecapacityofMIMOsystems

BOOKSFORREFERENCES:

1. AndreViterbi "PrinciplesofSpread SpectrumTechniques"AddisonWesley2295
2. Jafarkhani,Hamid.Space-timecoding:Theory andPractice.CambridgeUniversity Press, 2005.
3. Paulraj,RohitNabar,DhananjayGore.,"IntroductiontoSpaceTimeWireless Communication Systems", Cambridge University Press, 2003
4. SergioVerdu"MultiUserDetection"CambridgeUniversityPress,2298

ELECTIVE- VI
SEMESTERIII

22271E34B MEDICAL IMAGING LT PC
3003

AIM:

Tostudytheproductionofx-raysanditsapplicationtodifferentmedicalImaging techniques.TostudythedifferenttypesofRadiodiagnostic techniques.

OBJECTIVES:

- Tostudythespecialimaging techniquesusedforvisualizingthecrosssectionsofthebody.
- Tostudytheimagingofsofttissuesusingultrasoundtechnique

UNITI PRINCIPLESOFRADIOGRAPHICEQUIPMENTS 8

X-Raytubes,coolingsystems,removalofscatters,constructionofimageIntensifiertubes,angiographic setup, digital radiology.

UNITII COMPUTERAIDEDTOMOGRAPHY 10

Need forsectional images,Principles of sectional scanning,Method of convolution and Back-Propagation, Methods of reconstruction, Artifacts, Principle of 3D imaging

UNITIII RADIOISOTOPICIMAGING 9

Radiationdetectors,Radioisotopicimagingequipment,scanners,Principleofsemiconductordetectors, Gamma ray camera, Positron Emission tomography.SPECT.

UNITIVULTRASONICSYSTEMS 9

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

Wave propagation and interaction in Biological tissues, Acoustic radiation, continuous andpulsed excitation, Transducers and imaging systems, Scanning methods, Principle of imagegeneration.

UNITV MAGNETICRESONANCEIMAGING 9

PrinciplesofMRI,Relaxationprocessesandtheirmeasurements,PulsesequencingandMRimage acquisition.

TOTAL:45PERIODS

OUTCOMES:

Attheendofthiscourse, thestudentsshouldbeableto:

- Explaincomputeraidedtomography
- Discussultrasonicsystems
- Outlinemagneticresonanceimaging

BOOKSFORREFERENCES:

1. D.N.ChesneyandM.O.ChesneyRadiographicimaging,CBSPublications,NewDelhi, 2287.
2. Peggy,W.,RogerD.Ferimarch,MRIforTechnologists,McGrawHill,NewYork,2295.
3. SteveWebb, ThePhysicsofMedicalImaging, Taylor&Francis, NewYork.2288.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE- VI
SEMESTERIII

22271E34C MOBILEADHOC NETWORKS L T PC
3003

AIM:

Theaimofthiscourse istounderstandthe basicsofAd-hoc &SensorNetworks.

OBJECTIVES:

- Tolearnvariousfundamentalandemerging protocolsofalllayers.
- Tostudyabout theissuespertainingto major obstacles inestablishment andefficient management of Ad-hoc and sensor networks.
- TounderstandthenatureandapplicationsofAd-hocandsensor networks.
- TounderstandvarioussecuritypracticesandprotocolsofAd-hocandSensor Networks.

UNITI INTRODUCTION 9

Introduction to Ad Hoc networks – definition, characteristics features, applications.Characteristics of Wireless channel, Adhoc Mobility Models: - entity and group models.

UNITIIMEDIUMACCESSPROTOCOLS 9

MAC Protocols: design issues, goals and classification. Contention based protocols, reservationbased protocols, scheduling algorithms, protocols using directional antennas. IEEE standards:802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.

UNITIIINETWORKPROTOCOLS 9

Addressing issues in ad hoc network, Routing Protocols: Design issues, goals and classification.Proactive Vs reactive routing, Unicast routing algorithms, Multicast routing algorithms, hybridrouting algorithm, Power/ Energy aware routing algorithm,Hierarchical Routing, QoS awarerouting.

UNITIVEND-TO-ENDDELIVERYANDSECURITY 9

Transport layer: Issues in designing- Transport layer classification, adhoc transport protocols.Security issues in adhoc networks: issues and challenges, network security attacks, securerouting protocols.

UNITVCROSS LAYER DESIGN ANDINTEGRATIONOFADHOC FOR 4G9

CrosslayerDesign:Need forcrosslayerdesign,crosslayeroptimization,parameteroptimizationtechniques, Cross layer cautionaryperspective, Co-operative networks:-Architecture, methodsofcooperation, co-operative antennas, Integrationofad hoc networkswithother wired and wirelessnetworks.

TOTAL:45PERIODS

OUTCOMES:

UponCompletionofthecourse, thestudentsshould beableto

- Identifydifferentissuesinwirelessadhocandsensornetworks.
- Toanalyzeprotocolsdevelopedforadhocandsensornetworks.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

- Toidentifyandaddressthesecuritythreatsinadhocandsensornetworks.
- EstablishaSensornetworkenvironmentfordifferenttypesofapplications.

BOOKSFORREFERENCES:

1. C.Siva Ram Murthy and B.S.Manoj, “Ad Hoc Wireless Networks Architectures and protocols”, 2nd edition, Pearson Education, 2007.
2. CharlesE.Perkins,“AdhocNetworking”,Addison–Wesley, 2000.
3. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, “Mobile Ad Hoc networking”, Wiley-IEEE press, 2004.
4. MohammadIlyas, “Thehandbookofadhocwirelessnetworks”, CRCpress,2002.
5. T. Camp, J. Boleng, and V. Davies “A Survey of Mobility Models for Ad Hoc Network Research,” Wireless Communication and Mobile Comp., Special Issue on Mobile Ad Hoc Networking Research, Trends and Applications, vol. 2,no. 5, 2002, pp. 483–502.
6. Fekri M. Abduljalil and Shrikant K. Bodhe , “A survey of integrating IP mobility protocols and Mobile Ad hoc networks”, IEEE communication Survey and tutorials, v 9.no.1 2007.
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PRIST
DEEMED TO BE
UNIVERSITY
NAAC ACCREDITED
THANJAVUR – 613 403 - TAMIL NADU

SCHOOLOFENGINEERINGANDTECHNOLOGY

DEPARTMENTOF
ELECTRONICS&COMMUNICATIONENGINEERING

PROGRAMHANDBOOK

B.TECH–FULLTIME

[REGULATION2021]

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

B.TECH(FULLTIME)–ECE–R-2021

PROGRAMEDUCATIONALOBJECTIVES (PEOs)

PEO1: To provide the students with a strong foundation in the required sciences in order to pursue studies in Electronics and Communication Engineering.

PEO2: To gain adequate knowledge to become good professional in electronic and communication engineering associated industries, higher education and research.

PEO3: To develop attitude in lifelong learning, applying and adapting new ideas and technologies as their field evolves.

PEO4: To prepare students to critically analyze existingliterature in an area of specialization and ethically develop innovative and research oriented methodologies to solve the problems identified.

PEO5: To inculcate in the students a professional and ethical attitude and an ability to visualize the engineering issues in a broader social context.

PROGRAMOUTCOMES(POs)

PO1:**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2:**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3:**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4:**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5:**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6:**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilitiesrelevant to the professional engineering practice.

PO7:**Environmentandsustainability**:Understandthe impact oftheprofessionalengineering solutions in societaland environmentalcontexts, and demonstrate the knowledge of, and need for sustainable development.

PO8:**Ethics**: Apply ethical principles and commit to professional ethics and responsibilitiesand norms of the engineering practice.

PO9:**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: **Communication:** Communicate effectively on complex engineering activities with the engineering communityand withsocietyat large, suchas, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: **Project management and finance:** Demonstrate knowledge and understanding of the engineeringand management principles andapplythesetoone'sownwork, asamember and leader in a team, to manage projects and in multidisciplinary environments.

PO12: **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFICOUTCOMES (PSOs)

PSO1: Design, develop and analyze electronic systems through application of relevant electronics, mathematics and engineering principles

PSO2: Design, develop and analyze communication systems through application of fundamentals from communication principles, signal processing, and RF System Design & Electromagnetics.

PSO3: Adapt to emerging electronics and communication technologies and develop innovative solutions for existing and newer problems

B.TECH(FULLTIME)–ECE–R-2021 I -

VIII SEMESTERS CURRICULUM

SEMESTER I

Sl. No.	COURSE CODE	COURSETITLE	L	T	P	C
THEORY						
1.	21147IP	InductionProgramme	-	-	-	0
2.	21147S11	ProfessionalEnglish-I	3	0	0	3
3.	21148S12	MatricesandCalculus	3	1	0	4
4.	21149S13	EngineeringPhysics	3	0	0	3
5.	21149S14	EngineeringChemistry	3	0	0	3
6.	21150S15	ProblemSolvingandPython Programming	3	0	0	3
PRACTICALS						
7.	21150L16	ProblemSolvingandPython ProgrammingLaboratory	0	0	4	2
8.	21149L17	PhysicsandChemistryLaboratory	0	0	4	2
9.	21147L18	CommunicationLab –I	0	0	2	1
		TOTAL	15	1	10	**21**

SEMESTER II

Sl. No.	COURSE CODE	COURSETITLE	L	T	P	C
THEORY						
1.	21147S21	ProfessionalEnglish–II(COMMON TOCIVIL, CSE,EEE,ECE,MECH)	3	0	0	3
2.	21148S22	StatisticsandNumericalMethods (COMMONTOCIVIL,CSE,EEE, ECE, MECH)	3	1	0	4
3.	21149S23B	PhysicsforElectronicsEngineering	3	0	0	3
4.	21154S24	EngineeringGraphics(COMMONTO CIVIL, CSE,EEE,ECE,MECH)	2	0	4	4
5.	21153S25B	Electrical and Instrumentation Engineering	3	0	0	3
6.	21153S26 A	CircuitAnalysis	3	1	0	4
PRACTICALS						
7.	21154L27	EngineeringPractices Laboratory(COMMONTOALL)	0	0	4	2
8.	21153L28 A	CircuitsAnalysisLaboratory	0	0	4	2
9.	21147L29	CommunicationLab –II	0	0	4	2
		TOTAL	17	2	16	**27**

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

SEMESTER III

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
THEORY						
1.	21148S31B	RandomProcessesandLinearAlgebra	3	1	0	4
2.	21152S32	ControlSystems	3	0	0	3
3.	21152S33	CProgrammingandData Structures	3	0	0	3
4.	21152C34	DigitalSystemsDesign	3	0	2	4
5.	21152C35	SignalsandSystems	3	1	0	4
6.	21152C36	ElectronicDevicesandCircuits	3	0	0	3
PRACTICALS						
7.	21152L37	CProgrammingandData Structures Lab	0	0	4	2
8.	21152L38	ElectronicDevicesandCircuitsLab	0	0	4	2
9.	21152L39	ProfessionalDevelopment	0	0	2	1
		TOTAL	18	2	12	**26**

SEMESTER IV

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
THEORY						
1.	21152C41	ElectromagneticFields	3	0	0	3
2.	21152C42	LinearIntegratedCircuits	3	0	0	3
3.	21152C43	CommunicationSystems	3	0	0	3
4.	21152C44	DigitalSignalProcessing	3	0	2	4
5.	21152C45	NetworksandSecurity	3	0	2	4
6.	21149S46	EnvironmentalSciencesand Sustainability	2	0	0	2
PRACTICALS						
7.	21152L47	LinearIntegratedCircuits Laboratory	0	0	4	2
8.	21152L48	CommunicationSystems Laboratory	0	0	4	2
		TOTAL	17	0	12	**23**

SEMESTERV

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
THEORY						
1.	21152C51	WirelessCommunication	3	0	2	4
2.	21152C52	VLSIandChipDesign	3	0	0	3
3.	21152C53	TransmissionLinesandRFSystems	3	0	0	3
4.	**21152E54_**	**Elective-I**	3	0	0	3
5.	**21152E55_**	**Elective–II**	3	0	0	3
6.	**21152E56_**	**Elective-III**	3	0	0	3
7.	**21147MC57_**	**MandatoryCourse-I**	3	0	0	0
PRACTICALS						
8.	20152L58	VLSILaboratory	0	0	4	2
		TOTAL	21	0	4	**21**

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

SEMESTER VI

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
THEORY						
1.	21152S61	EmbeddedSystemsandIOTDesign	3	0	2	4
2.	21152S62	ArtificialIntelligenceandMachineLearning	3	0	2	4
3.	**211 OE63_**	**OpenElective -I**	3	0	0	3
4.	**21152E64_**	**Elective–IV**	3	0	0	3
5.	**21152E65_**	**Elective–V**	3	0	0	3
6.	**21152E66_**	**Elective–VI**	3	0	0	3
7.	**21147MC67_**	**MandatoryCourse-II**	3	0	0	0
		TOTAL	21	0	4	**20**

SEMESTER VII

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
THEORY						
1.	211S71	HumanValuesandEthics	2	0	0	2
2.	**21160S72_**	**Elective-VII**	3	0	0	3
3.	**211_ _OE73_**	**OpenElective – II**	3	0	0	3
4.	**211_ _OE74_**	**OpenElective – III**	3	0	0	3
5.	**211_ _OE75_**	**OpenElective – IV**	3	0	0	3
PRACTICALS						
6.	21152INT76	SummerInternship	0	0	0	2
		TOTAL	14	0	0	**16**

SEMESTERVIII

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
PRACTICALS						
1.	21152P81	ProjectWork	0	0	20	10
		TOTAL	0	0	20	**10**
		TOTALNO.OFCREDITS:				**164**

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

LISTOF ELECTIVES

ELECTIVE-I(SEMESTERV)

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
1.	21152E54A	OpticalCommunication Networks	3	0	0	3
2.	21152E54B	4G/5GCommunication Networks	3	0	0	3
3.	21152E54C	AvionicsSystems	3	0	0	3

ELECTIVE–II(SEMESTERV)

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
1.	21152E55A	SatelliteCommunication	3	0	0	3
2.	21152E55B	ImageProcessing	3	0	0	3
3.	21152E55C	SpeechProcessing	3	0	0	3

ELECTIVE–III(SEMESTERV)

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
1.	21152E56A	DSPArchitectureandProgramming	3	0	0	3
2.	21152E56B	AdvancedDigitalSignalProcessing	3	0	0	3
3.	21152E56C	ComputerVision	3	0	0	3

ELECTIVE– IV(SEMESTER VI)

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
1.	21152E64A	SoftwareDefinedRadio	3	0	0	3
2.	21152E64B	SoftwareDefinedNetworks	3	0	0	3
3.	21152E64C	MassiveMIMO Networks	3	0	0	3

ELECTIVE-V(SEMESTERVI)

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
1.	21152E65A	Advanced WirelessCommunication Techniques	3	0	0	3
2.	21152E65B	MEMS Design	3	0	0	3
3.	21152E65C	Fundamentalsof Nanoelectronics	3	0	0	3

ELECTIVE-VI(SEMESTERVI)

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
1.	21152E66A	RemoteSensing	3	0	0	3
2.	21152E66B	WirelessSensorNetwork Design	3	0	0	3
3.	21152E66C	WearableDevices	3	0	0	3

LISTOFMANDATORYCOURSES

ELECTIVE-I(SEMESTERV)

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
4.	21152E54A	OpticalCommunication Networks	3	0	0	3
5.	21152E54B	4G/5GCommunication Networks	3	0	0	3
6.	21152E54C	AvionicsSystems	3	0	0	3

ELECTIVE–II(SEMESTERV)

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
4.	21152E55A	SatelliteCommunication	3	0	0	3
5.	21152E55B	ImageProcessing	3	0	0	3
6.	21152E55C	SpeechProcessing	3	0	0	3

LISTOFOPENELECTIVES

OPENELECTIVE–I(SEMESTERVI)

Sl. No	DEPT	COURSE CODE	COURSETITLE	L	T	P	C
1.	Civil	21155OE63	ClimateChangeandits Impact	3	0	0	3
2.	EEE	21153OE63	RenewableEnergySystem	3	0	0	3
3.	Mech	21154OE63	IntroductiontoIndustrial Engineering	3	0	0	3
4.	CSE	21150OE63	GraphTheory	3	0	0	3
5.	ECE **	21152OE63	DeepLearning	3	0	0	3

**Applicablefor other Departments

OPENELECTIVE–II(SEMESTERVII)

SKILL DEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

Sl. No	DEPT	COURSE CODE	COURSETITLE	L	T	P	C
1.	Civil	21155OE73	ICTinAgriculture	3	0	0	3
2.	EEE	21153OE73	IntroductiontoControl Engineering	3	0	0	3
3.	Mech	21154OE73	AviationManagement	3	0	0	3
4.	CSE	21150OE73	Dev-Ops	3	0	0	3
5.	ECE **	21152OE73	RoboticsProcessAutomation	3	0	0	3

**Applicablefor other Departments

OPENELECTIVE–III(SEMESTERVII)

Sl. No	DEPT	COURSE CODE	COURSETITLE	L	T	P	C
1.	Eng	21147OE74	EnglishforCompetitive Examinations	3	0	0	3
2.	Civil	21155OE74A	RemoteSensingConcepts	3	0	0	3
3.	Civil	21155OE74B	DrinkingWaterSupplyand Treatment	3	0	0	3
4.	EEE	21153OE74A	RenewableEnergy Technologies	3	0	0	3
5.	EEE	21153OE74B	ElectricandHybridVehicle	3	0	0	3
6.	Mech	21154OE74A	IndustrialManagement	3	0	0	3
7.	Mech	21154OE74B	IntroductiontoNonDestructive Testing	3	0	0	3
8.	ECE **	21152OE74A	BiomedicalInstrumentation	3	0	0	3
9.	ECE **	21152OE74B	FundamentalsofElectronicDevices and Circuits	3	0	0	3

**Applicablefor other Departments

OPENELECTIVE–IV(SEMESTERVII)

Sl. No	DEPT	COURSE CODE	COURSETITLE	L	T	P	C
1.	Civil	21155OE75A	GeographicalInformation System	3	0	0	3
2.	Civil	21155OE75B	BasicsofIntegratedWater Resources Management	3	0	0	3
3.	EEE	21153OE75A	Sensors	3	0	0	3

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

4.	EEE	21153OE75B	Electrical,Electronicand Magnetic materials	3	0	0	3
5.	Mech	21154OE75A	AdditiveManufacturing	3	0	0	3
6.	Mech	21154OE75B	IndustrialSafety	3	0	0	3
7.	ECE **	21152OE75A	Wearabledevices	3	0	0	3
8.	ECE **	21152OE75B	MedicalInformatics	3	0	0	3

**Applicablefor other Departments

LISTOFMANDATORYCOURSES

MANDATORYCOURSE–I(SEMESTER V)

Sl. No	COURSE CODE	COURSETITLE	L	T	P	C
1.	21147MC57A	IntroductiontoWomenand Gender Studies	3	0	0	3
2.	21147MC57B	ElementsofLiterature	3	0	0	3
3.	21147MC57C	FilmAppreciation	3	0	0	3
4.	21147MC51B	DisasterManagement	3	0	0	3

MANDATORYCOURSE –II(SEMESTERVI)

Sl. No	COURSE CODE	COURSETITLE	L	T	P	C
1.	21147MC67A	Well Being with TraditionalPractices(Yoga,Ayurvedaand Siddha)	3	0	0	3
2.	21147MC57B	HistoryofScienceandTechnology in India	3	0	0	3
3.	21147MC57C	PoliticalandEconomicThoughtfor a Humane Society	3	0	0	3
4.	21147MC57D	State,NationBuildingandPolitics in India	3	0	0	3

SKILL DEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

B.TECH(FULLTIME)–ECE–R-2021

CREDITSDISTRIBUTION
CGPA CREDITS

Sem.	CoreCourses				Elective Courses				Foundation Courses		Mandatory Courses		TOTAL CGPACredits
	Theory Courses		Practical Courses		Dept.Elective		OpenElective						
	Nos.	Credits	Nos.	Credits	Nos.	Credits	Nos.	Credits	Nos.	Credits	Nos.	Credits	
I	01	3	03	5	-	-	-	-	04	13	-	-	21
II	02	7	03	6	-	-	-	-	04	14	-	-	27
III	05	17	03	5	-	-	-	-	01	4	-	-	26
IV	05	17	02	4	-	-	-	-	01	2	-	-	23
V	03	10	01	2	03	9	-	-	-	-	1	0	21
VI	02	8	-	-	03	9	01	3	-	-	1	0	20
VII	-	-	01	2	01	3	03	9	01	2	-	-	16
VIII	-	-	01	10	-	-	-	-	-	-	-	-	10
TOTALCREDITS													**164**

NONCGPACREDITS

Sem.	Non-CGPACredits	
	NoofCourses	Credits
I	01	00
II	-	-
III	-	-
IV	-	-
V	01	00
VI	01	00
VII	-	-
VIII	-	-
Total	**03**	**00**

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

21147IP INDUCTIONPROGRAMME

Thisisamandatory2weekprogrammetobeconductedassoonasthestudentsentertheinstitution. Normal classes start only after the induction program is over.

TheinductionprogrammehasbeenintroducedbyAICTEwiththefollowingobjective:

“Engineering colleges were established to train graduates well in the branch/department ofadmission, have a holistic outlook, and have a desire to workfor national needs and beyond.The graduating student must have knowledge and skills in the area of his/her study.However, he/she must also have a broad understanding of society and relationships.Character needs to be nurturedas an essential quality by which he/she would understand andfulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above,several meta-skills and underlying values are needed.”

“One will have to work closely with the newly joined studentsin making them feelcomfortable, allow them to explore their academic interests and activities, reducecompetition and make them work for excellence, promote bonding within them, buildrelations between teachers and students, give a broader view of life, and build character.”

Hence, the purpose of this programme is to make the students feel comfortable in their newenvironment, open them up, set a healthy daily routine, createbonding in the batch as wellas between faculty and students, develop awareness, sensitivity and understanding of theself, peoplearound them, society at large, and nature.

The following are the activities under the induction program in which the student would befully engaged throughout the day for the entire duration of the program.

(i) PhysicalActivity

Thiswouldinvolveadailyroutineofphysicalactivitywithgamesandsports,yoga,gardening,etc.

(ii) Creative Arts

Every student would choose one skill related to the arts whether visual arts or performingarts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursueit everyday for the duration of the program. These would allow for creative expression. Itwould develop a sense of aesthetics and alsoenhancecreativitywhichwould,hopefully,growintoengineeringdesignlater.

(iii) UniversalHumanValues

This is the anchoring activity of the Induction Programme. It gets the student to exploreoneself andallows one to experience the joy of learning, stand up to peer pressure, makedecisions with courage, be aware of relationships with colleagues and supporting stay in thehostel and department, be sensitive to others, etc. A module in Universal Human Valuesprovides the base. Methodology ofteaching this content is extremely important. It must notbe through do's and don'ts, but get students to explore and think by engaging them in adialogue. It is best taught through group discussions and real life activities rather thanlecturing.
Discussionswouldbeconductedinsmallgroupsof about20studentswithafaculty
mentor each. It would be effective that the faculty mentor assigned is also the facultyadvisor for the student for the full duration of the UG programme.

(iv) LiteraryActivity

Literaryactivitywouldencompassreading,writingandpossibly,debating,enactingaplayetc.

(v) ProficiencyModules

Thiswouldaddresssomelacunasthatstudentsmighthave,forexample,English,computerfamiliarity etc.

(vi) LecturesbyEminentPeople

Motivationallecturesbyeminentpeoplefrom all walksoflifeshould be arrangedtogivethe students exposure to people who are socially active or in public life.

(vii) VisitstoLocalArea

Acouple of visits to the landmarks of the city, or a hospital or orphanage could be organized.Thiswould familiarize them with the area as well as expose them to the underprivileged.

(viii) FamiliarizationtoDept./Branch&Innovations

They should be toldabout what gettinginto abranch or department means what role it playsinsociety, throughitstechnology. Theyshould alsobeshownthelaboratories,workshops &other facilities.

(ix) DepartmentSpecificActivities

About a week can be spent in introducing activities (games, quizzes, social interactions,small experiments, design thinking etc.) that are relevant to the particular branch ofEngineering/ Technology / Architecture that can serve as a motivation and kindle interest inbuilding things (become a maker) in that particular field. This can be conducted in the formofaworkshop. For example, CSEand ITstudentsmaybeintroducedtoactivitiesthat kindlecomputational thinking, and get them to build simple games. ECE students may beintroduced to building simple circuits asan extension of their knowledge in Science, and soon. Students may be asked to build stuff using their knowledge of science.

Induction Programme istotallyan activitybased programme and thereforethere shallbe notests / assessments during this programme.

21147S11 **PROFESSIONALENGLISH-I** LTPC 3104

COURSEOBJECTIVES:

- Toimprovethecommunicative competenceoflearners
- Tohelplearnersuselanguageeffectivelyinacademic/workcontexts
- To build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
- Todeveloplearners'ability toreadandwritecomplextexts,summaries,articles,blogs, definitions, essays and user manuals.
- Touselanguageefficientlyinexpressingtheiropinions viavariousmedia.

INTRODUCTIONTOEFFECTIVECOMMUNICATION 1

- Whatiseffectivecommunication?(Therearemanyinterestingactivitiesforthis.)
- Whyiscommunicationcriticalforexcellenceduringstudy,researchand work?
- What arethesevenC'sofeffective communication?
- Whatarekeylanguageskills?
- Whatiseffective listening?What doesitinvolve?
- Whatiseffectivespeaking?
- Whatdoesitmeantobeanexcellentreader?Whatshouldyoubeabletodo?
- Whatiseffectivewriting?
- Howdoesonedeveloplanguageandcommunicationskills?
- What does the course focus on? How are communication and language skills going to be enhancedduring this course? What do you as a learner need to do to enhanceyourEnglish language and communication skills to get the best out of this course?

UNITI INTRODUCTIONTOFUNDAMENTALSOFCOMMUNICATION 11

Listening –for general information-specific details- conversation: Introduction to classmates -Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages;Listening and filling a form

Speaking - Self Introduction; Introducing a friend; Conversation - politeness strategies;Telephone conversation; Leave a voicemail; Leave a message with another person; askingfor information to fill details in a form.

Reading - Reading brochures (technical context), telephone messages / social mediamessages relevant to technical contexts and emails.

Writing-Writingemails/lettersintroducingoneself

Grammar-PresentTense(simpleandprogressive);Questiontypes:Wh/YesorNo/andTagsVocabulary -Synonyms; One word substitution; Abbreviations & Acronyms (as used intechnicalcontexts).

UNITII NARRATIONANDSUMMATION 12

Listening - Listening to podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities.

Speaking-Narratingpersonalexperiences/events;Interviewingacelebrity;Reporting/andsummarizing documentaries / podcasts/ interviews.

SKILL DEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

Reading-Readingbiographies,travelogues,newspaperreports,Excerptsfromliterature,andtravel & technical blogs.
Writing-Guidedwriting--ParagraphwritingShortReportonanevent(fieldtrip etc.)Grammar –Past tense (simple); Subject-Verb Agreement; andPrepositions
Vocabulary-Wordforms(prefixes&suffixes);SynonymsandAntonyms.Phrasalverbs.

UNITIII DESCRIPTIONOFAPROCESS/PRODUCT 12

Listening - Listen to a product and process descriptions; a classroom lecture; andadvertisementsabout products.
Speaking–Picturedescription;givinginstructiontousetheproduct;Presentingaproduct;andSummarizing a lecture.
Reading–Readingadvertisements, gadget reviews;usermanuals.Writing - Writing definitions; instructions; and Product /Processdescription.
Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses.Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers(connectives &sequence words)

UNITIV CLASSIFICATIONANDRECOMMENDATIONS 12

eports–andNonVerbalCommunication(tables,piechartsetc,)
Writing –Note-making /Note-taking (*Studyskillstobe taught,nottested;Writing recommendations;Transferringinformationfromnon verbal(chart,graphetc,toverbal mode)
Grammar – Articles; Pronouns - Possessive & Relative pronouns.
Vocabulary-Collocations;Fixed/Semifixedexpressions.

UNITV EXPRESSION 12

Listening – Listening to debates/ discussions; different viewpoints on an issue; and paneldiscussions.
Speaking–groupdiscussions,Debates, andExpressingopinionsthroughSimulations &Roleplay.Reading – Reading editorials; and Opinion Blogs;
Writing–EssayWriting(Descriptiveornarrative).
Grammar – Future Tenses, Punctuation; Negation (Statements & Questions); and Simple,Compound & Complex Sentences.
Vocabulary-Cause&EffectExpressions–ContentvsFunctionwords.

TOTAL:60PERIODS

COURSEOUTCOMES:

Attheendofthecourse,learnerswillbe able

- Tolistenandcomprehendcomplexacademictexts
- Toreadandinfer thedenotativeandconnotativemeaningsoftechnicaltexts
- Towritedefinitions,descriptions, narrationsandessaysonvarioustopics
- Tospeakfluentlyandaccuratelyinformalandinformalcommunicative contexts
- Toexpresstheiropinionseffectivelyin bothoraland writtenmediumofcommunication

TEXTBOOKS:

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

1. English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English, Anna University, (2020 edition).
2. Englishfor Science&TechnologyCambridgeUniversityPress,2021.
3. AuthoredbyDr.VeenaSelvam,Dr.SujathaPriyadarshini, Dr.DeepaMaryFrancis,Dr. KN.Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCES:

1. Technical Communication–PrinciplesandPracticesBy Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
2. A Course Book on Technical English By Lakshmi Narayanan, Scitech Publications (India) Pvt. Ltd.
3. EnglishFor TechnicalCommunication(WithCD)ByAyshaViswamohan, McgrawHill Education, ISBN : 0070264244.
4. EffectiveCommunicationSkill,KulbhusanKumar,RSSalaria,KhannaPublishingHouse.
5. LearningtoCommunicate–Dr.V.Chellammal,AlliedPublishingHouse,NewDelhi,2003

CO's-PO's &PSO's MAPPING CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	1	1	1	1	3	3	3	1	3	-	3	-	-	-
2	1	1	1	1	1	3	3	3	1	3	-	3	-	-	-
3	2	3	2	3	2	3	3	3	2	3	3	3	-	-	-
4	2	3	2	3	2	3	3	3	2	3	3	3	-	-	-
5	2	3	3	3	-	3	3	3	2	3	-	3	-	-	-
AVg.	**1.6**	**2.2**	**1.8**	**2.2**	**1.5**	**3**	**3**	**3**	**1.6**	**3**	**3**	**3**	**-**	**-**	**-**

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1-low,2-medium, 3-high,'-'-no correlation

21148S12 **MATRICESANDCALCULUS**

L	T	P	C
3	**1**	**0**	**4**

COURSEOBJECTIVES:

- To develop the use of matrixalgebra techniques that areneeded byengineers for practical applications.
- Tofamiliarizethestudentswithdifferentialcalculus.
- Tofamiliarizethestudentwithfunctionsofseveralvariables. Thisisneededinmany branches of engineering.
- Tomakethe studentsunderstand varioustechniquesofintegration.
- Toacquaintthestudentwithmathematicaltools neededinevaluatingmultipleintegralsand

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

theirapplications.

UNITI MATRICES 9+3

EigenvaluesandEigenvectorsofarealmatrix–Characteristicequation–Propertiesof Eigenvalues and Eigenvectors – Cayley - Hamilton theorem – Diagonalization of matricesby orthogonal transformation – Reduction of a quadratic form to canonical form byorthogonal transformation – Nature of quadratic forms –Applications: Stretching of anelastic membrane.

UNITII DIFFERENTIALCALCULUS 9+3

Representationoffunctions-Limitofafunction-Continuity- Derivatives-Differentiation rules(sum,product,quotient,chainrules)-Implicitdifferentiation-Logarithmicdifferentiation - Applications: Maxima and Minima of functions of one variable.

UNITIII FUNCTIONSOFSEVERALVARIABLES 9+3

Partialdifferentiation–HomogeneousfunctionsandEuler'stheorem–Totalderivative– Change of variables –Jacobians – Partial differentiation of implicit functions – Taylor'sseries for functions of two variables – Applications: Maxima and minima of functions oftwo variables and Lagrange'smethod of undetermined multipliers.

UNITIV INTEGRALCALCULUS 9+3

DefiniteandIndefiniteintegrals-Substitutionrule-TechniquesofIntegration:Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rationalfunctions by partial fraction, Integration of irrational functions - Improper integrals - Applications:Hydrostaticforceand pressure, momentsandcentres ofmass.

UNITV MULTIPLEINTEGRALS 9+3

Doubleintegrals–Changeoforderofintegration–Doubleintegralsinpolarcoordinates– Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variablesin double andtriple integrals – Applications:Moments and centresof mass, momentofinertia.

TOTAL:60PERIODS

COURSEOUTCOMES:

Attheendofthecoursethestudentswillbeableto

- Usethematrixalgebramethodsforsolvingpracticalproblems.
- Applydifferentialcalculustoolsinsolvingvariousapplicationproblems.
- Abletousedifferentialcalculusideasonseveralvariablefunctions.
- Applydifferent methodsofintegrationinsolving practicalproblems.
- Applymultipleintegralideas insolvingareas,volumesandother practicalproblems.

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1. yszig.E, vanced ineering thematics", n ey and Sons,

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

10th Edition,NewDelhi,2016.
2. Grewal.B.S.,“Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 44th Edition , 2018.
3. JamesStewart,"Calculus:EarlyTranscendentals",CengageLearning,8thEdition,New Delhi,2015.[ForUnitsII&IV -Sections1.1,2.2,2.3,2.5,2.7 (Tangentsproblemsonly), 2.8,3.1to3.6,3.11,4.1,4.3,5.1(Areaproblemsonly),5.2,5.3,5.4(excludingnetchange theorem),5.5,7.1-7.4and7.8].

REFERENCES:

1. Anton.H,Bivens.IandDavis.S,"Calculus",Wiley,10thEdition,2016
2. Bali. N., Goyal. M. and Watkins. C., “Advanced Engineering Mathematics”,FirewallMedia(An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7thEdition, 2009.
3. Jain.R.K. and Iyengar.S.R.K.,“Advanced Engineering Mathematics”,Narosa Publications, NewDelhi, 5thEdition, 2016.
4. Narayanan.S.andManicavachagomPillai.T.K.,“Calculus"VolumeIandII, S.ViswanathanPublishersPvt.Ltd.,Chennai,2009.
5. Ramana.B.V.,"HigherEngineeringMathematics", McGraw HillEducationPvt.Ltd, New Delhi, 2016.
6. Srimantha Paland Bhunia.S.C,“EngineeringMathematics"OxfordUniversityPress, 2015.
7. Thomas.G.B.,Hass.J,and Weir.M.D,"Thomas Calculus",14thEdition,Pearson India, 2018.

CO’s-PO’s &PSO’s MAPPING CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
CO2	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
CO3	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
CO4	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
CO5	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
Avg	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-

1-low,2-medium, 3-high,‘-'-no correlation

21149S13 ENGINEERINGPHYSICS LTPC
3003

COURSEOBJECTIVES:

- Tomakethe studentseffectivelyachieveanunderstandingofmechanics.
- Toenablethestudentsto gainknowledgeofelectromagneticwavesandits applications.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEUERSHIP

- Tointroducethebasicsofoscillations,opticsandlasers.
- Equippingthestudentsto successfullyunderstand theimportanceofquantumphysics.
- Tomotivatethestudentstowardstheapplicationsofquantummechanics.

UNITI MECHANICS 9

Multi-particledynamics:Centerofmass(CM)–CMofcontinuousbodies–motionofthe CM–kineticenergyofthesystemofparticles.Rotationofrigidbodies:Rotational kinematics – rotationalkineticenergyandmomentofinertia-theoremsofM.I–momentof inertia of continuous bodies –

of a diatomic molecule - torque – rotational dynamics of rigid bodies – conservation of angularmomentum–rotational energystate ofarigid diatomicmolecule - gyroscope -torsional pendulum– double pendulum –Introduction to nonlinear oscillations.

UNITII ELECTROMAGNETICWAVES 9

TheMaxwell'sequations-waveequation;Planeelectromagneticwavesinvacuum, Conditionsonthewavefield-

propertiesofelectromagneticwaves:speed,amplitude,phase,orientation and waves in matter - polarization - Producing electromagnetic waves - Energyand momentum in EM waves: Intensity, waves from localized sources, momentum andradiation pressure - Cell-phone reception. Reflection and transmission of electromagneticwaves from a non-conducting medium- vacuum interface for normal incidence.

UNITIII OSCILLATIONS,OPTICSANDLASERS 9

Simpleharmonicmotion-resonance–analogybetweenelectricalandmechanicaloscillating systems - waves on a string - standingwaves - travelingwaves - Energy transfer of a wave - sound waves - Doppler effect. Reflection and refraction of light waves - total internalreflection-interference–Michelsoninterferometer–

Theoryofairwedgeandexperiment.Theoryoflaser-characteristics-

Spontaneousandstimulatedemission-

Einstein'scoefficients-populationinversion-Nd-YAGlaser,CO_2laser,semiconductor laser–Basicapplicationsoflasersinindustry.

UNITIV BASICQUANTUMMECHANICS 9

Photonsandlightwaves-Electronsandmatterwaves–Comptoneffect-TheSchrodinger equation (Time dependent and time independent forms) - meaning of wave function- Normalization –Free particle - particle in a infinite potential well: 1D,2D and 3D Boxes- Normalization, probabilities and the correspondence principle.

UNITV APPLIEDQUANTUMMECHANICS 9

The harmonic oscillator(qualitative)- Barrier penetration and quantum tunneling(qualitative)- Tunneling microscope - Resonant diode - Finite potential wells(qualitative)- Bloch's theoremfor particles in aperiodic potential –Basics of Kronig-Penneymodel and origin of energy bands.

SKILL DEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

TOTAL:45PERIODS

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

COURSEOUTCOMES:

Aftercompletionofthiscourse,thestudentsshouldbeable to

- Understandtheimportanceofmechanics.
- Expresstheirknowledgeinelectromagneticwaves.
- Demonstrateastrongfoundationalknowledgeinoscillations,opticsandlasers.
- Understandtheimportance ofquantumphysics.
- Comprehendandapply quantummechanicalprinciplestowardstheformationofenergy bands.

TEXTBOOKS:

1. D.Kleppner and R.Kolenkow. An IntroductiontoMechanics. McGraw HillEducation (IndianEdition), 2017.
2. E.M.PurcellandD.J.Morin,ElectricityandMagnetism, CambridgeUniv.Press, 2013.
3. Arthur Beiser,Shobhit Mahajan, S.RaiChoudhury, Concepts ofModernPhysics, McGraw-Hill (Indian Edition), 2017.

REFERENCES:

1. R.Wolfson.EssentialUniversityPhysics.Volume 1&2.PearsonEducation(Indian Edition),2009.
2. PaulA. Tipler,Physic–Volume1&2, CBS,(IndianEdition),2004.
3. K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications,LaxmiPublications, (Indian Edition), 2019.
4. D.Halliday,R.ResnickandJ.Walker.PrinciplesofPhysics,Wiley(IndianEdition),2015.
5. N.Garcia,A.DamaskandS.Schwarz.PhysicsforComputerScienceStudents.Springer- Verlag, 2012.

CO's-PO's &PSO's MAPPINGCO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	3	2	1	1	1	-	-	-	-	-	-	-	-	-
2	3	3	2	1	2	1	-	-	-	-	-	-	-	-	-
3	3	3	2	2	2	1	-	-	-	-	-	1	-	-	-
4	3	3	1	1	2	1	-		-	-	-	-	-	-	-
5	3	3	1	1	2	1	-	-	-	-	-	-	-	-	-
AVG	3	3	1.6	1.2	1.8	1	-	-	-	-	-	1	-	-	-

1-low,2-medium, 3-high,'-'-no correlation

21149S14 **ENGINEERINGCHEMISTRY** **LTPC**
3003

COURSEOBJECTIVES:

- To inculcate sound understanding of water quality parameters and water treatmenttechniques.
- Toimpartknowledge onthebasicprinciplesandpreparatorymethodsofnanomaterials.
- Tointroducethebasicconceptsandapplications ofphaseruleand composites.
- Tofacilitatetheunderstandingofdifferenttypesoffuels,theirpreparation,propertiesand

combustioncharacteristics.

- Tofamiliarizethestudentswiththeoperatingprinciples,workingprocessesand applications of energy conversion and storage devices.

UNITI WATERANDITS TREATMENT 9

Water:Sourcesandimpurities,Waterqualityparameters:Definitionandsignificanceof-color, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD, fluoride and arsenic.Municipal water treatment: primary treatment and disinfection (UV, Ozonation, break-pointchlorination).Desalination of brackish water: Reverse Osmosis. Boiler troubles: Scale andsludge, Boiler corrosion, Caustic embrittlement, Priming & foaming. Treatment of boilerfeed water: Internal treatment (phosphate, colloidal, sodium aluminate and calgonconditioning) and External treatment –Ionexchangedemineralizationandzeoliteprocess.

UNITII NANOCHEMISTRY 9

Basics:Distinctionbetweenmolecules,nanomaterialsandbulkmaterials;Size-dependent properties (optical, electrical, mechanical and magnetic); Types of nanomaterials:Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire andnanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemicalvapour deposition, electrochemical deposition and electro spinning. Applications ofnanomaterials in medicine, agriculture, energy, electronics and catalysis.

UNITIII PHASERULEANDCOMPOSITES 9

Phaserule:Introduction,definitionoftermswithexamples.Onecomponentsystem-water system;Reduced phase rule; Construction of a simple eutectic phase diagram - Thermalanalysis; Two component system: lead-silver system - Pattinson process.
Composites: Introduction: Definition & Need for composites; Constitution: Matrixmaterials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber,particulates, flakes and whiskers). Properties and applications of: Metal matrix composites(MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites -definition and examples.

UNITIV FUELSANDCOMBUSTION 9

Fuels:Introduction:Classificationoffuels;Coalandcoke:Analysisofcoal(proximateand ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method).Petroleumand Diesel: Manufacture of synthetic petrol (Bergius process), Knocking -octanenumber, diesel oil -cetanenumber;Poweralcoholandbiodiesel.
Combustion of fuels: Introduction: Calorific value - higher and lower calorific values,Theoreticalcalculationofcalorificvalue;Ignitiontemperature:spontaneousignition temperature,Explosiverange;Fluegasanalysis-ORSATMethod.CO_2emissionand carbonfootprint.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

UNITV ENERGYSOURCESANDSTORAGEDEVICES 9

Stabilityofnucleus:massdefect(problems),bindingenergy;Nuclearenergy:lightwater nuclearpowerplant,breederreactor.Solarenergyconversion:Principle,workingand applicationsofsolarcells;Recentdevelopmentsinsolarcellmaterials.Windenergy; Geothermalenergy;Batteries:Typesofbatteries,Primarybattery-drycell,Secondary battery-leadacidbatteryandlithium-ion-battery;Electricvehicles-workingprinciples; Fuelcells:H_2-O_2fuelcell,microbialfuelcell;Supercapacitors:Storageprinciple,typesand examples.

TOTAL:45PERIODS

COURSEOUTCOMES:

Attheendofthecourse,thestudentswillbeable:

- To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
- To identify and apply basic concepts of nanoscience and nanotechnology in designingthe synthesis of nanomaterials for engineering and technology applications.
- Toapplytheknowledgeofphaseruleandcompositesformaterialselection requirements.
- Torecommendsuitablefuelsforengineeringprocessesandapplications.
- Torecognizedifferentformsofenergyresourcesandapplythemforsuitable applications in energy sectors.

TEXTBOOKS:

1. P. C. Jain and Monica Jain, “Engineering Chemistry”, 17th Edition, Dhanpat RaiPublishing Company (P) Ltd, New Delhi, 2018.
2. Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company Ltd, NewDelhi, 2008.
3. S.S. Dara, “A Text book of Engineering Chemistry”, S. Chand Publishing, 12thEdition,2018

REFERENCES:

1. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, “Text book of nanoscience and nanotechnology”, Universities Press-IIM Series in Metallurgy andMaterials Science, 2018.
2. O.G.Palanna,“EngineeringChemistry”McGrawHillEducation(India)PrivateLimited,2nd Edition,2017.
3. Friedrich Emich, “Engineering Chemistry”, Scientific International PVT, LTD, New Delhi, 2014.
4. ShikhaAgarwal,“EngineeringChemistry-FundamentalsandApplications”,Cambridge University Press, Delhi, Second Edition, 2019.
5. O.V.RoussakandH.D.Gesser,AppliedChemistry-ATextBookforEngineersand Technologists, Springer Science Business Media, New York, 2nd Edition, 2013.

CO’s-PO’s&PSO’s MAPPIN	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO 3

SKILL DEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

GCO															
1	3	2	2	1	-	1	1	-	-	-	-	1	-	-	-
2	2	-	-	1	-	2	2	-	-	-	-	-	-	-	-
3	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
4	3	1	1	-	-	1	2	-	-	-	-	-	-	-	-
5	3	1	2	1	-	2	2	-	-	-	-	2	-	-	-
CO	**2.8**	**1.3**	**1.6**	**1**	**-**	**1.5**	**1.8**	**-**	**-**	**-**	**1.5**	-	-	-	

1-low,2-medium, 3-high,'-'-no correlation

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

0S15	**PROBLEMSOLVINGANDPYTHONPROGRAMMING**	**L**		**C**
		3	**0**	

COURSEOBJECTIVES:

- Tounderstandthebasicsofalgorithmicproblemsolving.
- TolearntosolveproblemsusingPythonconditionalsandloops.
- TodefinePythonfunctionsand usefunctioncallstosolve problems.
- TousePythondatastructures-lists,tuples, dictionariestorepresentcomplexdata.
- Todoinput/output withfilesinPython.

UNITI COMPUTATIONALTHINKINGANDPROBLEMSOLVING 9

FundamentalsofComputing–IdentificationofComputationalProblems-Algorithms,building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code,flowchart,programminglanguage),algorithmicproblemsolving,simplestrategiesfor developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert acard in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNITII DATATYPES,EXPRESSIONS, STATEMENTS 9

Pythoninterpreterandinteractivemode,debugging;valuesandtypes:int,float,boolean,string , and list; variables, expressions, statements, tuple assignment, precedence of operators, comments;Illustrative programs: exchange the values of two variables, circulate the values of n variables,distance between two points.

UNITIII CONTROLFLOW,FUNCTIONS,STRINGS 9

Conditionals:Booleanvaluesandoperators,conditional(if),alternative(if-else),chainedconditional (if-elif-else);Iteration: state, while, for, break, continue, pass; Fruitful functions: returnvalues,parameters, local and global scope, function composition, recursion; Strings:stringslices,immutability, string functions and methods, string module; Lists as arrays. Illustrativeprograms: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNITIV LISTS,TUPLES, DICTIONARIES 9

Lists:listoperations,listslices,listmethods,listloop,mutability,aliasing,cloninglists,list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods;advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram,Students marks statement, Retail bill preparation.

UNITV FILES,MODULES,PACKAGES 9

Filesandexceptions:textfiles,readingandwritingfiles,formatoperator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs:word count, copy file, Voter's age validation, Marks range validation (0-100).

TOTAL:45PERIODS

COURSEOUTCOMES:

Uponcompletionofthecourse,studentswillbeableto

CO1:Developalgorithmicsolutionstosimplecomputationalproblems.

CO2:DevelopandexecutesimplePythonprograms.

CO3:WritesimplePythonprogramsusingconditionalsandloopsforsolvingproblems. CO4: Decompose a Python program into functions.

CO5:RepresentcompounddatausingPythonlists,tuples,dictionariesetc. CO6: Read and write data from/to files in Python programs.

TEXTBOOKS:

1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, "ComputationalThinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

REFERENCES:

1. PaulDeitelandHarveyDeitel,"PythonforProgrammers",PearsonEducation,1stEdition,2021.
2. GVenkatesh andMadhavan Mukund,"ComputationalThinking:A PrimerforProgrammersand Data Scientists", 1st Edition, Notion Press, 2021.
3. JohnVGuttag, "Introductionto Computationand ProgrammingUsingPython: WithApplicationsto Computational Modeling and Understanding Data", Third Edition,MIT Press, 2021
4. EricMatthes, "PythonCrashCourse, AHands- onProject BasedIntroductiontoProgramming", 2nd Edition, No Starch Press, 2019.
5. https://www.python.org/
6. MartinC.Brown,"Python:TheCompleteReference",4thEdition, Mc-GrawHill,2018.

CO's-PO's&PSO'sMAPPING CO's					**PO's**					**PSO's**				
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	
1	3	3	3	3	2	-	-	-	-	-	2	2	3	3
2	3	3	3	3	2	-	-	-	-	-	2	2	3	-
3	3	3	3	3	2	-	-	-	-	-	2	-	3	-
4	2	2	-	2	2	-	-	-	-	-	1	-	3	-
5	1	2	-	-	1	-	-	-	-	-	1	-	2	-
6	2	2	-	-	2	-	-	-	-	-	1	-	2	-
AVg.	**2**	**3**	**3**	**3**	**2**	-	-	-	-	-	**2**	**2**	**3**	**3**

1-low,2-medium, 3-high,'-'-no correlation

21150L16 PROBLEMSOLVINGANDPYTHONPROGRAMMINGLABORATORY LTPC

0042

COURSEOBJECTIVES:

- Tounderstandtheproblemsolvingapproaches.
- TolearnthebasicprogrammingconstructsinPython.
- Topractice variouscomputingstrategiesforPython-basedsolutionstorealworld problems.
- TousePythondatastructures-lists,tuples,dictionaries.

- Todoinput/output withfilesinPython.

EXPERIMENTS:

Note:Theexamplessuggestedineachexperimentareonlyindicative.Thelabinstructorisexpectedtodesignother problems on similar lines. The Examination shall not be restricted to the sample experiments listed here.

1. Identificationand solving of simple real life or scientific or technical problems, and developingflow charts for the same. (ElectricityBilling, Retailshop billing, Sinseries, weight ofa motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions (exchange the values oftwo variables,circulate the values of n variables, distance between two points).
3. Scientific problemsusing Conditionalsand Iterative loops. (Number series, Number Patterns,pyramidpattern)
4. Implementing real-time/technical applications using Lists, Tuples. (Items present in alibrary/Components of a car/ Materials required for construction of a building –operations of list &tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of anautomobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. ImplementingprogramsusingFunctions.(Factorial,largest numberinalist,areaofshape)
7. ImplementingprogramsusingStrings.(reverse,palindrome,charactercount,replacingcharacters)
8. Implementing programsusing writtenmodulesand PythonStandard Libraries(pandas,numpy.Matplotlib, scipy)
9. Implementingreal-time/technicalapplicationsusingFile handling. (copyfromone filetoanother,word count, longest word)
10. Implementingreal-time/technicalapplicationsusingExceptionhandling. (divide byzero error,voter'sage validity, student mark range validation)
11. ExploringPygametool.
12. DevelopingagameactivityusingPygamelikebouncingball,carraceetc.

TOTAL:60PERIODS

COURSEOUTCOMES:

Oncompletionofthecourse,studentswillbeable to:

CO1:Developalgorithmicsolutionstosimplecomputationalproblems

CO2: Develop and execute simple Python programs.

CO3:ImplementprogramsinPythonusingconditionalsandloopsforsolvingproblems. CO4: Deploy functions to decompose a Python program.

CO5:ProcesscompounddatausingPythondatastructures.

CO6:UtilizePythonpackagesindevelopingsoftwareapplications.

TEXTBOOKS:

1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

REFERENCES:

1. PaulDeitelandHarveyDeitel,"Pythonfor Programmers",PearsonEducation,1st Edition,2021.
2. GVenkatesh andMadhavan Mukund,"Computational Thinking:A PrimerforProgrammersand Data Scientists", 1st Edition, Notion Press, 2021.
3. JohnVGuttag, "Introductionto Computationand ProgrammingUsingPython: WithApplicationsto Computational Modeling and Understanding Data", Third Edition,MIT Press, 2021.
4. EricMatthes, "PythonCrashCourse, AHands- onProject BasedIntroductiontoProgramming", 2nd Edition, No Starch Press, 2019.
5. https://www.python.org/
6. MartinC.Brown,"Python:TheCompleteReference",4th Edition, Mc-GrawHill,2018.

CO's-PO's&PSO'sMAPPING CO's					PO's					PSO's				
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	
1	3	3	3	3	3	-	-	-	-	-	3	2	3	3
2	3	3	3	3	3	-	-	-	-	-	3	2	3	-
3	3	3	3	3	2	-	-	-	-	-	2	-	3	-
4	3	2	-	2	2	-	-	-	-	-	1	-	3	-
5	1	2	-	-	1	-	-	-	-	-	1	-	2	-
6	2	-	-	-	2	-	-	-	-	-	1	-	2	-
AVg.	**2**	**3**	**3**	**3**	**2**	-	-	-	-	-	**2**	**2**	**3**	**3**

1-low,2-medium, 3-high,'-'-no correlation

21149L17 PHYSICSANDCHEMISTRYLABORATORY LTPC0042

PHYSICSLABORATORY:(AnySeven Experiments)

COURSEOBJECTIVES:

- Tolearntheproperuseofvariouskindsofphysicslaboratoryequipment.
- Tolearnhowdatacanbecollected,presentedandinterpretedinaclearandconcisemanner.
- Tolearnproblemsolvingskillsrelatedtophysicsprinciplesandinterpretationofexperimental data.
- Todetermineerrorinexperimentalmeasurementsandtechniquesusedtominimizesucherror.
- Tomakethestudentanactive participantineachpartofalllabexercises.

1. Torsionalpendulum- Determinationofrigiditymodulusofwireand momentofinertiaofregular and irregular objects.
2. Simpleharmonicoscillationsofcantilever.
3. Non-uniformbending-DeterminationofYoung'smodulus
4. Uniformbending–DeterminationofYoung'smodulus
5. Laser-Determinationofthewavelengthofthelaserusing grating

6. Air wedge -Determinationofthicknessofathinsheet/wire
7. a)Opticalfibre-DeterminationofNumericalApertureandacceptanceangle
   b)Compactdisc-Determinationofwidthofthegrooveusinglaser.
8. Acousticgrating-Determinationofvelocityofultrasonicwavesinliquids.
9. Ultrasonic interferometer–determinationofthevelocityofsoundandcompressibilityofliquids
10. Postofficebox-DeterminationofBandgapofasemiconductor.
11. Photoelectriceffect
12. MichelsonInterferometer.
13. Melde'sstringexperiment
14. Experimentwithlatticedynamics kit.

TOTAL:30PERIODS

COURSEOUTCOMES:

Uponcompletionofthecourse,thestudentsshouldbeableto

- Understandthefunctioningofvariousphysics laboratoryequipment.
- Usegraphicalmodelstoanalyzelaboratorydata.
- Usemathematicalmodelsasamediumforquantitativereasoninganddescribing physicalreality.
- Access,processandanalyzescientificinformation.
- Solveproblemsindividuallyandcollaboratively.

CHEMISTRYLABORATORY:(Anysevenexperimentstobeconducted)

COURSE OBJECTIVES:

- Toinculcateexperimentalskillstotest basicunderstandingofwater qualityparameters,suchas, acidity, alkalinity, hardness, DO, chloride and copper.
- Toinducethestudentstofamiliarizewithelectroanalyticaltechniquessuchas, pHmetry, potentiometryandconductometryinthedeterminationofimpuritiesinaqueoussolutions.
- Todemonstratetheanalysisofmetalsandalloys.
- Todemonstratethesynthesisofnanoparticles

1. PreparationofNa_2CO_3asaprimarystandardandestimationofacidityofawatersampleusing the primary standard
2. Determinationoftypesand amount ofalkalinityinawatersample.
- Splitthefirstexperimentintotwo
3. Determinationoftotal, temporary&permanenthardness ofwaterbyEDTA method.
4. DeterminationofDOcontentofwatersamplebyWinkler's method.
5. DeterminationofchloridecontentofwatersamplebyArgentometric method.
6. EstimationofcoppercontentofthegivensolutionbyIodometry.
7. EstimationofTDSofawatersamplebygravimetry.
8. Determinationofstrengthofgivenhydrochloricacid using pHmeter.
9. Determinationofstrengthofacidsinamixtureofacidsusingconductivitymeter.
10. Conductometrictitrationofbariumchlorideagainstsodiumsulphate(precipitationtitration)
11. Estimationofironcontentofthegivensolutionusingpotentiometer.
12. Estimationofsodium/potassiumpresentinwaterusingaflame photometer.
13. Preparationofnanoparticles (TiO_2/ZnO/CuO)bySol-Gelmethod.
14. EstimationofNickelinsteel
15. ProximateanalysisofCoal

TOTAL:30PERIODS

COURSEOUTCOMES:

- Toanalysethequalityofwatersampleswithrespecttotheiracidity,alkalinity,hardnessand DO.
- Todeterminetheamountofmetalionsthrough volumetricandspectroscopic techniques
- Toanalyseanddeterminethecompositionofalloys.
- Tolearnsimplemethodofsynthesisofnanoparticles
- Toquantitativelyanalysetheimpuritiesinsolutionbyelectroanalyticaltechniques

TEXTBOOKS:

1. J.Mendham,R.C.Denney,J.D.Barnes,M.ThomasandB.Sivasankar,Vogel's Textbookof Quantitative Chemical Analysis (2009).

CO's-PO's&PSO's MAPPINGCO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	3	2	3	1	1	-	-	-	-	-	-	-	-	-	-
2	3	3	2	1	1	-	-	-	-	-	-	-	-	-	-
3	3	2	3	1	1	-	-	-	-	-	-	-	-	-	-
4	3	3	2	1	1	-	-	-	-	-	-	-	-	-	-
5	3	2	3	1	1	-	-	-	-	-	-	-	-	-	-
AVG	3			2.4				2.6		1			1		

1-low,2-medium, 3-high,'-'-no correlation

21147S21 PROFESSIONALENGLISH-II L TPC
2002

COURSEOBJECTIVES:

- To engagelearnersin meaningful language activitiestoimprovetheirreadingand writing skills
- To learn various reading strategies and apply in comprehending documents in professional context.
- Tohelplearnersunderstandthepurpose, audience,contextsofdifferent typesofwriting
- Todevelopanalyticalthinkingskillsforproblemsolvingincommunicative contexts
- Todemonstrateanunderstandingofjobapplicationsand interviewsfor internshipand placements

UNITI MAKINGCOMPARISONS 6

Reading - Reading advertisements, user manuals, brochures; Writing – Professional emails,Email etiquette - Compare and Contrast Essay; Grammar – Mixed Tenses, Prepositionalphrases

UNITIIEXPRESSINGCAUSALRELATIONSINSPEAKINGANDWRITING 6

Reading - Reading longer technical texts– Cause and Effect Essays, and Letters / emails ofcomplaint, Writing - Writing responses to complaints. Grammar - Active Passive Voicetransformations, Infinitive and Gerunds

UNITIII PROBLEMSOLVING 6

Reading-CaseStudies,excerptsfrom literarytexts,newsreports etc.Writing–Letterto the

Editor,Checklists,Problemsolutionessay/ArgumentativeEssay.Grammar–Errorcorrection; If conditional sentences

UNITIV REPORTINGOFEVENTSANDRESEARCH 6

Reading –Newspaper articles; Writing – Recommendations, Transcoding, Accident Report,Survey Report Grammar – Reported Speech, Modals Vocabulary – Conjunctions- use ofprepositions

UNITV THEABILITYTOPUTIDEASORINFORMATIONCOGENTLY 6

Reading – Company profiles, Statement of Purpose, (SOP), an excerpt of interview withprofessionals; Writing – Job / Internship application – Cover letter & Resume; Grammar –Numericaladjectives, Relative Clauses.

TOTAL:30PERIODS

COURSEOUTCOMES:

Attheendofthecourse,learnerswillbe able

CO1:Tocompareandcontrastproductsandideasintechnicaltexts.

CO2:To identify and report cause and effects in events, industrial processes through technicaltexts**CO3**:Toanalyseproblemsinordertoarriveatfeasiblesolutionsand communicatetheminthewritten format.

CO4:Topresenttheirideasandopinionsinaplannedandlogicalmanner

CO5:Todrafteffectiveresumesinthecontextofjobsearch.

TEXTBOOKS:

1. EnglishforEngineers&Technologists (2020 edition) Orient Blackswan Private Ltd. Department of English, Anna University.
2. Englishfor Science&TechnologyCambridgeUniversityPress 2021.
3. Authored byDr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa MaryFrancis, Dr. KN.Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCEBOOKS:

1. Raman. Meenakshi, Sharma. Sangeeta (2019). ProfessionalEnglish. Oxford universitypress. New Delhi.
2. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, NewDelhi.
3. LearningtoCommunicate–Dr.V.Chellammal.AlliedPublishers, NewDelhi,2003
4. BusinessCorrespondence and Report Writing byProf. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
5. Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd.1990, Delhi.

ASSESSMENTPATTERN

Two internal assessments and an end semester examination to test students' reading and writingskills along with their grammatical and lexical competence.

CO's-PO's&PSO'sMAPPING

CO	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12	SO1	SO2	SO3
1	3	3	3	3	3	3	3	3	2	3	3	3	-	-	-
2	3	3	3	3	3	3	3	3	2	3	3	3	-	-	-
3	3	3	3	3	3	3	3	3	2	3	3	3	-	-	-
4	3	3	3	3	2	3	3	3	2	3	3	3	-	-	-
5	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**-**	**-**	**-**
Vg.	**3**	**3**	**3**	**3**	**.75**	**3**	**3**	**3**	**2.2**	**3**	**3**	**3**	**-**	**-**	**-**

1-low,2-medium,3-high,'-"-nocorrelation

Note: Theaveragevalueofthiscoursetobeusedforprogramarticulationmatrix.

21148S22

STATISTICSANDNUMERICALMETHODS **LTPC**

310

4

COURSEOBJECTIVES:

- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kindsof problems occurring in engineering and technology.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- Tointroducethebasicconceptsofsolving algebraicand transcendentalequations.
- To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNITI TESTINGOFHYPOTHESIS 9+3

Sampling distributions - Tests for single mean, proportion and difference of means (Largeand small samples) – Tests for single variance and equality of variances – Chi square test forgoodness of fit –Independence of attributes.

UNITII DESIGNOFEXPERIMENTS 9+3

One way and two way classifications - Completely randomized design – Randomized blockdesign –Latin square design - 2^2 factorial design.

UNITIII SOLUTIONOFEQUATIONSANDEIGENVALUEPROBLEMS 9+3

Solutionofalgebraicandtranscendentalequations-Fixedpointiterationmethod–Newton Raphsonmethod-Solutionoflinearsystemofequations-Gausseliminationmethod–Pivoting-GaussJordanmethod–IterativemethodsofGaussJacobiandGaussSeidel-EigenvaluesofamatrixbyPowermethodandJacobi'smethodforsymmetricmatrices.

UNITIV INTERPOLATION,NUMERICALDIFFERENTIATIONANDNUMERICAL INTEGRATION 9 +3

Lagrange'sandNewton'sdivideddifferenceinterpolations–Newton'sforwardand backward difference interpolation – Approximation of derivates usinginterpolation polynomials–NumericalsingleanddoubleintegrationsusingTrapezoidalandSimpson's 1/3rules.

UNITV NUMERICALSOLUTIONOFORDINARYDIFFERENTIALEQUATIONS 9+3

Single step methods: Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order differential equations - Multi stepmethods: Milne's and Adams - Bash forth predictor corrector methods for solving first orderdifferential equations.

TOTAL:60 PERIODS

COURSEOUTCOMES:

Uponsuccessfulcompletionofthecourse,studentswillbeableto:

CO1:Apply the concept of testing of hypothesis for small and large samples in real life problems.CO2:Applythebasicconceptsofclassificationsofdesignofexperimentsinthe fieldofagriculture. CO3:Appreciate the numerical techniques of interpolation in various intervals and apply thenumerical techniques of differentiation andintegration for engineering problems.

CO4:Understand the knowledge ofvarious techniques and methods for solvingfirstandsecondorder ordinary differential equations.

CO5:Solve thepartial andordinarydifferential equations with initial and boundary conditions byusing certain techniques with engineering applications.

TEXTBOOKS:

1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10^{th} Edition, New Delhi, 2015.
2. Johnson,R.A.,Miller,IandFreundJ.,"MillerandFreund'sProbabilityandStatistics forEngineers", Pearson Education, Asia, 8^{th} Edition, 2015.

REFERENCES:

1. Burden,R.LandFaires,J.D,"NumericalAnalysis",9^{th}Edition, CengageLearning, 2016.
2. Devore.J.L.,"ProbabilityandStatisticsforEngineeringandtheSciences",Cengage Learning, New Delhi, 8^{th} Edition, 2014.
3. Gerald. C.F. andWheatley. P.O. "AppliedNumericalAnalysis" PearsonEducation, Asia, New Delhi, 7^{th} Edition, 2007.
4. Gupta S.C. and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12^{th} Edition, 2020.
5. Spiegel. M.R., Schiller. J. and Srinivasan.R.A., "Schaum's Outlines on Probability and Statistics ", Tata McGraw Hill Edition, 4^{th} Edition, 2012.
6. Walpole.R.E., Myers. R.H., Myers. S.L. andYe.K., "Probabilityand Statistics for Engineers and Scientists", 9^{th} Edition, Pearson Education, Asia, 2010.

CO's-PO's &PSO's MAPPING CO	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
CO2	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
CO3	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
CO4	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
CO5	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
Avg	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-

1-low,2-medium,3-high,'-"-nocorrelation

Note: Theaveragevalueofthiscoursetobeusedforprogramarticulationmatrix.

21149S23B	**PHYSICSFORELECTRONICSENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSEOBJECTIVES:

- Tomakethestudentstounderstandthebasicsofcrystallographyanditsimportancein studying materials properties.
- Tounderstandtheelectricalpropertiesofmaterialsincludingfreeelectrontheory, applications of quantum mechanics and magnetic materials.
- Toinstilknowledgeonphysicsofsemiconductors,determinationofchargecarriersand device applications
- To establish a sound grasp of knowledge on different optical properties of materials, optical displays and applications
- To inculcate an idea of significance of nano structures, quantum confinement and ensuingnano device applications.

UNITI CRYSTALLOGRAPHY 9

Crystal structures: Crystal lattice– basis - unit cell and lattice parameters– crystal systemsandBravaislattices–StructureandpackingfractionsofSC,BCC,FCC,diamondcubic, NaCL,ZnSstructures–crystalplanes,directionsandMillerindices–distancebetween successiveplanes–linearandplanardensities–crystallineandnoncrystallinematerials– Example use of Miller indices: wafer surface orientation – wafer flats and notches – patternalignment - imperfections in crystals.

UNITII ELECTRICALANDMAGNETICPROPERTIESOFMATERIALS 9

Classicalfreeelectrontheory-Expressionfor electricalconductivity– Thermalconductivity,expression - Quantum free electron theory :Tunneling – degenerate states – Fermi- Diracstatistics – Density of energy states – Electron in periodic potential – Energy bands in solids – tightbinding approximation - Electron effective mass – concept of hole. Magnetic materials: Dia,para and ferromagnetic effects – paramagnetism in the conduction electrons in metals– exchange interaction and ferromagnetism – quantum interference devices – GMR devices.

UNITIII SEMICONDUCTORSANDTRANSPORTPHYSICS 9

Intrinsic Semiconductors – Energy band diagram– direct and indirect band gap semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors-CarrierconcentrationinN-type&P-typesemiconductors–Variationof carrier concentration with temperature – Carrier transport in Semiconductors: Drift, mobilityand diffusion – Hall effect and devices – Ohmiccontacts –Schottkydiode.

UNITIV OPTICALPROPERTIESOFMATERIALS 9

Classificationofopticalmaterials–Opticalprocessesinsemiconductors:opticalabsorption andemission,chargeinjectionandrecombination,opticalabsorption,lossandgain.Optical processesinquantumwells–Optoelectronicdevices:lightdetectorsandsolarcells–light emittingdiode–laserdiode-opticalprocessesinorganicsemiconductordevices–excitonic state–Electro-opticsandnonlinearoptics:Modulatorsandswitchingdevices–plasmonics.

UNITV NANODEVICES 9

Densityofstatesforsolids- SignificancebetweenFermienergyand volumeofthe material – Quantumconfinement– Quantumstructures– Density ofstatesforquantumwells,wires and dots–Bandgapofnanomaterials–Tunneling–Singleelectronphenomena–Singleelectron Transistor.Conductivityofmetallicnanowires–Ballistictransport–Quantumresistanceand conductance–Carbonnanotubes:Propertiesandapplications-Spintronicdevicesandapplications – Optics in quantum structures – quantum well laser.

TOTAL:45PERIODS

COURSEOUTCOMES:

Attheendofthecourse,thestudentsshouldbeable to

CO1:knowbasicsofcrystallographyanditsimportanceforvariedmaterialsproperties

CO2:gainknowledgeontheelectricalandmagneticpropertiesofmaterialsandtheir applications **CO3**:understand clearly of semiconductor physics and functioning of semiconductor devices **CO4**:understand the optical properties of materials and working principlesofvariousopticaldevices**CO5**:appreciatetheimportanceofnanotechnologyand nanodevices.

TEXTBOOKS:

1. S.O. Kasap.Principles of Electronic Materials and Devices, McGraw Hill Education (IndianEdition), 2020.
2. R.F.Pierret.SemiconductorDeviceFundamentals.Pearson(IndianEdition),2006.
3. G.W.Hanson.FundamentalsofNanoelectronics.PearsonEducation(IndianEdition),2009.

REFERENCES:

1. Laszlo Solymar,Walsh,Donald,Syms and Richard R.A., Electrical Properties ofMaterials, Oxford Univ. Press (Indian Edition) 2015.
2. JaspritSingh,SemiconductorOptoelectronics:PhysicsandTechnology,McGraw-Hill Education (Indian Edition), 2019.
3. CharlesKittel, IntroductiontoSolidStatePhysics,WileyIndiaEdition, 2019.
4. MarkFox,OpticalPropertiesofSolids,OxfordUniv.Press,2001.
5. N.Gershenfeld.ThePhysicsofInformationTechnology. CambridgeUniversityPress,2011.

CO's-PO's&PSO'sMAPPING

O	O1	O2	O3	PO	O5	O6	O7	O8	O9	O10	O11	O12	SO1	SO2	SO3
1	3	-	1	-	-	-	-	-	-	-	-	-	-	-	-
2	3	2	1	2	-	2	-	-	-	-	-	-	-	-	-
3	3	2	2	-	2	-	-	-	-	-	-	-	-	-	-
4	3	-	1	-	3	2	3	-	-	-	-	1	-	-	-
5	3	-	2	1	-	2	-	-	-	-	-	1	-	-	-
VG	3	2	1.4	1.5	2.5	2	3					1			

1-low,2-medium, 3-high,'-'-no correlation

21153S25B

ELECTRICALANDINSTRUMENTATIONENGINEERING LTPC
3003

COURSEOBJECTIVES:

- Toimpartknowledgeintypes, constructionandworkingoftransformers
- Toimpartknowledgeintypes,constructionandworking ofDC machines
- Toimpartknowledgeintypes, constructionandworkingofACrotatingmachines
- Tointroducethefunctionalelementsandworkingofmeasuringinstruments.
- Tointroducethebasicsofpowersystemandprotectionschemes

UNITI TRANSFORMER 9

Introduction - Ideal and Practical Transformer – Phasor diagram-– Per Unit System – Equivalent circuit- Testing- Efficiency and Voltage Regulation– Three Phase Transformers – Applications- Auto Transformers, Advantages- Harmonics.

UNITII DCMACHINES 9

Introduction–ConstructionalFeatures–MotorandGeneratormode-EMFandTorque equation–CircuitModel–MethodsofExcitation-Characteristics–StartingandSpeedControl – Universal Motor- Stepper Motors – Brushless DC Motors- Applications

UNITIII ACROTATINGMACHINES 9

Principleofoperationofthree-phaseinductionmotors–Construction–Types–Equivalent circuit,SpeedControl-SinglephaseInductionmotors-Construction–Types–starting methods.Alternator:Workingprinciple–EquationofinducedEMF–Voltageregulation, Synchronousmotors-workingprinciple-startingmethods–Torqueequation.

UNITIV MEASUREMENTSANDINSTRUMENTATION 9

Functionalelementsofaninstrument,Standardsandcalibration,OperatingPrinciple,types - Moving Coil and Moving Iron meters, Measurement of three phase power, Energy Meter,InstrumentTransformers-CT andPT,DSO- Block diagram- Data acquisition.

UNITV BASICSOFPOWERSYSTEMS 9

Power system structure -Generation , Transmission and distribution , Various voltage levels,Earthing – methods of earthing, protective devices- switch fuse unit- Miniature circuitbreaker- moulded case circuit breaker- earth leakage circuit breaker, safety precautions andFirst Aid

TOTAL:45PERIODS

COURSEOUTCOMES :

Aftercompletingthiscourse,thestudentswillbeable to

CO1: Explaintheworkingprincipleofelectricalmachines

CO2: Analyzetheoutputcharacterizesofelectricalmachines

CO3: Choose the appropriate electrical machines for various applications **CO4:** Explain the types and operating principles of measuring instruments **CO5:** Explain the basic power systemstructure and protection schemes

TEXTBOOKS:

1. Kothari DP and I.J Nagrath, “Basic Electrical and Electronics Engineering”, Second Edition,McGraw Hill Education, 2020
2. S. K, Bhattacharya, “Basic Electricaland Electronics Engineering”, Second Edition, Pearson Education, 2017.
3. A.K.Sawhney,PuneetSawhney‘ACourseinElectrical&ElectronicMeasurements&

Instrumentation’,DhanpatRaiandCo,NewDelhi,2015.

4. C.L.Wadhwa, “Generation, Distribution and Utilisation of Electrical Energy”, New Age International pvt.ltd.,2003

REFERENCES:

1. KothariDPandI.JNagrath,“BasicElectricalEngineering”,FourthEdition,McGraw HillEducation, 2019
2. MahmoodNahviandJosephA.Edminister,“ElectricCircuits”,Schaum’Outline Series,McGraw Hill, 2002.
3. H.S.Kalsi,‘ElectronicInstrumentation’,TataMcGraw-Hill,NewDelhi,2010

CO’s-PO’s&PSO’sMAPPING

O	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12	D1	D2	D3
1	2	1	1	-	-	-	-	1	-	-	-	-	-		
2	2	1	1	-	-	-	-	1	-	-	-	-			
3	2	1	1	-	-	-	-	1	-	-	-	-			
4	2	1	1	-	-	-	-	1	-	-	-	-			
5	2	1	1	-	-	-	-	1	-	-	-	-			
O	**2**	**1**	**1**	-	-	-	-	**1**	-	-	-	-			

1-low,2-medium, 3-high,‘-’-no correlation

21154S24 **ENGINEERINGGRAPHICS** **L TP C**
204 4

COURSEOBJECTIVES:

Themainlearningobjectiveofthiscourseistopreparethestudentsfor:

- Drawingengineeringcurves.
- Drawingfreehandsketchofsimple objects.
- Drawingorthographic projectionofsolidsandsectionofsolids.
- Drawingdevelopmentofsolids
- Drawingisometricandperspectiveprojectionsofsimplesolids.

CONCEPTSANDCONVENTIONS(NotforExamination)

Importance of graphics in engineering applications — Use of drafting instruments — BIS conventions and specifications — Size, layout and folding of drawing sheets — Lettering and dimensioning.

UNITI PLANECURVES 6+12

Basic Geometrical constructions, Curves used in engineering practices: Conics — Construction of ellipse, parabola and hyperbola by eccentricity method — Construction ofcycloid — construction ofinvolutes of square and circle — Drawing of tangents and normalto the above curves.

UNITII PROJECTIONOFPOINTS,LINESANDPLANESURFACE 6+12

Orthographicprojection-principles-Principalplanes-Firstangleprojection-projectionof points.Projectionofstraightlines(onlyFirstangleprojections)inclinedtoboththeprincipal planes-Determinationoftruelengthsandtrueinclinationsbyrotatinglinemethodand traces. Projection of planes (polygonal and circular surfaces) inclined to both the principalplanes by rotating object method.

UNITIII PROJECTIONOFSOLIDSANDFREEHANDSKETCHING 6+12

Projectionofsimplesolidslikeprisms,pyramids,cylinder,coneandtruncatedsolidswhen theaxisisinclinedtooneoftheprincipalplanesandparalleltotheotherbyrotatingobject method.VisualizationconceptsandFreeHandsketching:Visualizationprinciples—RepresentationofThreeDimensionalobjects—Layoutofviews-Freehandsketchingofmultiple views from pictorial views of objects.

PracticingthreedimensionalmodelingofsimpleobjectsbyCADSoftware(Notforexamination)

UNITIV PROJECTIONOFSECTIONEDSOLIDSANDDEVELOPMENTOF SURFACES 6 +12

Sectioning of above solids in simple vertical position when the cutting plane is inclined tothe one ofthe principal planes and perpendicular to the other — obtaining true shape ofsection.Development oflateral surfaces of simple and sectioned solids — Prisms, pyramidscylinders and cones.

PracticingthreedimensionalmodelingofsimpleobjectsbyCADSoftware(Notforexamination)

UNITV ISOMETRICANDPERSPECTIVEPROJECTIONS 6+12

Principlesofisometric projection — isometric scale —Isometric projectionsofsimplesolidsand truncated solids - Prisms, pyramids, cylinders, cones-combination of two solid objectsin simple vertical positions - Perspective projection of simple solids-Prisms, pyramids andcylinders by visual ray method.

Practicing three dimensional modeling of isometric projection of simple objects by CADSoftware (Not for examination)

TOTAL:(L=30+P=60)90PERIODS

COURSEOUTCOMES:

On successful completion of this course, the student will be able to **CO1**:Use BISconventions and specifications for engineering drawing.**CO2**:Constructtheconiccurves,involutesandcycloid.

CO3:Solve practical problems involving projection of lines.

CO4:Drawtheorthographic,isometricandperspectiveprojectionsofsimplesolids.

CO5:Drawthedevelopmentofsimplesolids.

TEXTBOOKS:

1. BhattN.D.andPanchal V.M.,“EngineeringDrawing”,Charotar Publishing House, 53rd Edition,2019.
2. NatrajanK.V.,“ATextBookofEngineeringGraphics”,DhanalakshmiPublishers,

Chennai,2018.

3. Parthasarathy,N.S.andVelaMurali,“EngineeringDrawing”,OxfordUniversityPress,2015

REFERENCES:

1. BasantAgarwalandAgarwalC.M.,“EngineeringDrawing”,McGrawHill,2nd Edition,2019.
2. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Publications, Bangalore,27th Edition,2017.
3. Luzzader, Warren.J. and Duff,John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
4. Parthasarathy N. S. and Vela Murali, “Engineering Graphics”, Oxford University, Press, New Delhi, 2015.
5. ShahM.B., andRanaB.C.,“EngineeringDrawing”,PearsonEducationIndia, 2nd Edition,2009.
6. VenugopalK. and Prabhu Raja V., “Engineering Graphics", New Age International(P) Limited, 2008.

PublicationofBureauofIndianStandards:

1. IS10711—2001:TechnicalproductsDocumentation—Sizeandlayoutofdrawingsheets.
2. IS9609(Parts0 &1)—2001:TechnicalproductsDocumentation—Lettering.
3. IS10714(Part20)—2001&SP46—2003:Lines fortechnicaldrawings.
4. IS11669—1986&SP46—2003:DimensioningofTechnicalDrawings.
5. IS15021(Parts1to4)—2001:Technicaldrawings—ProjectionMethods.

SpecialpointsapplicabletoUniversityExaminationsonEngineeringGraphics:

1. Therewillbefivequestions,eachofeitherortype covering allunitsofthesyllabus.
2. Allquestionswill carryequalmarksof20each makingatotalof100.
3. TheanswerpapershallconsistofdrawingsheetsofA3sizeonly.Thestudentswillbe permitted to useappropriate scale to fit solution within A3 size.
4. Theexaminationwillbe conducted inappropriatesessionsonthesameday

CO’s-PO’s&PSO’sMAPPING

O	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12	SO1	SO2	SO3
1	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
2	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
3	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
4	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
5	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
O	**3**	**1**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**3**	**-**	**2**	**2**	**2**	**-**

1-low,2-medium, 3-high,‘-'-no correlation

21153S26A

CIRCUIT ANALYSIS

LTPC
310
4

COURSEOBJECTIVES:

- TolearnthebasicconceptsandbehaviourofDCand AC circuits.
- Tounderstand variousmethodsofcircuit/networkanalysisusing networktheorems.
- Tounderstandthetransient andsteadystateresponseofthecircuitssubjectedtoDC excitations and AC with sinusoidal excitations.
- Tolearntheconcept ofcouplingincircuitsandtopologies.

UNITI DCCIRCUITANALYSIS 12

Basic Components of electric Circuits, Charge, current, Voltage and Power, Voltage andCurrent Sources, Ohms Law, Kirchoff's Current Law, Kirchoff's voltage law, The singleNode – Pair Circuit, series and Parallel Connected Independent Sources, Resistors in Seriesand Parallel, voltage and current division, Nodal analysis, Mesh analysis.

UNITII NETWORKTHEOREMANDDUALITY 12

Useful Circuit Analysis techniques - Linearity and superposition, Thevenin and NortonEquivalent Circuits, Maximum Power Transfer, Delta-Wye Conversion. Duals, Dual circuits.Analysis using dependent current sources and voltage sources

UNITIII SINUSOIDALSTEADYSTATEANALYSIS 12

SinusoidalSteady–Stateanalysis,CharacteristicsofSinusoids,TheComplexForcing Function,ThePhasor,PhasorrelationshipforR,L,andC,impedanceandAdmittance,Nodal andMeshAnalysis,PhasorDiagrams,ACCircuitPowerAnalysis,InstantaneousPower, AveragePower,apparentPowerandPowerFactor,ComplexPower.

UNITIV TRANSIENTSANDRESONANCEINRLCCIRCUITS 12

BasicRLandRCCircuits,TheSource-FreeRLCircuit,TheSource-FreeRCCircuit,The Unit-StepFunction,DrivenRLCircuits,DrivenRCCircuits,RLCCircuits,Frequency Response,ParallelResonance,SeriesResonance,QualityFactor.

UNITV COUPLEDCIRCUITSANDTOPOLOGY 12

Magnetically Coupled Circuits, mutual Inductance, the Linear Transformer, the IdealTransformer,Anintroduction to Network Topology, Trees and General Nodal analysis, Linksand Loop analysis.

SUGGESTEDACTIVITIES:

- Practicesolvingvarietyofproblems

COURSEOUTCOMES

Onsuccessfulcompletionofthiscourse,thestudentwillbeableto

CO1: Applythebasicconceptsofcircuitanalysissuchas Kirchoff'slaws,mesh currentandnode voltage method for analysis of DC and AC circuits.

CO2: ApplysuitablenetworktheoremsandanalyzeACandDCcircuits

CO3: AnalyzesteadystateresponseofanyR,LandCcircuits

CO4: Analyze the transient response for anyRC, RL and RLC circuits and frequency responseof parallel and series resonance circuits.

CO5: Analyzethecoupledcircuitsandnetworktopologies

TOTAL:60PERIODS

TEXTBOOKS:

1. Hayt JackKemmerly, StevenDurbin, "Engineering Circuit Analysis",Mc GrawHill education,9th Edition, 2018.
2. Charles K. Alexander & Mathew N.O.Sadiku, "Fundamentals of Electric Circuits", Mc Graw-Hill, 2nd Edition, 2003.
3. Joseph Edminister and Mahmood Nahvi, ―Electric Circuits, Schaum's Outline Series, Tata McGraw Hill Publishing Company, New Delhi, Fifth Edition Reprint 2016.

REFERENCES:

1. Robert.L.Boylestead,"IntroductoryCircuit Analysis",PearsonEducationIndia,12thEdition, 2014. David Bell, "Fundamentals of Electric Circuits", Oxford University press, 7thEdition, 2009.
2. John O Mallay, Schaum's Outlines "Basic Circuit Analysis", The Mc Graw Hill companies, 2nd Edition, 2011
3. Allan H.Robbins, Wilhelm C.Miller, "Circuit Analysis Theory and Practice",Cengage Learning, Fifth Edition, 1st Indian Reprint 2013

CO's-PO's&PSO'sMAPPING

O	O1	O2	O3	O4	O5	O6	O7	O8	9	O10	O11	O12	SO1	SO2	SO3
1	3	2	1	1	-	-	-	1		1	-	-	-	-	-
2	3	3	2	2	-	-	-	1		1	-	-	-	-	-
3	3	3	3	3	-	-	-	1		1	-	-	-	-	-
4	3	3	3	3	-	-	-	1		1	-	-	-	-	-
5	3	3	3	2	-	-	-	1		1	-	-	-	-	-
O	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**1**		**1**	**-**	**-**	**-**	**-**	**-**

1-low,2-medium, 3-high,'-'-no correlation

21154L21

ENGINEERINGPRACTICESLABORATORY LTPC

0042

COURSEOBJECTIVES:

Themainlearningobjectiveofthiscourseistoprovidehandsontrainingtothestudentsin:

- Drawingpipe lineplan; layingandconnecting variouspipe fittingsused incommon householdplumbingwork;Sawing;planing;makingjointsinwoodmaterials used in common household wood work.

- Wiring various electrical joints in common household electrical wire work.
- Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Makinga tray out ofmetal sheet using sheet metal work.
- Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP–A(CIVIL&ELECTRICAL)

PARTI CIVILENGINEERINGPRACTICES 15

PLUMBING WORK:

a) Connecting various basic pipe fittings like valves, taps, coupling,unions,reducers,elbowsandothercomponentswhicharecommonlyused in household.
b) Preparingplumbinglinesketches.
c) Laying pipeconnectionto thesuctionsideofa pump
d) Layingpipe connectiontothedeliverysideofapump.
e) Connectingpipesofdifferentmaterials:Metal,plasticandflexible pipesusedinhousehold appliances.

WOODWORK:

a) Sawing,
b) Planing and
c) MakingjointslikeT-Joint,MortisejointandTenonjointandDovetailjoint.

WoodWorkStudy:

a) Studyingjointsindoorpanelsandwoodenfurniture
b) Studyingcommonindustrialtrussesusingmodels.

PARTII ELECTRICALENGINEERINGPRACTICES 15

a) Introductiontoswitches, fuses, indicatorsandlamps -Basicswitchboardwiringwith lamp, fan and three pin socket
b) Staircasewiring
c) Fluorescent LampwiringwithintroductiontoCFLandLED types.
d) Energymeterwiringandrelatedcalculations/calibration
e) StudyofIronBoxwiringandassembly
f) StudyofFanRegulator(ResistortypeandElectronictypeusingDiac/Triac/quadrac)
g) Studyofemergencylampwiring/Water heater

GROUP–B(MECHANICALANDELECTRONICS)

PARTIII MECHANICALENGINEERINGPRACTICES 15

WELDINGWORK:

a) WeldingofButtJoints, LapJoints,andTeeJointsusingarcwelding.

b) Practicinggaswelding.

BASIC MACHININGWORK:

a) (simple)Turning.
b) (simple)Drilling.
c) (simple)Tapping.

ASSEMBLYWORK:

a) Assemblingacentrifugalpump.
b) Assemblingahouseholdmixer.
c) Assemblinganairconditioner.

SHEETMETALWORK:

a)Makingofasquaretray

FOUNDRYWORK:

a)Demonstratingbasicfoundryoperations.

PARTIV ELECTRONICENGINEERINGPRACTICES 15

SOLDERINGWORK:

a)Solderingsimpleelectroniccircuitsandcheckingcontinuity.

ELECTRONICASSEMBLYANDTESTINGWORK:

a)AssemblingandtestingelectroniccomponentsonasmallPCB.

ELECTRONICEQUIPMENTSTUDY:

a) Studyanelements ofsmartphone..
b) Assemblyand dismantleofLED TV.
c) Assemblyand dismantleofcomputer/laptop

COURSEOUTCOMES:

Uponcompletionofthiscourse,thestudentswillbeableto:TOTAL:60PERIODS

CO1:Draw pipe line plan; lay and connect various pipe fittings used in common household plumbingwork; Saw; plan; make joints in wood materials used in common household wood work.

CO2:Wirevariouselectricaljointsincommonhouseholdelectricalwirework.

CO3:Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.

CO4:Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

CO’s-PO’s&PSO’sMAPPING

O	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12	SO1	SO2	SO3
1	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
2	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
3	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
O	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1

1-low,2-medium, 3-high,‘-’-no correlation

21153L22A

CIRCUIT ANALYSIS LABORATORY

LT PC
00 21

COURSEOBJECTIVES:

- Togainhands-onexperience inThevenin&Nortontheorem,KVL&KCL, andSuperposition Theorems.
- TounderstandtheworkingofRL,RCandRLCcircuits

ListofExperiments:

1. VerificationsofKVL& KCL.
2. Verifications ofThevenin&Nortontheorem.
3. VerificationofSuperpositionTheorem.
4. VerificationofmaximumpowertransferTheorem
5. DeterminationofResonanceFrequencyofSeries &ParallelRLCCircuits.
6. TransientanalysisofRLandRCcircuits.

TOTAL:30PERIODS

COURSEOUTCOMES:

Attheendofthecourse,thestudentwillbeableto

- DesignRLandRCcircuits.
- VerifyThevinin &NortontheoremKVL&KCL,and SuperPositionTheorems.

TEXTBOOKS

1. HaytJackKemmerly,StevenDurbin,"EngineeringCircuitAnalysis",McGrawHill education,9th Edition, 2018.
2. Charles K. Alexander & Mathew N.O.Sadiku, "Fundamentals of Electric Circuits", McGraw- Hill, 2nd Edition, 2003.
3. Joseph Edminister and Mahmood Nahvi,“Electric Circuits, Schaum‘s Outline Series”, Tata McGraw Hill Publishing Company, New Delhi, Fifth Edition Reprint 2016.

REFERENCES

1. DavidBell,"FundamentalsofElectricCircuits",OxfordUniversitypress,7th Edition,2009
2. JohnOMallay,Schaum’sOutlines"BasicCircuit Analysis",TheMcGrawHillcompanies, 2nd Edition, 2011.
3. A.BruceCarlson,“Cicuits:EngineeringConceptsandAnalysisofLinearElectric Circuits,Cengage Learning, India Edition 2nd Indian Reprint 2009.
4. AllanH.Robbins,WilhelmC.Miller,“CircuitAnalysisTheoryandPractice”,Cengage

Learning,FifthEdition,1stIndianReprint2013

CO's-PO's&PSO'sMAPPING

O	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12	SO1	SO2	SO3
1	3	2	1	1	-	-	-	1	-	1	-	-	-	-	-
2	3	3	2	2	-	-	-	1	-	1	-	-	-	-	-
3	3	3	3	3	-	-	-	1	-	1	-	-	-	-	-
4	3	3	3	3	-	-	-	1	-	1	-	-	-	-	-
5	3	3	3	2	-	-	-	1	-	1	-	-	-	-	-
O	3	3	3	2	-	-	-	1	-	1	-	-	-	-	-

1-low,2-medium, 3-high,'-'-no correlation

21147L23

COMMUNICATION LABORATORY

LTPC
004
2

COURSEOBJECTIVES:

- Toidentifyvariedgroupdiscussionskillsandapplythemtotakepartineffectivediscussions in a professional context.
- Toanalyseconceptsandproblemsandmakeeffectivepresentationsexplainingthemclearly and precisely.
- Tobeabletocommunicateeffectivelythroughformalandinformalwriting.
- Tobeabletouseappropriatelanguagestructurestowriteemails,reportsandessays
- Togiveinstructionsandrecommendationsthatareclearandrelevant tothecontext

UNITI **12**

Speaking-Role Play Exercises Based on Workplace Contexts, - talking aboutcompetition-discussing progress toward goals-talking about experiences- talking about events in life-discussing past events-Writing: writing emails (formal & semi-formal).

UNITII **12**

Speaking: discussing news stories-talking about frequency-talking about travel problems-discussingtravel procedures- talking about travel problems- making arrangements-describingarrangements- discussing plans and decisions- discussing purposes and reasons-understanding common technology terms-Writing: - writing different types of emails.

UNITIII **12**

Speaking:discussingpredictions-describingtheclimate-discussingforecastsandscenarios-talkingaboutpurchasing-discussingadvantagesanddisadvantages-makingcomparisons-discussinglikesanddislikes-discussingfeelingsaboutexperiences-discussingimaginary scenariosWriting:shortessaysandreports-formal/semi-formalletters.

UNITIV **12**

Speaking:discussingthenaturalenvironment-describingsystems-describingpositionand movement-explainingrules-(example-discussingrentalarrangements)-understandingtechnical instructions-Writing: writing instructions-writing a short article.

UNITV **12**

Speaking:describingthingsrelatively-describingclothing-discussingsafetyissues(makingrecommendations) talking about electrical devices-describing controlling actions- Writing:job application(Cover letter + Curriculum vitae)-writing recommendations.

TOTAL:60PERIODS

LEARNINGOUTCOMES

CO1:Speak effectively in group discussions held informal/semi formal contexts.

CO2:Discuss,analyseandpresentconceptsandproblemsfromvariousperspectivestoarrive atsuitable solutions

CO3:Writeemails,lettersandeffectivejobapplications.

CO4:Writecriticalreportstoconveydataandinformationwithclarityandprecision

CO5:Giveappropriateinstructionsandrecommendationsforsafeexecutionoftasks

AssessmentPattern

- Oneonline/appbasedassessmenttotestspeakingandwriting skills
- Proficiencycertificationisgivenonsuccessfulcompletionofspeaking andwriting.

CO's-PO's&PSO'sMAPPING

CO	PO	2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12	SO1	SO2	SO3
1	2	3	3	3	1	3	3	3	3	3	3	3	-	-	-
2	2	3	3	3	1	3	3	3	3	3	3	3	-	-	-
3	2	2	3	3	1	3	3	3	3	3	3	3	-	-	-
4	3	3	3	3	3	3	3	3	3	3	3	3	-	-	-
5	3	3	3	3	3	3	3	3	3	3	3	3	-	-	-
Vg.	2.		3	3	1.8	3	3	3	3	3	3	3	-	-	-

1-low,2-medium,3-high,'-"-nocorrelation

- **Note:**Theaveragevalueofthiscoursetobeusedforprogramarticulationmatrix.

21148S31B **RANDOMPROCESSESANDLINEARALGEBRA** **LTPC**
3104

COURSEOBJECTIVES:

- Tointroducethebasicnotionsofvectorspaceswhichwillthenbeusedtosolve related problems.
- To understand the concepts of vector space, linear transformations ,inner product spaces and orthogonalization..
- To provide necessary basic concepts in probability and random processes for applicationssuch as random signals, linear systems in communication engineering.
- To provide necessary basics in probability that are relevant in applications such as random

signals, linear systems in communication engineering.

- Tounderstandthebasicconceptsofprobability, oneandtwodimensionalrandom
- variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.

UNIT-I PROBABILITYANDRANDOMVARIABLES 9+3

Axioms of probability – Conditional probability – Baye's theorem - Discrete and continuousrandom variables – Moments – Moment generating functions – Binomial, Poisson,Geometric, Uniform, Exponential and Normal distributions - Functions of arandom variable.

UNIT-II TWO-DIMENSIONALRANDOMVARIABLES 9+3

Joint distributions – Marginal and conditional distributions – Covariance – Correlation andlinear regression – Transformation of random variables – Central limit theorem (forindependent and identically distributed random variables).

UNIT–III RANDOMPROCESSES9+3

Classification–Stationaryprocess–Markovprocess-Poissonprocess-DiscreteparameterMarkov chain –ChapmanKolmogorovequations(Statement only) - Limitingdistributions .

UNIT-IV VECTORSPACES 9+3

Vector spaces – Subspaces – Linear combinations and linear system of equations – Linearindependence and linear dependence – Bases and dimensions.

UNIT-V LINEARTRANSFORMATIONANDINNERPRODUCTSPACES 9+3

Linear transformation - Null spaces and ranges - Dimension theorem - Matrix representationof a linear transformations - Inner product - Norms - Gram Schmidtorthogonalizationprocess - Adjoint of linear operations - Leastsquareapproximation.

TOTAL:60 PERIODS

COURSEOUTCOMES :

Uponsuccessfulcompletionofthecourse,studentswillbeableto:

CO1:Explain the fundamental concepts of advanced algebra and theirroleinmodern mathematics and applied contexts.

CO2:Demonstrateaccurateandefficientuseofadvancedalgebraictechniques.

CO3:Applytheconceptofrandomprocessesinengineeringdisciplines.

CO4:Understand the fundamental concepts of probability with a thorough knowledge of standarddistributions that can describe certain real-life phenomenon.

CO5:Understandthebasicconceptsofoneandtwodimensionalrandomvariablesand appl ythemtomodelengineeringproblems.

TEXTBOOKS:

1. Gross, D., Shortle, J.F, Thompson, J.M and Harris. C.M., "Fundamentals of Queueing Theory", Wiley Student 4th Edition, 2014.
2. Ibe,O.C.,"FundamentalsofAppliedProbabilityandRandom Processes",Elsevier,1stIndian Reprint, 2007.
3. Friedberg. A.H., Insel. A.J. and Spence. L., "Linear Algebra", Prentice Hall of India, New Delhi,4th Edition, 2004.

REFERENCES:

1. Hsu, "Schaum'sOutlineofTheoryand Problems ofProbability, RandomVariablesandRandom Processes", Tata McGraw Hill Edition, New Delhi, 2004.
2. Trivedi, K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", 2nd Edition, John Wiley and Sons, 2002.
3. Yates,R.D.andGoodman.D.J.,"ProbabilityandStochasticProcesses",2ndEdition,Wiley India Pvt. Ltd., Bangalore, 2012.
4. Kolman.B.Hill.D.R.,"IntroductoryLinearAlgebra",PearsonEducation,NewDelhi, FirstReprint, 2009.
5. Kumaresan. S., "Linear Algebra – A Geometric Approach", Prentice – Hall of India, New Delhi,Reprint, 2010.
6. Strang.G.,"LinearAlgebraanditsapplications",Thomson(Brooks/Cole),NewDelhi,2005.

CO's-PO's&PSO'sMAPPING

CO	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12	SO1	SO2	SO3
O1	3	3	0	0	0	0	0	0	3	0	0	2	-	-	-
O2	3	3	0	0	0	0	0	0	3	0	0	2	-	-	-
O3	3	3	0	0	0	0	0	0	3	0	0	2	-	-	-
O4	3	3	0	0	0	0	0	0	3	0	0	2	-	-	-
O5	3	3	0	0	0	0	0	0	3	0	0	2	-	-	-
O6	3	3	0	0	0	0	0	0	3	0	0	2	-	-	-

1-low,2-medium, 3-high,'-'-no correlation

2S33 **CPROGRAMMINGANDDATASTRUCTURES** **LT 30**

COURSEOBJECTIVES:

- TointroducethebasicsofCprogramminglanguage.
- TolearntheconceptsofadvancedfeaturesofC.
- TounderstandtheconceptsofADTsandlineardata structures.
- Toknowthe conceptsofnon-lineardatastructureandhashing.
- Tofamiliarizetheconceptsofsorting andsearchingtechniques.

UNITI CPROGRAMMINGFUNDAMENTALS(8+1SKILL) 9

Data Types – Variables – Operations – Expressions and Statements – Conditional Statements – Functions – Recursive Functions – Arrays – Single and Multi-Dimensional Arrays.

UNITIICPROGRAMMING- ADVANCEDFEATURES(8+1SKILL) 9

Structures – Union – Enumerated Data Types – Pointers: Pointers to Variables, Arrays and Functions – FileHandling – Preprocessor Directives.

UNITIIILINEARDATASTRUCTURES(8+1SKILL) 9

Abstract Data Types (ADTs) – List ADT – Array-Based Implementation – Linked List – Doubly- LinkedLists – Circular Linked List – Stack ADT – Implementation of Stack – Applications – Queue ADT –PriorityQueues – Queue Implementation – Applications.

UNITIVNON-LINEARDATASTRUCTURES(8+1SKILL) 9

Trees – Binary Trees – Tree Traversals – Expression Trees – Binary Search Tree – Hashing - HashFunctions–SeparateChaining–OpenAddressing–LinearProbing–QuadraticProbing–DoubleHashing–Rehashing.

UNITV SORTINGANDSEARCHINGTECHNIQUES(8+1SKILL) 9

InsertionSort –QuickSort–HeapSort–MergeSort –LinearSearch–BinarySearch.

TOTAL:45PERIODS

SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini Project/Assignment/ContentPreparation/Quiz/SurpriseTest/SolvingGATEquestions/etc) 5

COURSEOUTCOMES:

CO1:DevelopCprogramsforanyrealworld/technicalapplication.

CO2:ApplyadvancedfeaturesofCinsolvingproblems.

CO3:Writefunctionstoimplementlinearandnon–lineardatastructureoperations.

CO4: Suggestanduseappropriatelinear/non–lineardatastructureoperations forsolvinga givenproblem.

CO5:Appropriatelyusesortandsearchalgorithmsforagivenapplication.

CO6:Apply appropriate hash functions that result in a collision free scenario for datastorage andretrieval.

TEXTBOOKS:

1. MarkAllenWeiss,"DataStructuresandAlgorithmAnalysisinC",SecondEdition, PearsonEducation, 1997.
2. ReemaThareja,"ProgramminginC",SecondEdition,OxfordUniversityPress,2016.

REFERENCES:

1. BrianW.Kernighan,RobPike,"ThePracticeofProgramming",PearsonEducation,1999.
2. PaulJ.Deitel,HarveyDeitel,"CHowtoProgram",SeventhEdition,PearsonEducation, 2013.
3. AlfredV. Aho, JohnE. Hopcroft,JeffreyD.Ullman, "DataStructuresandAlgorithms", Pearson Education,1983.
4. Ellis Horowitz, SartajSahni and Susan Anderson, "Fundamentals of Data Structures", Galgotia, 2008.

List of Open Source Software/ Learning website:

https://www.coursera.org/specializations/data-structures-algorithmshttps://nptel.ac.in/courses/112107243https://nptel.ac.in/courses/112105598

CO's-PO's&PSO'sMAPPING

O	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12	SO1	SO2	SO3
1	2	3	1	2	2	1	1	-	1	2	1	3	2	1	3
2	1	2	1	2	2	-	-	-	1	1	1	2	2	2	2
3	2	3	1	2	3	-	-	-	1	1	1	2	2	1	2
4	2	1	-	1	1	-	-	-	2	1	1	2	2	3	1
5	1	2	1	2	2	1	1	-	1	2	1	3	2	2	3
O	2	2	1	2	2	1	1	-	1	1	1	2	2	2	2

1-low,2-medium, 3-high,'-'-no correlation

21152C35 SIGNALSANDSYSTEMS LTPC

3104

COURSEOBJECTIVES:

- Tounderstandthebasicproperties ofsignal&systems
- ToknowthemethodsofcharacterizationofLTIsystemsintimedomain
- Toanalyzecontinuoustime signalsandsystemintheFourierandLaplacedomain
- ToanalyzediscretetimesignalsandsystemintheFourierand Ztransformdomain

UNITI CLASSIFICATIONOFSIGNALSANDSYSTEMS 6+6

Standardsignals-Step,Ramp,Pulse,Impulse,Realandcomplexexponentialsand Sinusoids_Classificationofsignals–Continuoustime(CT)andDiscreteTime(DT) signals,Periodic&Aperiodicsignals,Deterministic&Randomsignals,Energy&Power signals-Classificationofsystems-CTsystemsandDTsystems-–Linear&Nonlinear,Time-variant& Time-invariant,Causal & Non-causal, Stable & Unstable.

UNITIIANALYSISOFCONTINUOUSTIMESIGNALS 6+6

Fourier series for periodic signals - Fourier Transform– properties- Laplace Transforms andProperties

UNITIII LINEARTIMEINVARIANTCONTINUOUSTIMESYSTEMS 6+6

Impulseresponse-convolutionintegrals-DifferentialEquation-FourierandLaplacetransforms in Analysis of CT systems - Systems connected in series / parallel.

UNITIV ANALYSISOFDISCRETETIMESIGNALS 6+6

BasebandsignalSampling–FourierTransformofdiscretetimesignals(DTFT)–PropertiesofDTFT -ZTransform&Properties

UNITV LINEARTIMEINVARIANT-DISCRETE TIME SYSTEMS 6+6

Impulseresponse–Differenceequations-Convolutionsum-DiscreteFourierTransformand

ZTransformAnalysisofRecursive&Non-Recursivesystems-DTsystemsconnectedin seriesand parallel.

TOTAL:30+30PERIODS

COURSEOUTCOMES:

Attheendofthecourse,thestudentwillbeableto:

CO1:determineifagivensystemislinear/causal/stable

CO2:determinethefrequencycomponentspresentinadeterministicsignal

CO3:characterizecontinuousLTIsystemsinthetimedomainandfrequency domainCO4:characterize discrete LTI systems in the time domain and frequencydomainCO5:computetheoutputofanLTIsysteminthetimeandfrequency domains

TEXTBOOKS:

1. Oppenheim,Willsky andHamid,"SignalsandSystems",2ndEdition,Pearson Education,New Delhi, 2015.(Units I - V)
2. SimonHaykin,BarryVanVeen,"SignalsandSystems",2ndEdition,Wiley, 2002

REFERENCES:

1. B. P.Lathi,"PrinciplesofLinearSystemsandSignals",2nd Edition,Oxford,2009.
2. M.J.Roberts,"SignalsandSystemsAnalysisusingTransformmethodsand MATLAB",McGraw- Hill Education, 2018.
3. JohnAlanStuller,"AnIntroductiontoSignalsandSystems",Thomson,2007.

CO's-PO's&PSO'sMAPPING

C	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12	SO1	SO2	SO3
	3	-	3	-	3	2	-	-	-	-	-	3	-	-	1
	3	-	3	-	-	2	-	-	-	-	-	3	-	3	-
	3	3	-	-	3	2	-	-	-	-	-	3	2	-	-
	3	3	-	-	3	2	-	-	-	-	-	3	-	3	1
	3	3	-	3	3	2	-	-	-	-	-	3	-	3	1
C	**3**	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**3**	**1**

1-low,2-medium,3-high,'-'-nocorrelation21152C36ELECTRONICDEVICESANDCIRCUITS LTPC3003

COURSEOBJECTIVES:

- To give a comprehensive exposure to all types of devices and circuits constructed withdiscrete components. Thishelpsto develop a strong basis for building linear and digitalintegrated circuits
- Toanalyze thefrequencyresponseofsmallsignalamplifiers
- Todesignandanalyzesinglestageandmultistageamplifier circuits
- Tostudyaboutfeedbackamplifiersand oscillatorsprinciples
- Tounderstandtheanalysis anddesignofmultivibrators

UNITI SEMICONDUCTORDEVICES 9

PNjunctiondiode,Zenerdiode,BJT,MOSFET,UJT–structure,operationandV-Icharacteristics,diffusionandtransitioncapacitance-Rectifiers–HalfWaveandFullWave

Rectifier,Zeneras regulator

UNITII AMPLIFIERS 9

Load line, operating point, biasing methods for BJT and MOSFET,BJT small signal model–Analysis of CE, CB, CC amplifiers- Gain and frequency response –MOSFET small signalmodel– Analysis of CS, CG and Source follower – Gain and frequency response-Highfrequency analysis.

UNITIII MULTISTAGEAMPLIFIERSANDDIFFERENTIALAMPLIFIER 9

Cascode amplifier, Differential amplifier – Common mode and Difference mode analysis – MOSFET input stages – tuned amplifiers – Gain and frequency response – Neutralizationmethods.

UNITIV FEEDBACKAMPLIFIERSANDOSCILLATORS 9

Advantages of negative feedback – Voltage / Current, Series , Shunt feedbackAmplifiers–positivefeedback–Conditionforoscillations, phaseshift – Wienbridge,Hartley, Colpitts andCrystal oscillators.

UNITV POWERAMPLIFIERSANDDC/DCCONVERTERS 9

Power amplifiers- class A-Class B-Class AB-Class C-Power MOSFET-TemperatureEffect-ClassABPoweramplifierusingMOSFET –DC/DCconvertors–Buck,Boost,Buck-Boost analysis and design.

TOTAL:45PERIODS

COURSEOUTCOMES :

Attheendofthecoursethestudentswillbeableto
CO1:Explainthestructureandworkingoperationofbasicelectronicdevices.
CO2:Designandanalyzeamplifiers.
CO3: Analyze frequency response of BJT and MOSFET amplifiers **CO4**: Design and analyze feedback amplifiers and oscillatorprinciples.**CO5**:Designandanalyzepoweramplifiers and supply circuits

TEXTBOOKS:

1. David A. Bell, "Electronic Devices and Circuits", Oxford Higher Educationpress, 5 th Edition,2010.
2. RobertL.BoylestadandLouisNasheresky,“ElectronicDevicesandCircuitTheory”, 10thEdition, Pearson Education / PHI, 2008.
3. Adel .S. Sedra, Kenneth C. Smith, "Micro Electronic Circuits", Oxford University Press, 7 thEdition, 2014.REFERENCES :
   1. Donald.A. Neamen, "Electronic Circuit Analysisand Design", TataMcGraw Hill, 3 rd Edition, 2010.
   2. D.SchillingandC.Belove,"ElectronicCircuits",McGrawHill,3rdEdition,1989

3. MuhammadH.Rashid, "PowerElectronics",PearsonEducation/PHI,2004.

CO’s-PO’s&PSO’sMAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	3		3	3	2	1	-		-		-				1
2	3		2	3	2	2	-		-		-				1
3	3		3	2	1	2	-		-		-				1
4	3		2	3	2	2	-		-		-				1
5	3		3	2	2	1	-		-		-				1
CO	**3**		**3**	**3**	**2**	**2**	-		-		-				**1**

1-low,2-medium, 3-high,‘-’-nocorrelation

2S32	**CONTROLSYSTEMS**	**L**	**PC**
		3	**03**

COURSEOBJECTIVES:

- Tointroducethecomponents andtheirrepresentationofcontrolsystems
- Tolearnvariousmethodsforanalyzingthetimeresponse, frequencyresponseandstabilityof the systems.
- Tolearnthevariousapproachforthestatevariableanalysis.

UNITI SYSTEMSCOMPONENTSANDTHEIRREPRESENTATION 9

Control System: Terminology and Basic Structure-Feed forward and Feedback controltheory-Electrical and Mechanical Transfer Function Models-Block diagram Models-Signalflow graphsmodels-DC and AC servo Systems-Synchronous -Multivariable control system

UNITII TIMERESPONSEANALYSIS 9

Transient response-steady state response-Measures of performance of the standard first orderand second order system-effect on an additional zero and an additional pole-steady errorconstant and system- type number-PID control-Analytical design for PD, PI,PID controlsystems

UNITIII FREQUENCYRESPONSEANDSYSTEMANALYSIS 9

Closedloopfrequencyresponse-Performancespecificationinfrequencydomain-Frequency responseofstandardsecondordersystem-BodePlot-PolarPlot-Nyquistplots-Designof compensatorsusingBodeplots-Cascadeleadcompensation-Cascadelagcompensation-Cascadelag-leadcompensation

UNITIV CONCEPTSOFSTABILITYANALYSIS 9

Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Relative stability-Root locus concept-Guidelines for sketching root locus-Nyquist stabilitycriterion.

UNITV CONTROLSYSTEMANALYSISUSINGSTATEVARIABLEMETHODS 9

Statevariablerepresentation-Conversionofstatevariablemodelstotransferfunctions-Conversionoftransferfunctionstostatevariablemodels-Solutionofstateequations-Concepts ofControllabilityandObservability-Stability oflinear systems-Equivalencebetween transfer functionandstatevariablerepresentations-Statevariableanalysisofdigitalcontrolsystem-Digitalcontroldesignusingstatefeedback.

TOTAL:45PERIODS

COURSEOUTCOMES :

UponsuccessfulcompletionofthecoursethestudentwillbeabletoCO1: Compute the transfer function of different physical systems.

CO2:Analysethetimedomainspecificationandcalculatethesteadystateerror.

CO3: Illustrate the frequency response characteristics of open loop and closed loop system response.

CO4:AnalysethestabilityusingRouthandrootlocustechniques.

CO5: Illustrate the state space model of a physical system and discuss the concepts ofsampleddata control system.

TEXTBOOK:

1. M.Gopal,“ControlSystem–PrinciplesandDesign”,TataMcGrawHill,4th Edition,2012.

REFERENCE:

1. J.NagrathandM.Gopal,“ControlSystemEngineering”,NewAgeInternationalPublishers, 5th Edition, 2007.
2. K.Ogata,“ModernControlEngineering”,PHI,5th Edition,2012.
3. S.K.Bhattacharya,“ControlSystemEngineering”,Pearson,3rd Edition, 2013.
4. Benjamin.C.Kuo,“AutomaticControlSystems”,PrenticeHallofIndia,7th Edition,1995.

CO’s-PO’s&PSO’sMAPPING

O	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12	SO1	SO2	SO3
1	3	3	3	2	2	2	-	-	-	-	2	3	3	3	3
2	3	3	3	3	2	3	-	-	-	-	2	2	3	3	3
3	3	2	3	3	2	2	-	-	-	-	2	3	3	2	3
4	3	3	3	2	2	2	-	-	-	-	2	2	3	3	3
5	2	2	3	3	2	3	-	-	-	-	2	3	2	2	3
O	3	3	3	3	2	2	-	-	-	-	2	3	3	3	3

1-low,2-medium, 3-high,‘-'-no correlation

21152C34 DIGITALSYSTEMSDESIGN L TPC

3024

COURSEOBJECTIVES:

- Topresentthefundamentalsofdigitalcircuitsand simplificationmethods
- Topracticethedesignofvariouscombinationaldigitalcircuitsusinglogicgates
- Tobringouttheanalysisanddesignproceduresforsynchronousandasynchronous

Sequentialcircuits

- Tolearnintegratedcircuitfamilies.
- Tointroducesemiconductormemoriesandrelatedtechnology

UNITI BASICCONCEPTS 9

Reviewofnumbersystems-representation-conversions,ReviewofBooleanalgebra-theorems,sumofproductandproductofsumsimplification,canonicalformsmintermand max term,Simplification of Boolean expressions-Karnaugh map, completely and incompletelyspecifiedfunctions,ImplementationofBooleanexpressionsusinguniversal gates,Tabulationmethods.

UNITII COMBINATIONALLOGICCIRCUITS 9

Problemformulationanddesignofcombinationalcircuits-Code-Converters,HalfandFull Adders,BinaryParallelAdder–CarrylookaheadAdder,BCDAdder,Magnitude Comparator,Decoder,Encoder,PriorityEncoder,Mux/Demux,Casestudy:Digitaltrans-receiver/8bitArithmeticandlogicunit,ParityGenerator/Checker,SevenSegmentdisplay decoder

UNITIII SYNCHRONOUSSEQUENTIALCIRCUITS 9

Latches,Flipflops–SR,JK,T,D,Master/SlaveFF,Triggering ofFF,Analysisanddesign ofclockedsequentialcircuits–Design-Moore/Mealymodels,stateminimization,state assignment,lock-outconditioncircuitimplementation-Counters,RippleCounters,Ring Counters,Shiftregisters,UniversalShiftRegister.ModelDevelopment:Designingofrolling display/real time clock

UNITIV ASYNCHRONOUSSEQUENTIALCIRCUITS 9

StableandUnstablestates,outputspecifications,cyclesandraces,statereduction,racefree assignments, Hazards, Essential Hazards, Fundamental and Pulse mode sequential circuits,Design of Hazard free circuits.

UNITV LOGICFAMILIESANDPROGRAMMABLELOGICDEVICES 9

Logicfamilies-PropagationDelay,Fan-InandFan-Out-NoiseMargin-RTL ,TTL,ECL,CMOS-ComparisonofLogicfamilies-Implementationofcombinational logic/sequentiallogicdesignusingstandardICs,PROM,PLAandPAL,basicmemory, staticROM,PROM,EPROM,EEPROMEAPROM.

45PERIODS

PRACTICALEXERCISES: **30PERIODS**

1. Designofadders andsubtractors&codeconverters.
2. DesignofMultiplexers&Demultiplexers.
3. DesignofEncodersandDecoders.
4. DesignofMagnitudeComparators
5. Designandimplementationofcountersusingflip-flops
6. Designandimplementationofshift registers.

COURSEOUTCOMES:

Attheendofthecoursethestudentswillbeableto

CO1:UseBooleanalgebraandsimplificationproceduresrelevanttodigitallogic.
CO2:Designvariouscombinationaldigitalcircuitsusinglogicgates.
CO3:Analyse and design synchronous sequential circuits. **CO4**: Analyse and design asynchronous sequentialcircuits..**CO5**:Buildlogicgatesanduse programmable devices

TOTAL:75PERIODS

TEXTBOOKS:

1. M.MorrisManoandMichaelD.Ciletti,'Digital Design',Pearson,5thEdition,2013.(Unit-I-V)

REFERENCES:

1. CharlesH. Roth,Jr,'FundamentalsofLogicDesign',JaicoBooks,4thEdition, 2002.
2. WilliamI.Fletcher,"AnEngineeringApproachtoDigitalDesign",Prentice-Hall of India,1980.
3. FloydT.L.,"DigitalFundamentals",CharlesE.Merrilpublishingcompany,1982.
4. John. F.Wakerly, "DigitalDesignPrinciples and Practices", PearsonEducation, 4 th Edition,2007.

CO's-PO's&PSO'sMAPPING

O	1	O2	3	O4	O5	O6	O7	O8	O9	O10	O11	O12	SO1	SO2	SO3
1	3	2	2	2	-	2	-	-	-	-	3	3	3	3	2
2	-	-	-	-	-	-	-	-	-	-	2	1	2	3	2
3		3	3	2	-	2	-	-	-	-	2	2	3	3	2
4	-	-	-	-	-	-	-	-	-	-	3	2	2	3	1
5	-	3	3	3	-	-	-	-	-	-	2	2	3	3	2
O	**3**	**2.6**		**2.3**	**-**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**3**	**3**	**2**

1-low,2-medium, 3-high,'-'-no correlation

21152L38 ELECTRONICDEVICESANDCIRCUITSLABORATORY LTPC
00 3 1.5

COURSEOBJECTIVES

- TolearnthecharacteristicsofPNJunctiondiodeandZenerdiode.
- Tounderstandtheoperationofrectifiersand filters.
- Tostudythecharacteristics ofamplifier.

LISTOFEXPERIMENTS

1. CharacteristicsofPNJunctionDiodeandZenerdiode.
2. FullWaveRectifierwithFilters.
3. DesignofZenerdiodeRegulator.
4. CommonEmitterinput-outputCharacteristics.
5. MOSFETDraincurrentandTransferCharacteristics.

6.FrequencyresponseofCEandCSamplifiers.
7.FrequencyresponseofCB andCC amplifiers.
8.FrequencyresponseofCascodeAmplifier
9.CMRRmeasurementofDifferentialAmplifier
10.ClassATransformer Coupled Power Amplifier.

COURSEOUTCOMES

Attheendofthelaboratorycourse,thestudentwillbeabletounderstand the

CO1: Characteristics of PN Junction Diode and Zener diode.

CO2: DesignandTestingofBJTandMOSFETamplifiers.

CO3: Operationofpoweramplifiers.

TOTAL:45PERIODS

REFERENCE:

XYZofOscilloscope–Applicationnote:TektronixUSA.

CO's-PO's&PSO'sMAPPING

O	O1	O2	PO	O4	O5	O6	O7	O8	O9	O10	O11	O12	SO1	SO2	SO3
1	2	2	3	3	2	1	-	-	-	-	-	1	2	1	1
2	2	2	3	3	2	1	-	-	-	-	-	1	2	1	1
3	2		2		1	1	-	-	-	-	-	1	2	1	1
4	-	-	-	-	3	1	-	-	-	-	-	1	2	1	1
5	-	-	-	-	2	1	-	-	-	-	-	1	2	1	1
O	**2**	**2**	2.6	**3**	**2**	**1**	-	-	-	-	-	**1**	**2**	**1**	**1**

1-low,2-medium, 3-high,'-'-no correlation

2L37 **PROGRAMMINGANDDATASTRUCTURESLABORATORY** **L T P**
0 0 3 5

COURSEOBJECTIVES:

- TodevelopapplicationsinC
- Toimplementlinearandnon-lineardatastructures
- Tounderstandthedifferentoperationsofsearchtrees
- Togetfamiliarizedtosortingandsearchingalgorithms

LISTOFEXPERIMENTS

1. PracticeofCprogrammingusingstatements, expressions,decisionmakinganditerativestatements
2. PracticeofCprogramming usingFunctionsandArrays
3. ImplementCprogramsusingPointersandStructures
4. ImplementCprogramsusingFiles
5. Developmentofrealtime C applications
6. ArrayimplementationofListADT
7. ArrayimplementationofStack andQueue ADTs
8. LinkedlistimplementationofList,StackandQueue ADTs
9. ApplicationsofList,Stack andQueueADTs
10. 10.ImplementationofBinaryTreesandoperations ofBinaryTrees
11. Implementation ofBinarySearchTrees

12. Implementationofsearchingtechniques
13. ImplementationofSortingalgorithms:InsertionSort,QuickSort,MergeSort
14. ImplementationofHashing– anytwocollisiontechniques

TOTAL:45PERIODS

COURSEOUTCOMES:

Attheendofthecourse,thestudentswillbeable to:

CO1:UsedifferentconstructsofCanddevelopapplications

CO2:Writefunctionstoimplementlinearandnon-lineardatastructureoperations

CO3:Suggestandusetheappropriatelinear/non-lineardatastructureoperationsfora givenproblem

CO4:Apply appropriate hash functions that result in a collision free scenario for data storage andRetrieval

CO5:ImplementSortingandsearchingalgorithmsforagivenapplication

CO's-PO's&PSO'sMAPPING

O	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12	SO1	SO2	SO3
1	2	3	1	2	2	1	1	-	1	2	1	3	2	1	3
2	1	2	1	2	2	-	-	-	1	1	1	2	2	2	2
3	2	3	1	2	3	-	-	-	1	1	1	2	2	1	2
4	2	1	-	1	1	-	-	-	2	1	1	2	2	3	1
5	1	2	1	2	2	1	1	-	1	2	1	3	2	2	3
vg	2	2	1	2	2	1	1	-	1	1	1	2	2	2	2

1-low,2-medium, 3-high,'-'-no correlation

21152L39 PROFESSIONALDEVELOPMENT LTPC

00 21

COURSEOBJECTIVES:

TobeproficientinimportantMicrosoftOfficetools:MSWORD,EXCEL,POWERPOINT.

- To be proficient in using MS WORD to create quality technical documents,byusing standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize,interlink, and utilizing many more critical features offered
- To be able to create and share quality presentations by using the features ofMS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations.

MSWORD: 10Hours

CreateandformatadocumentWorkingwithtablesWorki

ng with Bullets and Lists

Workingwithstyles,shapes,smartart,charts

Insertingobjects,chartsandimportingobjectsfromotherofficetoolsCreating and

Using document templates

Insertingequations,symbolsandspecialcharactersWork

ing with Table of contents and

References,citationsInsert and review comments

Createbookmarks,hyperlinks,endnotesfootno

teViewing document in differentmodes

Working with document protection

andsecurityInspectdocumentforaccessibility

MSEXCEL: 10Hours

Createworksheets,insertandformatdata

Workwithdifferenttypesofdata:text,currency,date,nume

ric etc.Split, validate, consolidate, Convert dataSort

and filter data

Performcalculationsandusefunctions:(Statistical,Logical,Mathematical,date,

Timeetc.,)WorkwithLookupandreferenceformulaeCre

ate and Work with different types of

chartsUsepivottablestosummarizeandanalyse

data

Performdataanalysisusingownformulaeandfunctions

Combinedatafrommultipleworksheetsusingownformulaeandbuilt-infunctionstogenerateresults

ExportdataandsheetstootherfileformatsWorki

ng with macros

ProtectingdataandSecuringtheworkbook

MSPOWERPOINT: 10Hours

Selectslidetemplates,layoutandthemes

Formatting slide content and using bullets

andnumberingInsertandformatimages,smartart,tables,

charts

UsingSlidemaster,notesandhandoutmasterW

orking with animation andtransitions

Organize and Group slides

Importorcreateandusemediaobjects:audio,video,animation

PerformslideshowrecordingandRecordnarrationandcreatepresentablevideos

TOTAL:30PERIODS

COURSEOUTCOMES:

Onsuccessfulcompletionthestudentswillbeableto

CO1:Use MSWord to create quality documents, by structuring and organizing content for their dayto day technical and academic requirements

CO2:Use MSEXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding

CO3:UseMSPowerPointtocreatehighqualityacademicpresentationsbyincluding commontables, charts, graphs, interlinking other elements, and using media objects.

21152C41 ELECTROMAGNETICFIELDS L TPC
3003

COURSEOBJECTIVES:

- Toimpartknowledgeonthebasicsofstaticelectricfieldandtheassociated laws
- Toimpartknowledgeonthebasicsofstaticmagneticfieldand theassociatedlaws
- Togive insight into coupling betweenelectric and magnetic fieldsthroughFaraday's law, displacement current and Maxwell's equations
- TogainthebehaviourofthepropagationofEMwaves
- Tostudythesignificance ofTimevaryingfields.

UNITI INTRODUCTION 9

Electromagneticmodel,Unitsandconstants,Reviewofvectoralgebra,Rectangular, cylindricalandsphericalcoordinatesystems,Line,surfaceandvolumeintegrals, Gradientof ascalarfield,Divergenceofavectorfield,Divergencetheorem,Curlofavectorfield, Stoke'stheorem,Nullidentities,Helmholtz'stheorem,Verifytheoremsfordifferentpath, surfaceandvolume.

UNITII ELECTROSTATICS 9

Electricfield,Coulomb'slaw,Gauss'slawandapplications,Electricpotential,Conductors instaticelectricfield,Dielectricsinstaticelectricfield,Electricfluxdensityanddielectric constant,Boundaryconditions,Electrostaticsboundaryvalueproblems,Capacitance, Parallel,cylindricalandsphericalcapacitors,Electrostaticenergy,Poisson'sandLaplace's equations, Uniqueness of electrostatic solutions, Current density and Ohm's law, ElectromotiveforceandKirchhoff'svoltagelaw,EquationofcontinuityandKirchhoff's currentlaw

UNITIII MAGNETOSTATICS 9

Lorentzforceequation,Ampere'slaw,Vectormagneticpotential,Biot-Savartlawand applications, Magnetic field intensity and idea of relative permeability, Calculation ofmagnetic field intensity for various current distributions Magnetic circuits, Behaviour ofmagnetic materials, Boundary conditions, Inductance and inductors, Magnetic energy,Magnetic forces and torques

UNITIV TIME-VARYINGFIELDSANDMAXWELL'sEQUATIONS 9

Faraday'slaw,DisplacementcurrentandMaxwell-Amperelaw,Maxwell'sequations, Potentialfunctions,Electromagneticboundaryconditions,Waveequationsandsolutions, Time-harmonicfields,ObservingthePhenomenonofwavepropagationwiththeaidofMaxwell's equations

UNITV PLANEELECTROMAGNETICWAVES 9

Planewavesinlosslessmedia,Planewavesinlossymedia(low-lossdielectricsandgood conductors),Groupvelocity,ElectromagneticpowerflowandPoyntingvector,Normalincidence at a plane conducting boundary, Normal incidence at a plane dielectric boundary

COURSEOUTCOMES:

Attheendofthecoursethestudentswillbeableto

CO1:Relatethefundamentalsofvector,coordinatesystemtoelectromagneticconcepts
CO2:AnalyzethecharacteristicsofElectrostaticfield
CO3:InterprettheconceptsofElectricfieldinmaterialspaceandsolvetheboundary conditions**CO4**: Explain the concepts and characteristics of Magneto Static field in material space and solve boundary conditions.
CO5:Determinethesignificanceoftimevaryingfields

TOTAL:45PERIODS

TEXTBOOKS

1. D.K.Cheng,Fieldandwaveelectromagnetics,2nd ed.,Pearson(India),2002
2. M.N.O.Sadiku and S.V. Kulkarni, Principles ofelectromagnetics, 6th ed., Oxford(Asian Edition), 2015

REFERENCES

1. EdwardC. Jordan&KeithG.Balmain,Electromagnetic waves andRadiating Systems, Second Edition, Prentice-Hall Electrical Engineering Series, 2012.
2. W.H.HaytandJ.A.Buck,Engineeringelectromagnetics,7thed.,McGraw-Hill(India), 2006
3. B.M.Notaros,Electromagnetics,Pearson:NewJersey,2011

CO's-PO's&PSO'sMAPPING

O	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	12
1	2	1	1	1	-	2	1	-	-	1	-	2
2	2	2	3	3	2	2	2	-	-	1	1	2
3	2	2	3	2	2	2	1	-	-	1	1	2
4	2	2	3	2	2	2	1	-	-	1	1	2
5	2	2	2	2	2	2	1	-	-	2	2	1
CO	**2**	**2**	**2**	**2**	**2**	**2**	**1**	-	-	**1**	**1**	**2**

1-low,2-medium, 3-high,'-'-no correlation

21152C45 NETWORKS AND SECURITY LTP C30 24

COURSEOBJECTIVES:

- TolearntheNetworkModelsanddatalinklayerfunctions.
- TounderstandroutingintheNetworkLayer.
- Toexploremethodsofcommunicationand congestioncontrolbytheTransportLayer.
- TostudytheNetworkSecurityMechanisms.
- Tolearnvarioushardwaresecurityattacksandtheircountermeasures**.**

UNITI NETWORKMODELSANDDATALINKLAYER 9

Overview of Networks and its Attributes – Network Models – OSI, TCP/IP, Addressing – Introductionto Datalink Layer – Error Detection and Correction – Ethernet(802.3)-WirelessLAN – IEEE 802.11, Bluetooth– Flow and Error Control Protocols – HDLC – PPP.

UNITII NETWORKLAYERPROTOCOLS 9

Network Layer – IPv4 Addressing – Network Layer Protocols(IP,ICMP and Mobile IP)Unicast and Multicast Routing – Intradomain and Interdomain Routing Protocols – IPv6Addresses – IPv6 – Datagram Format - Transition from IPv4 to IPv6.

UNITIII TRANSPORTANDAPPLICATIONLAYERS 9

TransportLayerProtocols–UDPandTCPConnectionandStateTransitionDiagram-CongestionControlandAvoidance(DECbit,RED)-QoS-ApplicationLayerParadigms–Client–ServerProgramming–DomainName System–WorldWideWeb,HTTP,Electronic Mail.

UNITIV NETWORKSECURITY 9

OSISecurityArchitecture–Attacks–SecurityServicesandMechanisms–Encryption–AdvancedEncryptionStandard–PublicKeyCryptosystems–RSAAlgorithm–Hash Functions–SecureHashAlgorithm–DigitalSignatureAlgorithm.

UNIT V HARDWARESECURITY 9

Introduction to hardware security, Hardware Trojans, Side – Channel Attacks – PhysicalAttacksandCountermeasures–DesignforSecurity.IntroductiontoBlockchainTechnology.

45PERIODS

PRACTICALEXERCISES: 30PERIODS

ExperimentsusingC

1. ImplementtheDataLinkLayerframingmethods,
   i) Bitstuffing,(ii)Characterstuffing
2. ImplementationofErrorDetection/ CorrectionTechniques
   i) LRC,(ii)CRC,(iii)Hammingcode
3. ImplementationofStopandWait,andSliding WindowProtocols
4. ImplementationofGoback-NandSelectiveRepeatProtocols.
5. ImplementationofDistanceVectorRoutingalgorithm(RoutingInformation Protocol)(Bellman-Ford).
6. ImplementationofLink StateRoutingalgorithm(OpenShortestPathFirst)with5 nodes(Dijkstra's).
7. Dataencryptionanddecryptionusing DataEncryptionStandardalgorithm.
8. DataencryptionanddecryptionusingRSA(Rivest,ShamirandAdleman) algorithm.
9. ImplementClientServermodelusingFTPprotocol.

ExperimentsusingToolCommandLanguage

1. ImplementandrealizetheNetworkTopology- Star,BusandRingusing NS2.
2. ImplementandperformtheoperationofCSMA/CDandCSMA/CAusing NS2.

COURSEOUTCOMES:

Upon successful completionofthecoursethestudentwillbeableto **CO1**: Explain the Network Models, layers and functions.

CO2:Categorizeandclassifytheroutingprotocols.

CO3: List the functions of the transport and application layer.

CO4: Evaluate and choose the network security mechanisms.

CO5:Discussthehardwaresecurityattacksandcountermeasures.

TOTAL:75PERIODS

TEXTBOOKS

1. Behrouz.A.Forouzan,DataCommunicationandNetworking,FifthEdition,TMH,2017.(Unit

–I,II,III)

2. William Stallings, Cryptographyand Network Security, Seventh Edition, Pearson Education,2017(Unit- IV)
3. BhuniaSwarup, HardwareSecurity–AHandsOnApproach,MorganKaufmann, First edition,2018.(Unit – V).

REFERENCES

1. James.F.Kurose and Keith.W.Ross, Computer Networking – ATop – Down Approach, SixthEdition, Pearson, 2017.
2. Doughlas.E.Comer,ComputerNetworksandInternetswithInternetApplications,Fourth Edition, Pearson Education, 2008.

21152C42 LINEARINTEGRATEDCIRCUITS LTPC

300

3

COURSEOBJECTIVES:

- Tointroducethebasicbuildingblocksoflinear integratedcircuits
- Tolearnthelinearandnon-linearapplicationsofoperationalamplifiers
- Tointroducethetheoryand applicationsofanalogmultipliersandPLL
- TolearnthetheoryofADCandDAC
- Tointroducethe conceptsofwaveformgenerationandintroducesomespecialfunctionICs

UNITI BASICSOFOPERATIONAL AMPLIFIERS 9

Currentmirrorandcurrentsources,Currentsourcesasactiveloads,Voltagesources, VoltageReferences,BJTDifferentialamplifierwithactiveloads,Basicinformationabout op-amps–IdealOperationalAmplifier-Generaloperationalamplifierstages-andinternal circuitdiagramsofIC741,DCandACperformancecharacteristics,slewrate,Openand closedloopconfigurations–MOSFETOperationalAmplifiers –LF155andTL082.

UNITII APPLICATIONSOFOPERATIONALAMPLIFIERS 9

SignChanger,ScaleChanger,PhaseShiftCircuits,VoltageFollower,V-to-IandI-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator,Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precisionrectifier, peak detector, clipper and clamper, Low-pass, high-pass and band-passButterworth filters.

UNITIII ANALOGMULTIPLIERANDPLL 9

AnalogMultiplier usingEmitterCoupled Transistor Pair - Gilbert Multiplier cell–Variable transconductancetechnique,analogmultiplierICsandtheirapplications,Operationofthe basicPLL,Closedloopanalysis,Voltagecontrolledoscillator,MonolithicPLLIC565, applicationofPLLforAMdetection,FMdetection,FSKmodulationanddemodulationand Frequencysynthesizingandclocksynchronization

UNITIV ANALOGTODIGITALANDDIGITALTOANALOGCONVERTERS 9

AnalogandDigitalDataConversions,D/Aconverter–specifications-weightedresistor type,R-2RLaddertype,VoltageModeandCurrent-Mode*R-2R*Laddertypes-switches forD/Aconverters,highspeedsample-and-holdcircuits,A/DConverters–specifications-Flashtype-SuccessiveApproximationtype-SingleSlopetype–DualSlopetype-A/D ConverterusingVoltage-to-TimeConversion-Over-samplingA/DConverters,Sigma–Delta converters.

UNITV WAVEFORMGENERATORSANDSPECIALFUNCTIONICS 9

Sine-wavegenerators,MultivibratorsandTriangularwavegenerator,Saw-toothwave generator,ICL8038functiongenerator,TimerIC555,ICVoltageregulators–Three terminalfixedandadjustablevoltageregulators-IC723generalpurposeregulator-Monolithicswitchingregulator,LowDrop–Out(LDO)Regulators-Switchedcapacitor filter IC MF10, Frequency to Voltage and Voltage to Frequency converters, Audio Poweramplifier, Video Amplifier, Isolation Amplifier, Opto-couplers and fibre optic IC

COURSEOUTCOMES:

Attheendofthecoursethestudentswillbeableto

CO1 : Design linear and nonlinear applications of OP – AMPS**CO2**:Designapplicationsusinganalogmultiplier and PLL **CO3** : Design ADC and DAC using OP – AMPS

CO4:GeneratewaveformsusingOP–AMPCircuits
CO5:AnalyzespecialfunctionICs

TEXTBOOK

TO

TOTAL:45PERIODS

1. 1.D.RoyChoudhry, Shail Jain, “Linear IntegratedCircuits”, New Age InternationalPvt. Ltd.,2018, Fifth Edition. (Unit I – V)
2. 2.Sergio Franco, “Design with Operational Amplifiers and Analog Integrated Circuits”, 4thEdition, Tata Mc Graw-Hill, 2016 (Unit I – V)

REFERENCES

1. RamakantA.Gayakwad,“OP-AMPandLinearICs”,4thEdition,PrenticeHall/ PearsonEducation, 2015
2. Robert F.Coughlin, Frederick F.Driscoll,“Operational Amplifiers and Linear Integrated Circuits”, Sixth Edition, PHI, 2001.
3. S.Salivahanan&V.S. KanchanaBhaskaran,“LinearIntegratedCircuits”,TMH,2nd Edition, 4th Reprint, 2016.

CO’s-PO’s&PSO’sMAPPING

C	O	O	O	O	O	O	O	O	O	O1	O1	O1	SO	SO	SO
1	2	-	-	-	-	-	-	-	-	-	1	-	2	1	1
2	2	3	3	2	-	-	-	-	-	-	-	-	2	1	1
3	1	-	-	2	-		-	-	-	-	-	-	2	1	1
4	1	-	-	2	-	-	-	-	-	-	-	-	2	1	1
5	1	2	3	3	-	-	-	-	-	-	-	3	2	1	1
C	**.4**	**.5**	**3**	**.2**	-	-	-	-	-	-	**1**	**3**	**2**	**1**	**1**

1-low,2-medium, 3-high,‘-’-no correlation

21152C44 **DIGITALSIGNALPROCESSING** **L C**
3 4

COURSEOBJECTIVES:

- Tolearndiscretefouriertransform,propertiesofDFT anditsapplicationtolinear filtering
- To understand the characteristics of digital filters, designdigital IIR and FIR filters and applythese filters to filter undesirable signals in various frequency bands
- Tounderstandtheeffectsoffinite precisionrepresentationondigitalfilters
- Tounderstandthefundamentalconceptsofmultiratesignalprocessinganditsapplications
- Tointroducetheconceptsofadaptivefiltersanditsapplicationtocommunication engineering

UNITI DISCRETEFOURIERTRANSFORM 9

SamplingTheorem,conceptoffrequencyindiscrete-timesignals,summaryofanalysis& synthesisequationsforFT&DTFT,frequencydomainsampling,DiscreteFouriertransform (DFT)-derivingDFTfromDTFT,propertiesofDFT-periodicity,symmetry,circular convolution.LinearfilteringusingDFT.Filteringlongdatasequences-overlapsaveand overlapaddmethod.FastcomputationofDFT-Radix-2Decimation-in-time(DIT)Fast Fouriertransform(FFT),Decimation-in-frequency(DIF)FastFouriertransform(FFT). LinearfilteringusingFFT.

UNITII INFINITEIMPULSERESPONSEFILTERS 9

Characteristicsofpracticalfrequencyselectivefilters.characteristicsofcommonlyusedanalogfilters-Butterworth filters,Chebyshevfilters.Design ofIIR filters fromanalogfilters

(LPF, HPF, BPF,BRF) - Approximation of derivatives, Impulse invariance method, Bilineartransformation. Frequency transformationintheanalogdomain.StructureofIIRfilter-directformI,directformII,Cascade, parallel realizations.

UNITIII FINITEIMPULSERESPONSEFILTERS 9

Design ofFIRfilters-symmetricand Anti-symmetricFIRfilters-designoflinearphaseFIR filters usingFourier series method - FIR filter design usingwindows (Rectangular, Hammingand Hanning window), Frequency sampling method. FIR filter structures - linear phasestructure, direct form realizations

UNITIV FINITEWORDLENGTHEFFECTS 9

Fixed point and floatingpoint number representation-ADC - quantization-truncationandrounding - quantization noise - input / output quantization - coefficient quantization error-productquantization error - overflow error - limit cycle oscillations due to product quantizationandsummation - scaling to prevent overflow.

UNIT V DSPAPPLICATIONS 9

Multirate signal processing: Decimation, Interpolation, Sampling rate conversion by a rational factor–AdaptiveFilters: Introduction,Applicationsofadaptivefiltering toequalization-DSPArchitecture-Fixed and Floating point architecture principles

45PERIODS

PRACTICALEXERCISES: 30PERIODS

MATLAB/EQUIVALENTSOFTWAREPACKAGE/DSPPROCESSORBASED IMPLEMENTATION

1. GenerationofelementaryDiscrete-Timesequences
2. LinearandCircular convolutions
3. AutocorrelationandCrossCorrelation
4. FrequencyAnalysisusingDFT
5. DesignofFIRfilters(LPF/HPF/BPF/BSF)anddemonstratesthefiltering operation
6. DesignofButterworthandChebyshevIIRfilters(LPF/HPF/BPF/BSF)anddemonstratethe filtering operations
7. Studyofarchitecture ofDigitalSignalProcessor
8. PerformMACoperationusingvariousaddressingmodes
9. Generationofvarioussignalsandrandomnoise
10. DesignanddemonstrationofFIRFilter forLowpass, Highpass, BandpassandBand stop filtering
11. DesignanddemonstrationofButterworthandChebyshevIIRFiltersforLowpass, High pass, Band pass and Band stop filtering
12. ImplementanUp-samplingandDown-samplingoperationinDSPProcessor

COURSEOUTCOMES:

Attheendofthecoursestudentswillbeableto:

CO1: ApplyDFTfortheanalysisofdigitalsignalsandsystems
CO2: DesignIIRandFIRfilters
CO3: Characterizetheeffectsoffiniteprecisionrepresentationondigitalfilters
CO4: Designmultiratefilters
CO5: Applyadaptivefiltersappropriatelyincommunicationsystems

TOTAL:75PERIODS

TEXTBOOKS:

1. 1.JohnG.ProakisandDimitrisG.Manolakis,DigitalSignalProcessing–Principles, Algorithms and Applications, Fourth Edition, Pearson Education / Prentice Hall, 2007.
2. 2.A. V. Oppenheim, R.W. Schafer andJ.R.Buck, ―Discrete-Time SignalProcessing", 8th Indian Reprint, Pearson, 2004.

REFERENCES

1. EmmanuelC.Ifeachor&Barrie.W. Jervis, "DigitalSignalProcessing", Second Edition, Pearson Education / Prentice Hall, 2002.
2. 2.Sanjit K. Mitra, "DigitalSignalProcessing – A Computer Based Approach", Tata Mc GrawHill, 2007.
3. 3.AndreasAntoniou,"DigitalSignalProcessing",TataMcGrawHill,2006.

CO's-PO's&PSO'sMAPPING

O	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12	SO1	SO2	SO3
1	3	3	3	3	2	2	-	-	-	-	1	1	3	3	2
2	3	3	3	3	2	2	-	-	-	-	1	1	2	2	2
3	3	3	**2**	2	2	2	-	-	-	-	1	1	1	2	2
4	3	3	2	2	3	1	-	-	-	-	1	1	2	2	3
5	3	2	2	2	3	2	-	-	-	-	1	1	2	2	1
O	**3**	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**1**	**2**	**2**	**2**

1- low,2-medium,3-high,'-'-nocorrelation

21152C43 COMMUNICATIONSYSTEMS LTPC

300

3

COURSEOBJECTIVES:

- TointroduceAnalogModulationSchemes
- Toimpartknowledgeinrandomprocess
- TostudyvariousDigitaltechniques
- Tointroducethe importanceofsampling&quantization
- Toimpartknowledge indemodulationtechniques
- Toenhancetheclassroomteaching using smart connectivityinstruments

UNIT I AMPLITUDEMODULATION 9

Reviewofsignalsandsystems,TimeandFrequencydomainrepresentationofsignals, PrinciplesofAmplitudeModulationSystems-DSB,SSBandVSBmodulations.Angle Modulation,RepresentationofFMandPMsignals,Spectralcharacteristicsofangle modulated signals. SSB Generation – Filter and Phase Shift Methods, VSB Generation –Filter Method, Hilbert Transform, Pre-envelope & complex envelope AM techniques,Superheterodyne Receiver.

UNITII RANDOMPROCESS&SAMPLING 9

Reviewofprobabilityandrandomprocess.Gaussianandwhitenoisecharacteristics,Noise inamplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis andDe- emphasis, Threshold effect in angle modulation.

ow pass sampling – Aliasing- Signal Reconstruction-Quantization - Uniform & non-uniformquantization - quantization noise - Nyquist criterion- Logarithmic Companding – PAM, PPM,PWM, PCM – TDM, FDM

UNITIII DIGITALTECHNIQUES 9

PulsemodulationDifferentialpulsecode modulation.Deltamodulation,Noiseconsiderationsin PCM,, Digital Multiplexers, Channel coding theorem - Linear Block codes - Hammingcodes - Cyclic codes - Convolutional codes - Viterbi Decoder

UNITIV DIGITALMODULATIONSCHEME 9

Geometric Representation of signals - Generation, detection, IQ representation, PSD & BERofCoherentBPSK,BFSK,&QPSK-QAM-CarrierSynchronization-StructureofNon-coherentReceiversSynchronizationandCarrierRecoveryforDigitalmodulation,Spectrum Analysis–Occupiedbandwidth–Adjacentchannelpower,EVM,Principleof DPSK

UNIT V DEMODULATIONTECHNIQUES 9

Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations. Baseband Pulse Transmission-IntersymbolInterference,Optimumdemodulationofdigitalsignalsoverband-limited channels.

TOTAL:45PERIODS

COURSEOUTCOMES:

Attheendofthecoursestudentswillbeableto

CO1: Gainknowledgeinamplitudemodulationtechniques

CO2: UnderstandtheconceptsofRandomProcesstothedesignofcommunicationsystems

CO3: Gainknowledgeindigitaltechniques

CO4: Gainknowledgeinsamplingandquantization

CO5: Understandtheimportanceofdemodulationtechniques

TEXTBOOKS:

1. SimonHaykins,"CommunicationSystems",Wiley, 5thEdition,2009.(UnitI -V)
2. B.P.Lathi,"Modern Digital andAnalog Communication Systems",4th Edition,Oxford University Press, 2011.

REFERENCES:

1. WaynerTomasi,ElectronicCommunicationSystem,5thEdition,PearsonEducation,2008.
2. D.Roody,J.Coolen,ElectronicCommunications,4theditionPHI2006
3. A.Papoulis,“Probability,RandomvariablesandStochasticProcesses”,McGrawHill,3rd edition, 1991.
4. B.Sklar,“DigitalCommunicationsFundamentalsand Applications”,2ndEditionPearson Education 2007
5. HPHsu,SchaumOutlineSeries-“Analog andDigitalCommunications” TMH 2006
6. Couch.L.,"ModernCommunicationSystems",Pearson,2001

CO’s-PO’s&PSO’sMAPPING

	Pos											
	PO1	O2	O3	O4	O5	PO6	O7	O8	O9	O10	O11	O12
1	3	3	3	3	2	1	1	-	-	-	1	1
2	3	3	3	3	2	1	1	-	-	-	1	1
3	3	3	3	3	3	1	1	-	-	-	1	1
4	3	3	3	3	3	1	1	-	-	-	1	1

5	3		3	3	2	1	1	-	-			1
Avg	3		3	3	2.5	1	1	-	-			1

1-low,2-medium, 3-high,'-'-no correlation

21149S46 ENVIRONMENTALSCIENCESANDSUSTAINABILITY LTPC
20 0 2

COURSEOBJECTIVES:

- To introduce the basic concepts of environment, ecosystems and biodiversityand emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of global and Indian scenario of renewable and nonrenewable resources, causes of their degradation and measures to preserve them.
- To familiarize the concept of sustainable development goals and appreciate the interdependence of economic and social aspects of sustainability, recognize and analyze climate changes, concept ofcarbon credit and the challenges ofenvironmental management.
- To inculcate and embrace sustainability practices and develop a broader understanding on green materials, energycycles and analyze the role of sustainable urbanization.

UNIT I ENVIRONMENTANDBIODIVERSITY 6

Definition,scopeandimportanceofenvironment–needforpublicawareness.Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species andecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots ofbiodiversity – threatsto biodiversity: habitat loss, poachingof wildlife, man-wildlife conflicts–endangeredandendemicspeciesofIndia–conservationofbiodiversity:In-situandex-situ.

UNITII ENVIRONMENTALPOLLUTION 6

Causes,EffectsandPreventivemeasuresofWater,Soil,AirandNoisePollutions. Solid, Hazardous andE-Wastemanagement.CasestudiesonOccupationalHealthand Safety Management system (OHASMS). Environmental protection, Environmentalprotectionacts .

UNITIII RENEWABLESOURCESOFENERGY 6

Energy managementandconservation, New Energy Sources: Need ofnewsources. Differenttypesnew energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidalenergy conversion. Concept, origin and power plants of geothermal energy.

UNITIV SUSTAINABILITYANDMANAGEMENT 6

Development,GDP,Sustainability-concept,needsandchallenges-economic,socialandaspectsofsustainability-fromunsustainabilitytosustainability-millenniumdevelopment goals,andprotocols-SustainableDevelopmentGoals-targets,indicatorsandintervention areasClimatechange-Global,Regionalandlocalenvironmentalissuesandpossible solutions-case studies. Concept of Carbon Credit, CarbonFootprint. Environmentalmanagement in industry-A case study.

UNIT V SUSTAINABILITYPRACTICES 6

Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycleassessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Greenmaterials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventionalSources, Energy Cycles- carbon cycle, emission and sequestration, Green Engineering:Sustainable urbanization- Socio- economical and technological change.

TOTAL:30PERIODS

COURSEOUTCOMES:

CO1:To recognize and understand the functions of environment, ecosystems and biodiversity andtheir conservation.

CO2:To identify the causes, effects of environmental pollution and natural disasters and contributeto the preventive measures in the society.

CO3:Toidentifyandapplytheunderstandingofrenewableandnon-renewableresourcesand contribute to the sustainable measures to preserve them for future generations.

CO4:Torecognizethedifferentgoalsofsustainabledevelopmentandapplythemfor suitabletechnological advancement and societal development.

CO5:To demonstrate the knowledge of sustainability practices and identify green materials, energycycles and the role of sustainable urbanization.

TEXTBOOKS:

1. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition,New Age International Publishers ,2018.
2. BennyJoseph, 'EnvironmentalScienceandEngineering', TataMcGraw-Hill,NewDelhi, 2016.
3. GilbertM.Masters,'IntroductiontoEnvironmentalEngineeringandScience',2nd edition,Pearson Education,2004.
4. Allen,D.T. and Shonnard,D. R., Sustainability Engineering:Concepts,Design and Case Studies, Prentice Hall.
5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.
6. EnvironmentImpactAssessmentGuidelines,NotificationofGovernmentofIndia,2006.
7. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.

REFERENCES:

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38 . edition 2010.
2. Cunningham,W.P.Cooper,T.H.Gorhani, 'EnvironmentalEncyclopedia',JaicoPubl., House,Mumbai, 2001.
3. Dharmendra S.Sengar,'Environmental law',Prenticehall of India PVT.LTD,New Delhi,2007.
4. Rajagopalan, R,'EnvironmentalStudies-FromCrisisto Cure',OxfordUniversityPress, ThirdEdition, 2015.

5. ErachBharucha“TextbookofEnvironmental StudiesforUndergraduateCourses”Orient Blackswan Pvt. Ltd. 2013.

CO’s-PO’s&PSO’sMAPPING

	PO											SO		
	1	2	3	4			7			1	1			3
1	2	1	-	-			3			-	-			-
2	3	2	-	-			3			-	-			
3	3	-	1	-			2			-	-			
4	3	2	1	1			2			-	-			-
5	3	2	1	-			2			-	-			
vg.	.8	.8	1	1			.4			-	-			

1-low,2-medium, 3-high,‘-'-no correlation

21152L48 COMMUNICATIONSYSTEMSLABORATORY LTPC

003

1.5

COURSEOBJECTIVES:

- TostudytheAM&FMModulationandDemodulation.
- TolearnandrealizetheeffectsofsamplingandTDM.
- TounderstandthePCM&DigitalModulation.
- ToSimulateDigitalModulationSchemes.
- ToImplement EqualizationAlgorithmsandErrorControlCodingSchemes.

LISTOFEXPERIMENTS

1. AM- ModulatorandDemodulator
2. FM-Modulatorand Demodulator
3. Pre-EmphasisandDe-Emphasis.
4. Signalsamplingand TDM.
5. PulseCodeModulationand Demodulation.
6. PulseAmplitudeModulationandDemodulation.
7. PulsePositionModulationandDemodulationandPulseWidthModulationandDemodulation.
8. DigitalModulation–ASK,PSK,FSK.
9. DeltaModulationandDemodulation.
10. SimulationofASK,FSK, andBPSKGenerationandDetectionSchemes.
11. SimulationofDPSK,QPSKandQAMGeneration and DetectionSchemes.
12. SimulationofLinearBlockandCyclicErrorControlcodingSchemes.

TOTAL:45PERIODS

COURSEOUTCOMES:

Attheendofthelaboratorycourse,thestudentwillbeabletounderstand the: CO1:Design AM, FM & Digital Modulators for specific applications.

CO2:Computethesamplingfrequencyfordigitalmodulation**.**

CO3:Simulate&validatethevariousfunctionalmodulesof Communication system.**CO4**:Demonstrate their knowledge in base band signaling schemes through implementation of digital modulation schemes.

CO5:Applyvariouschannelcodingschemes&demonstratetheircapabilities

towardstheimprovementofthenoiseperformanceofCommunicationsystem.

CO’s-PO’s&PSO’sMAPPING

	POs											
	PO1	O2	O3	O4	O5	PO 6	O7	O8	O9	O10	O11	O12
1	3	3	3	3	3	3	-	-	-	1	1	1
2	3	3	3	3	3	2	-	-	-	1	1	1
3	3	3	3	3	3	2	-	-	-	1	1	1
4	3	3	3	3	3	3	-	-	-	1	1	1
5	3	3	3	3	3	2	-	-	-	1	1	1
Avg	3	3	3	3	3	2.5	-	-	-	1	1	1

1-low,2-medium, 3-high,‘-’-no correlation

21152L47LINEARINTEGRATEDCIRCUITSLABORATORY **LTPC**

003 1.5

COURSEOBJECTIVES:

- Togainhandsonexperienceindesigning electroniccircuits
- Tolearnsimulationsoftwareusedincircuitdesign
- Tolearnthe fundamentalprinciplesofamplifiercircuits
- Todifferentiatefeedbackamplifiersandoscillators.
- Todifferentiatetheoperationofvariousmultivibrators

LISTOFEXPERIMENTS:

DESIGNANDANALYSISOFTHEFOLLOWINGCIRCUITS

1. SeriesandShuntfeedbackamplifiers-Frequencyresponse,Inputandoutput impedance
2. RCPhaseshiftoscillatorandWienBridgeOscillator
3. HartleyOscillatorandColpittsOscillator
4. RCIntegratorandDifferentiatorcircuitsusingOp-Amp
5. Clippersand Clampers
6. Instrumentationamplifier
7. Activelow-pass, Highpass&Bandpassfilters
8. PLLCharacteristicsanditsuseasfrequencymultiplier,clocksynchronization
9. R-2RladdertypeD-AconverterusingOp-Amp

SIMULATIONUSINGSPICE(UsingTransistor):

1. TunedCollector Oscillator
2. Twin-TOscillator/WeinBridgeOscillator
3. DoubleandStaggertunedAmplifiers
4. BistableMultivibrator
5. SchmittTriggercircuitwithPredictablehysteresis
6. Analysisofpoweramplifier

ComponentsandAccessories:

Transistors, Resistors, Capacitors, Inductors, diodes, Zener Diodes, Bread Boards, Transformers.SPICECircuitSimulationSoftware:(anypublicdomainorcommercial software)

Note: Op-AmpsuA741,LM301,LM311,LM324,LM317,LM723,7805,7812, 2N3524, 2N3525,2N3391, AD 633, LM 555, LM 565 may be used

TOTAL:45PERIODS

COURSEOUTCOMES:

Attheendofthecoursethestudentswillbeableto

CO1:Analyzevarioustypesoffeedbackamplifiers

CO2:Designoscillators,tunedamplifiers,wave-shapingcircuitsandmultivibrators

CO3:Design and simulate feedback amplifiers,oscillators, tuned amplifiers, wave-shapingcircuits and multivibrators, filters using SPICE Tool.

CO4:Designamplifiers,oscillators,D-Aconvertersusingoperationalamplifiers.

CO5:Designfiltersusingop-ampandperformanexperimentonfrequencyresponse

CO's-PO's&PSO'sMAPPING

CO	O1	O2	3		O5	O6	O7	O8	O9	O10	11	O12
CO 1	2	3	3	3	-	-	-	-	-	-	1	1
CO 2	2	3	3	3	-	-	-	-	-	-	1	1
CO 3	2	3	3	3	-	-	-	-	-	-	1	1
CO 4	2	3	3	3	2	-	-	-	-	-	1	1
CO 5	-	-	-	-	-	-	-	-	-	-	-	-
Av g	2	3	3	3	2	-	-	-	-	-	1	1

1-low,2-medium, 3-high,'-'-no correlation

21152C51 **WIRELESSCOMMUNICATION** **LTPC**

302

4

COURSEOBJECTIVES:

- Tostudyandunderstandtheconceptsanddesignofa CellularSystem.
- ToStudyAndUnderstandMobileRadio PropagationAndVariousDigital ModulationTechniques.
- ToUnderstandTheConceptsOfMultipleAccessTechniques AndWirelessNetworks

UNIT-I THECELLULARCONCEPT-SYSTEMDESIGNFUNDAMENTALS 9

Introduction-FrequencyReuse-Channel Assignment Strategies-**Handoff Strategies:**Prioritizing Handoffs, PracticalHandoff Considerations. **Interference And System Capacity**: Co-Channel Interference And System Capacity-Channel Planning For Wireless Systems, Adjacent Channel Interference, Power Control For Reducing Interference,Trunking And Grade Of Service. **Improving Coverage And Capacity In Cellular Systems:** CellSplitting,Sectoring.

UNIT-II MOBILERADIOPROPAGATION 9

LargeScalePathLoss: IntroductionToRadioWavePropagation-FreeSpacePropagationModel – **Three Basic Propagation Mechanism:** Reflection – Brewster Angle-Diffraction- Scattering.**Small ScaleFading And Multipath:** Small Scale Multipath Propagation, Factors Influencing Small-Scale Fading, Doppler Shift,Coherence Bandwidth, Doppler Spread And Coherence Time. **TypesOf Small- Scale Fading:** Fading Effects Due ToMultipath Time Delay Spread, Fading Effects Due To Doppler Spread.

UNIT-III MODULATIONTECHNIQUESANDEQUALIZATIONANDDIVERSITY9

Digital Modulation – An Overview: Factors That Influence The Choice Of Digital Modulation, **Linear ModulationTechniques:** Minimum Shift Keying (MSK), Gaussian Minimum ShiftKeying(GMSK), **Spread Spectrum ModulationTechniques:** Pseudo- Noise (PN) Sequences,Direct Sequence Spread Spectrum (DS-SS)- Modulation Performance InFading And Multipath Channels- **Equalization, Diversity And Channel Coding:** Introduction-Fundamentals OfEqualization- **Diversity Techniques:** Practical Space Diversity Considerations, Polarization Diversity, FrequencyDiversity, Time Diversity.

UNIT-IV MULTIPLEACCESSTECHNIQUES 9

Introduction: Introduction To Multiple Access- Frequency Division MultipleAccess(FDMA)- Time Division Multiple Access(TDMA)- Spread Spectrum MultipleAccess-Code Division Multiple Access(CDMA)- Space Division Multiple Access(SDMA)-**Capacity Of Cellular Systems:** Capacity Of Cellular CDMA, Capacity Of CDMA WithMultiple Cells.

UNIT-V WIRELESSNETWORKING 9

Introduction: Difference Between Wireless And Fixed Telephone Networks, The Public Switched TelephoneNetwork(PSTN), **Development Of Wireless Networks:** First Generation Wireless Networks, Second GenerationWireless Networks, Third Generation Wireless Networks, Fixed Network Transmission Hierarchy,**TrafficRoutingInWireless Networks**: Circuit Switching, Packet Switching- **Personal Communication Services/Networks(PCS/PCNs):**Packet VsCircuit Switching For PCN, Cellular Packet- Switched Architecture-PacketReservation Multiple Access(PRMA)- **Network Databases:** DistributedDatabase For Mobility Management-UniversalMobile Telecommunication Systems(UMTS).

45PERIODS

PRACTICALEXERCISES: **30PERIODS**

1. Modelingofwirelesscommunicationsystemsusing Matlab(Two raychannel andOkumura –Hata model)
2. ModelingandsimulationofMultipathfadingchannel
3. Design, analyze and test Wireless standards and evaluate the performance measurements suchasBER,PER,BLER,throughput,capacity,ACLR, EVMfor4Gand5GusingMatlab
4. Modulation:SpreadSpectrum–DSSSModulation&Demodulation
5. Wireless Channel equalization: Zero-Forcing Equalizer (ZFE),MMSE Equalizer(MMSEE),AdaptiveEqualizer(ADE),DecisionFeedbackEqualizer (DFE)
6. ModelingandsimulationofTDMA,FDMAandCDMAfor wirelesscommunication

TOTAL:75PERIODS

COURSEOUTCOMES :

Uponsuccessfulcompletionofthecoursethestudentwillbeableto: CO1:Understand TheConcept And Design Of A Cellular System.

CO2:UnderstandMobileRadioPropagationAndVariousDigitalModulation

Techniques.**CO3**:Understand The Concepts Of Multiple Access Techniques And Wireless Networks **CO4**:Characterize a wireless channel and evolve the system designspecifications**CO5**:Designacellularsystembasedonresourceavailability and traffic demands.

TEXTBOOK:

1. Rappaport,T.S.,-Wirelesscommunications”,PearsonEducation,SecondEdition,2010.

REFERENCES:

1. WirelessCommunication–AndreaGoldsmith,CambridgeUniversityPress, 2011
2. VanNee,R.andRamjiPrasad,—OFDMforwirelessmultimediacommunications, ArtechHouse, 2000
3. DavidTseandPramodViswanath,—FundamentalsofWirelessCommunication,Cambridge University Press, 2005.
4. UpenaDalal, —WirelessCommunication”,OxfordUniversityPress,2009.
5. Andreas.F.Molisch,—WirelessCommunications”,JohnWiley–India,2006.
6. WirelessCommunicationandNetworks–WilliamStallings,PearsonEducation,Second Edition2002.

CO’s-PO’s&PSO’sMAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	3		2	3			-	-	-		-	1	3		1
2	3		2	1			-	-	-		-	-	3		2
3	3		3	3			-	-	-		-	1	3		2
4	2		2	2			-	-	-		-	1	2		1
5	2		3	3			-	-	-		-	1	2		2
CO	**3**	**3**	**2**	**2**	**2**	**2**	-	-	-	-	-	**1**	**3**	**1**	**2**

1- low,2-medium,3-high,‘-’-nocorrelation

21152C52 VLSIANDCHIPDESIGN L TPC

3003

COURSEOBJECTIVES:

- UnderstandthefundamentalsofICtechnologycomponentsandtheircharacteristics.
- Understandcombinationallogiccircuitsanddesignprinciples.
- Understandsequentiallogiccircuitsandclockingstrategies.
- UnderstandASICDesignfunctioninganddesign.
- UnderstandMemoryArchitectureandbuilding blocks

UNITI MOSTRANSISTORPRINCIPLES 9

MOS logic families (NMOS and CMOS), Ideal and Non Ideal IV Characteristics, CMOSdevices. MOS(FET) Transistor Characteristic under Static and Dynamic Conditions,Technology Scaling, power consumption

UNITII COMBINATIONALLOGICCIRCUITS 9

Propagation Delays, stick diagram, Layout diagrams, Examples of combinational logicdesign,Elmore's constant, Static Logic Gates,Dynamic Logic Gates, Pass Transistor Logic,Power Dissipation, Low Power Design principles.

UNITIII SEQUENTIALLOGICCIRCUITSANDCLOCKINGSTRATEGIES 9

Static Latches and Registers, Dynamic Latches and Registers, Pipelines, NonbistableSequential Circuits.Timing classification of Digital Systems, Synchronous Design, Self-Timed Circuit Design .

UNIT IV

INTERCONNECT,MEMORYARCHITECTUREANDARITHMETIC 9CIRCUITS

InterconnectParameters–Capacitance,Resistance,andInductance,ElectricalWireModels, Sequential digital circuits: adders, multipliers, comparators, shift registers. Logic ImplementationusingProgrammableDevices(ROM,PLA,FPGA),MemoryArchitecture andBuildingBlocks,MemoryCoreandMemoryPeripheralsCircuitry

UNITV ASICDESIGNANDTESTING 9

Introductiontowafertochipfabricationprocessflow.Microchipdesignprocess&issuesin testandverificationofcomplexchips,embeddedcoresandSOCs,Fault models,Testcoding.ASIC Design Flow, Introduction to ASICs, Introduction to test benches,Writingtest benchesin Verilog HDL, Automatic test pattern generation, Design for testability, Scan design: Testinterface and boundary scan.

TOTAL:45PERIODS

COURSEOUTCOMES:

Upon successful completionofthecoursethestudentwillbeabletoCO1:In depth knowledge of MOS technology

CO2: Understand Combinational Logic Circuits and Design Principles**CO3**: Understand Sequential Logic Circuits and ClockingStrategies**CO4**:UnderstandMemoryarchitectureand building blocks

CO5:UnderstandtheASICDesignProcessandTesting.

TEXTBOOKS

1. Jan D Rabaey,Anantha Chandrakasan,“ DigitalIntegratedCircuits:A Design Perspective”, PHI, 2016.(Units II, III and IV).
2. Neil H E Weste, Kamran Eshranghian, “ Principles of CMOS VLSI Design: A SystemPerspective,” Addison Wesley, 2009.(Units - I, IV).
3. MichaelJSmith,”ApplicationSpecificIntegratedCircuits, AddisonWesley,(Unit- V)
4. Samir Palnitkar,” Verilog HDL:Aguideto DigitalDesignandSynthesis”, Second Edition, Pearson Education,2003.(Unit - V)
5. ParagK.Lala,”DigitalCircuitTestingandTestability”, AcademicPress,1997,(Unit-V)

REFERENCES

1. D.A.Hodges and H.G.Jackson,Analysisand Design of Digital Integrated Circuits, International Student Edition, McGraw Hill 1983
2. P. Rashinkar, Paterson and L. Singh, "System-on-a-Chip Verification-Methodologyand Techniques", Kluwer Academic Publishers,2001
3. SamihaMouradandYervantZorian,“PrinciplesofTestingElectronicSystems”,Wiley2000
4. M.Bushnell andV.D.Agarwal,"Essentialsof ElectronicTestingforDigital,Memory andMixed-Signal VLSI Circuits", Kluwer Academic Publishers,2000

CO’s-PO’s&PSO’sMAPPING

C	O	O	O	O	O	O	O	O	O	O1	O1	O1	SO	SO	SO
1	1	1	-	-	-	-	-	-	-	-	-	-	3	3	3
2	3	2	3	2	-	-	-	-	-	-	-	1	3	3	3
3	2	3	2	3	1	1	-	-	-	-	-	2	3	2	3
4	-	-	1	1	-	-	-	-	-	-	-	3	3	3	2
5	-	-	-	-	-	2	-	-	-	-	1	-	3	2	2
C	**2**	**2**	**2**	**2**	**1**	**.5**	**-**	**-**	**-**	**-**	**1**	**2**	**3**	**3**	**3**

1-low,2-medium, 3-high,‘-'-no correlation

21152C53 TRANSMISSIONLINESANDRFSYSTEMS LTPC 3003

COURSEOBJECTIVES:

- Tointroducethevarioustypesoftransmissionlinesandits characteristics
- Tounderstandhighfrequencyline, power andimpedancemeasurements
- Toimparttechnicalknowledgeinimpedancematchingusing SmithChart.
- Tointroducepassivefiltersand basicknowledgeofactiveRFcomponents
- Tolearnthe conceptsofa RFsystemtransceiverdesign.

UNIT I TRANSMISSIONLINETHEORY 9

GeneraltheoryofTransmissionlines-thetransmissionline-generalsolution-Theinfinite line-Wavelength,velocityofpropagation-Waveformdistortion-thedistortionlessline-Loadinganddifferentmethodsofloading-LinenotterminatedinZ0-Reflection coefficient-calculationofcurrent,voltage,powerdeliveredandefficiencyoftransmission-Inputandtransferimpedance-Openandshortcircuitedlines-reflectionfactorandreflection loss.

UNITII HIGHFREQUENCYTRANSMISSIONLINES 9

Transmissionlineequationsatradiofrequencies-LineofZerodissipation-Voltageand current on thedissipationlessline,StandingWaves,Nodes,StandingWaveRatio-Inputimpedance of the dissipation less line - Open and short circuited lines - Power and impedance measurement onlines -Reflection losses - Measurement of VSWR and wavelength.

UNITIII IMPEDANCEMATCHINGINHIGHFREQUENCYLINE 9

Impedance matching: Quarter wave transformer ,One Eighth wave line, Half wave line- Impedance matching by stubs- Single stub and double stub matching - Smith chart – Application of Smith chart, Solutions of problems using Smithchart - Singleand double stubmatching using Smith chart.

UNITIV WAVEGUIDES 9

Waves between parallel planes of perfect conductors- Transverse Electric waves andTransverse Magnetic waves, Characteristics of TE and TM waves, TransverseElectromagnetic waves, TM and TE waves in Rectangular waveguides, TMand TEwaves inCircular waveguides.

UNIT V RFSYSTEMDESIGNCONCEPTS 9

ActiveRFcomponents:SemiconductorbasicsinRF,bipolarjunctiontransistors,RFfield effecttransistors,Highelectronmobilitytransistors,FundamentalsofMMIC,Basicconcepts ofRFdesign:Filters,couplers,powerdividers,Amplifierpowerrelations,Lownoise amplifiers,Poweramplifiers.

COURSEOUTCOMES:

CO1:Explainthecharacteristicsoftransmissionlinesanditslosses.
CO2:Calculatethestandingwaveratioandinputimpedanceinhighfrequency transmission lines.
CO3:AnalyzeimpedancematchingbystubsusingSmithCharts.
CO4:ComprehendthecharacteristicsofTEandTMwaves.
CO5:DesignaRFtransceiversystemforwirelesscommunication

TOTAL:45PERIODS

TEXTBOOKS

1. JohnDRyder,“Networkslinesandfields”,PrenticeHallofIndia,NewDelhi,2005.(Unit I–IV)
2. Mathew M. Radmanesh, “Radio Frequency&Microwave Electronics”, Pearson Education Asia, Second Edition, 2002 (Unit – V)
3. AnnapurnaDas,Sisir K. Das,“MicrowaveEngineering”, McGrawHillEducation(India) private limited, Third edition,2000.(Unit – V)

REFERENCES

1. ReinholdLudwigandPowelBretchko,“RFCircuitDesign” –Theoryand Applications”,Pearson Education Asia, First Edition, 2001.
2. D. K. Misra, “Radio Frequencyand Microwave CommunicationCircuits”- Analysisand Design, John Wiley & Sons, 2004.
3. RichardChi-HsiLi-,“RFCircuitDesign”–AJohnWiley&Sons,Inc,Publications
4. W.Alan Davis, Krishna Agarwal, “Radio Frequency Circuit Design”, John willy & Sons,2001

CO’s-PO’s&PSO’sMAPPING

O	O 1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12	SO1	SO2	SO3
	3	3	3	3	2	1	-	-	-	1	-	1	2	1	1
	3	2	2	3	2	1	-	-	-	1	-	1	2	1	1
	3	3	3	2	1	2	-	-	-	1	-	1	2	1	1
	3	3	2	3	2	1	-	-	-	1	-	1	2	1	1
	3	2	3	2	2	1	-	-	-	1	-	1	2	1	1
O	**3**	**3**	**3**	**3**	**2**	**1**	-	-	-	**1**	-	**1**	**2**	**1**	**1**

21152L58 **VLSILABORATORY** **LTPC0 042**

COURSEOBJECTIVES:

- TolearnHardwareDescriptiveLanguage(Verilog/VHDL).
- Tolearnthefundamentalprinciples ofDigitalSystemDesingusingHDLandFPGA.
- TolearnthefundamentalprinciplesofVLSIcircuitdesignindigitaldomain
- TolearnthefundamentalprinciplesofVLSI circuitdesigninanalog domain
- Toprovidehandsondesignexperience withEDA platforms.

LISTOF EXPERIMENTS:

1. Designofbasiccombinationalandsequential(Flip-flops)circuitsusingHDL.Simulateitusing Xilinx/Altera Software and implement by Xilinx/Altera FPGA
2. Design an Adder ; Multiplier (Min 8 Bit) using HDL. Simulate it using Xilinx/AlteraSoftwareand implement by Xilinx/Altera FPGA
3. DesignandimplementUniversal ShiftRegisterusingHDL.SimulateitusingXilinx/AlteraSoftware
4. DesignMemoriesusingHDL.SimulateitusingXilinx/AlteraSoftwareandimplementbyXilinx/Altera FPGA
5. Design Finite State Machine (Moore/Mealy) using HDL. Simulate it using Xilinx/AlteraSoftware and implement by Xilinx/Altera FPGA
6. Design 3-bit synchronous up/down counter using HDL. Simulate it using Xilinx/AlteraSoftware and implement by Xilinx/Altera FPGA
7. Design4-bit Asynchronousup/downcounter usingHDL. Simulateit usingXilinx/AlteraSoftware and implement by Xilinx/Altera FPGA
8. Design and simulate a CMOS Basic Gates & Flip-Flops.Generate Manual/AutomaticLayout .
9. Design and simulate a 4-bitsynchronous counter using a Flip-Flops.GenerateManual/Automatic Layout
10. DesignandSimulateaCMOSInvertingAmplifier.
11. DesignandSimulatebasicCommonSource,CommonGateandCommonDrain Amplifiers.
12. Designandsimulatesimple5transistordifferentialamplifier.

COURSEOUTCOMES:

Oncompletionofthecourse,studentswillbeableto:

CO1: WriteHDLcodeforbasicaswellasadvanceddigitalintegratedcircuit
CO2: ImportthelogicmodulesintoFPGABoards
CO3: SynthesizePlaceandRoutethedigital Ips
CO4: Design,SimulateandExtractthelayoutsofDigital&AnalogICBlocks using EDAtools
CO5: TestandVerificationofICdesign

TOTAL:60PERIODS

CO's-PO's&PSO'sMAPPING

C	O	O	O	O	O	O	O	O	O	O1	O1	O1	SO	SO	SO
1	2	-	-	-	-	-	-	-	-	-	-	-	2	3	2
2	3	3	1	1	-	-	-	-	-	-	-	-	2	1	2
3	1	2	2	2	-	-	-	-	-	-	1	1	2	2	2
4	-	1	3	3	1	-	-	-	-	-	1	1	2	2	2
5	3	3	3	3	1	-	-	-	-	-	1	1	2	2	2
C	**.2**	**.2**	**.2**	**.2**	**1**	-	-	-	-	-	**1**	**1**	**2**	**2**	**2**

1-low,2-medium, 3-high,'-'-nocorrelation

21152S62 EMBEDDEDSYSTEMSANDIOTDESIGN LTP C3024

COURSEOBJECTIVES:

- Learnthe architectureandfeaturesof8051.
- Studythedesignprocess ofanembeddedsystem.
- Understandthereal–time processinginanembeddedsystem.
- Learnthearchitectureand designflowofIoT.
- BuildanIoTbased system.

UNIT I 8051MICROCONTROLLER 9

Microcontrollers for an Embedded System – 8051 – Architecture – Addressing Modes – Instruction Set– ProgramandDataMemory– Stacks– Interrupts–Timers/Counters – SerialPorts – Programming.

UNITII EMBEDDEDSYSTEMS 9

Embedded System Design Process – Model Train Controller – ARM Processor – InstructionSet Preliminaries – CPU – Programming Input and Output – Supervisor Mode – Exceptionsand Trap – Models for programs – Assembly, Linking and Loading – CompilationTechniques – Program Level Performance Analysis.

UNITIII PROCESSESANDOPERATINGSYSTEMS 9

Structure of a real – time system – Task Assignment and Scheduling – Multiple Tasks andMultiple Processes – Multirate Systems – Pre emptive real – time Operating systems – Priority based scheduling – Interprocess Communication Mechanisms – DistributedEmbedded Systems – MPSoCs and Shared Memory Multiprocessors – Design Example –Audio Player, Engine Control Unit and Video Accelerator.

UNITIV IOTARCHITECTUREANDPROTOCOLS 9

Internet – of – Things – Physical Design, Logical Design – IoT Enabling Technologies – Domain Specific IoTs – IoT and M2M– IoT SystemManagement with NETCONF – YANG– IoT Platform Design – Methodology – IoT Reference Model – Domain Model – CommunicationModel–IoTReferenceArchitecture–IoTProtocols-MQTT,XMPP, Modbus,CANBUSandBACNet.

UNITV IOTSYSTEMDESIGN 9

Basicbuildingblocksofan IoTdevice–RaspberryPi–Board–LinuxonRaspberryPi–Interfaces–Programming with Python – Case Studies: Home Automation, Smart Cities, Environment and Agriculture.

45PERIODS

PRACTICALEXERCISES **30PERIODS**

Experimentsusing8051.

1. ProgrammingArithmeticandLogicalOperations in8051.
2. GenerationofSquarewaveformusing8051.
3. ProgrammingusingOn– Chipportsin8051.
4. Programmingusing SerialPortsin8051.
5. DesignofaDigitalClockusingTimers/Countersin805

1.Experiments using ARM

InterfacingADCandDACBlinkingofLEDsandLCDInterfacing

keyboard and Stepper Motor.

MiniprojectsforIoT
Garbage Segregator and Bin
LevelIndicatorColourbasedProductSortin
gImage Processing based
FireDetectionVehicle Number
PlateDetection
SmartLockSystem

TOTAL:60PERIODS

COURSEOUTCOMES:

CO1:Explainthearchitectureandfeaturesof 8051.
CO2:Developamodelofanembeddedsystem.
CO3: List the concepts of real time operating systems.**CO4**: Learn the architecture and protocols of IoT. **CO5**: Design an IoT based system for any application.

TEXTBOOKS:

1. Mohammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D.McKinlay, The 8051 Microcontroller and Embedded Systems Using Assembly and C, Second Edition, Pearson Education, 2008.(Unit – I)
2. 2.Marilyn Wolf, Computers as Components – Principles of Embedded Computing System Design, Third Edition, Morgan Kaufmann, 2012.(Unit – II,III)
3. Arshdeep Bahga, VijayMadisetti, Internet –of- Things– AHandsonApproach, Universities Press, 2015.(Unit – IV,V)

REFERENCES:

1. MayurRamgir, Internet –of–Things,Architecture, ImplementationandSecurity,First Edition, Pearson Education, 2020.
2. LylaB.Das, EmbeddedSystems:AnIntegratedApproach,PearsonEducation2013.
3. Jane.W.S.Liu,Real–TimeSystems,PearsonEducation,2003.

CO’s-PO’s&PSO’sMAPPING

C	O	O	O	O	O	O	O	O	O	O1	O1	O1	SO	SO	SO
1	3	3	3	2	2	-	-	-	-	-	-	-	3	2	1
2	3	3	3	2	2	-	-	-	-	-	-	-	3	2	1
3	3	3	2	2	2	-	-	-	-	-	-	-	2	1	1
4	3	3	2	2	2	-	-	-	-	-	-	-	3	3	2
5	3	3	3	3	3	-	-	-	-	-	-	-	3	3	2
C	**3**	**3**	**.6**	**.2**	**.2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2.8**	**2.2**	**1.4**

1-low,2-medium, 3-high,‘-'-no correlation

21152S63 ARTIFICIALINTELLIGENCEANDMACHINE LEARNING LTPC

30 24

COURSEOBJECTIVES:

Themainobjectivesofthiscourseareto:

- StudyaboutuninformedandHeuristicsearchtechniques.
- Learntechniquesforreasoningunderuncertainty
- IntroduceMachineLearningandsupervisedlearningalgorithms
- Studyabout ensemblingandunsupervisedlearning algorithms
- Learnthebasicsofdeeplearning usingneuralnetworks

UNITI PROBLEMSOLVING 9

Introduction to AI - AI Applications - Problem solving agents – search algorithms – uninformed search strategies – Heuristic search strategies – Local search and optimizationproblems – adversarial search – constraint satisfaction problems (CSP)

UNITII PROBABILISTICREASONING 9

Acting under uncertainty – Bayesian inference – naïve bayes models. Probabilistic reasoning–Bayesiannetworks–exactinferenceinBN–approximateinferenceinBN–causal networks.

UNITIII SUPERVISEDLEARNING 9

Introductiontomachinelearning–LinearRegressionModels:Leastsquares,single& multiplevariables,Bayesianlinearregression,gradientdescent,LinearClassification Models:Discriminantfunction–Probabilisticdiscriminativemodel-Logisticregression, Probabilisticgenerativemodel–NaiveBayes,Maximummarginclassifier–Supportvector machine,DecisionTree,Randomforests

UNITIV ENSEMBLETECHNIQUESANDUNSUPERVISEDLEARNING 9

Combiningmultiplelearners:Modelcombinationschemes,Voting,EnsembleLearning-bagging,boosting,stacking,Unsupervisedlearning:K-means,InstanceBasedLearning:KNN, Gaussian mixture models and Expectation maximization

UNITV NEURALNETWORKS 9

Perceptron - Multilayer perceptron, activation functions, network training – gradient descentoptimization – stochastic gradient descent, error backpropagation, from shallow networks todeep networks –Unit saturation (aka the vanishing gradient problem) – ReLU,hyperparameter tuning, batch normalization, regularization, dropout.

45PERIODS

PRACTICALEXERCISES: **30PERIODS**

1. ImplementationofUninformedsearchalgorithms(BFS,DFS)
2. ImplementationofInformed searchalgorithms(A*,memory-boundedA*)
3. ImplementnaïveBayes models
4. ImplementBayesianNetworks
5. BuildRegressionmodels
6. Build decisiontreesandrandomforests
7. BuildSVMmodels
8. Implementensemblingtechniques
1. Implementclusteringalgorithms
2. ImplementEMforBayesian networks
3. BuildsimpleNNmodels
4. BuilddeeplearningNNmodels

OUTCOMES:

Attheendofthiscourse,thestudentswillbeableto:

CO1:Useappropriatesearchalgorithmsforproblemsolving

CO2:Applyreasoningunderuncertainty

CO3:Buildsupervisedlearningmodels

CO4:Buildensemblingandunsupervisedmodels

CO5:Builddeeplearningneuralnetworkmodels

TOTAL:75PERIODS

TEXTBOOKS:

1. StuartRussellandPeterNorvig,“ArtificialIntelligence–AModernApproach”, FourthEdition, Pearson Education, 2021.
2. EthemAlpaydin,“IntroductiontoMachineLearning”,MITPress,FourthEdition, 2020.

REFERENCES

1. DanW.Patterson,“IntroductiontoAIandES”,PearsonEducation,2007
2. KevinNight,ElaineRich,andNairB.,“ArtificialIntelligence”,McGrawHill, 2008
3. PatrickH.Winston,"ArtificialIntelligence",ThirdEdition,PearsonEducation,2006
4. Deepak Khemani, “ArtificialIntelligence”,Tata McGraw HillEducation, 2013 (http://nptel.ac.in/)
5. ChristopherM.Bishop,“PatternRecognitionandMachineLearning”,Springer,2006.
6. TomMitchell, “MachineLearning”,McGrawHill,3rdEdition,1997.
7. CharuC.Aggarwal,“DataClassificationAlgorithmsandApplications”,CRCPress,2014
8. MehryarMohri,AfshinRostamizadeh,AmeetTalwalkar,“FoundationsofMachine Learning”, MIT Press, 2012.
9. IanGoodfellow, YoshuaBengio,AaronCourville,“DeepLearning”,MITPress,2016

CO’s-PO’s&PSO’sMAPPING

O	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12	SO1	SO2	SO3
1	3	2	2	3	1	3	2	-	-	-	-	1	3	3	3
2	3	2	2	3	1	3	2	-	-	-	-	1	3	3	3
3	1	2	1	3	2	3	2	-	-	-	-	1	3	3	3
4	1	2	3	1	3	3	2	-	-	-	-	1	3	3	3
5	2	2	2	-	3	3	2	-	-	-	-	1	3	3	3
O	2	2	2	2	2	3	2	-	-	-	-	1	3	3	3

1-low,2-medium, 3-high,‘-'-no correlation

21152INT76 SUMMER INTERNSHIP LTP C000 2

COURSEOBJECTIVES:

Toenablethestudentsto

- Getconnectedwithindustry/laboratory/researchinstitute
- Getpracticalknowledgeonproductionprocessintheindustryanddevelopskillstosolve related problems
- Developskillstocarryout researchintheresearch institutes/laboratories

The students individually undergo training in reputed firms/ research institutes / laboratories for the specified duration. After the completion of training, a detailed report should be submitted within ten days from the commencement of next semester. The students will be evaluated as per the Regulations.

No.ofWeeks:04 COURSE

OUTCOMES:

Oncompletionofthecourse,thestudentwillknowabout

CO1:System-leveldesignprocesses,verificationandvalidationtechniques, manufacturingandproductionprocessesinthefirmorresearchfacilitiesinthe laboratory/research institute

CO2:Analysisofindustrial/researchproblemsandtheirsolutions

CO3:Documentationofsystemspecifications,designmethodologies,process parameters,testing parameters and results

CO4:Preparingoftechnicalreportandpresentation

21152P81 PROJECTWORK/INTERNSHIP LTPC002010

COURSEOBJECTIVES:

Totrainthestudentsin

- Identifying problem and developing the structured methodologyto solve theidentifiedproblemintheindustryorresearchproblemat researchInstitutionor college.
- Conductingexperiments,analyzeanddiscussthetestresults,andmakeconclusions.
- Preparingprojectreportsand presentation

The students shall individually / or as group work on a specific topic approved by theDepartment. The student can select any topic which is relevant to his/her specialization ofthe programme. The student should continue the work on the selected topic as per theformulated methodology. At the end of the semester, after completing the work to thesatisfaction of the supervisor and review committee, a detailed report which contains cleardefinitionoftheidentifiedproblem, detailed literaturereviewrelatedtotheareaofworkandmethodology for carrying out the work, results and discussion, conclusion and referencesshould be prepared asperthe format prescribed by the University and submitted to the Headof the department. The students will be evaluated based on the report and viva-voceexamination by a panel of examiners as per the Regulations.

TOTAL:300PERIODS

COURSEOUTCOMES:

Attheendoftheproject,thestudentwillbeableto

CO1: Formulate and analyze problem / create a new product/ process.CO2:Designandconductexperimentstofindsolution

CO3: Analyze the results and provide solution for the identified problem, prepare project report andmake presentation.

21152E54A OPTICALCOMMUNICATION&NETWORKS LT P C300 3

COURSEOBJECTIVES:

- ToStudyAboutTheVariousOpticalFiberModes,ConfigurationOfOpticalFibers
- ToStudyTransmissionCharacteristicsOfOpticalFibers.
- ToLearnAboutTheVariousOpticalSources,DetectorsAndTransmissionTechniques.
- ToExploreVariousIdeaAboutOpticalFiberMeasurementsAndVariousCoupling
- Techniques.
- ToEnrichTheKnowledgeAboutOpticalCommunicationSystemsAnd Networks.

UNIT-IINTRODUCTIONTOOPTICALFIBERCOMMUNICATION9

Introduction - TheGeneral Systems - Advantages of OpticalFiber Communication- **RayTheoryTransmission** : TotalInternalReflection,AcceptanceAngle, Numerical Aperture,Skew Rays- **ElectromagneticModeTheoryforOpticalPropagation**: Modes ina PlanarGuide, Phaseand group velocity - **CylindricalFiber**: Stepindexfibers, Gradedindexfibers - **Single mode fibers**: Cutoff wavelength.

UNIT-II TRANSMISSIONCHARACTERISTICSOFOPTICALFIBERS9

Attenuation -**Material absorption losses in silica glass fibers:** Intrinsicabsorption, Extrinsicabsorption -**Linear scattering losses**: Rayleigh Scattering, Mie Scattering -**Nonlinear scattering losses**: Stimulated BrillouinScattering, Stimulated Raman Scattering – Fiber Bend Loss – Dispersion- **Chromatic dispersion**: Material dispersion,Waveguide dispersion- **Intermodal dispersion** : Multimodestep indexfiber,Multimode graded index fiber.

UNIT-III OPTICALSOURCESANDOPTICALDETECTORS9

Thelaser:Introduction-**Basicconcepts**:Absorptionandemissionofradiation, Populationinversion,Opticalfeedbackandlaseroscillation,Thresholdconditionforlaser oscillation-**Opticalemissionfromsemiconductors**:ThePNjunction,Spontaneous emission, Carrier recombination, Stimulated emission and lasing, Hetero junctions- **LED**:Introduction- Power and Efficiency - **LED structures**: Planar LED, Dome LED, SurfaceemitterLED,EdgeemitterLED-LEDCharacteristics.**OpticalDetectors:**Introduction ,Optical Detection Principles, Quantum Efficiency, Resposivity, P-N Photodiode ,P-I-NPhoto Diode and Avalanche Photodiode.

UNIT-IVOPTICALFIBERMEASUREMENTS 9

Introduction- Total Fiber Attenuation Measurement, Fiber Dispersion Measurements InTime Domain and Frequency Domain, Fiber Cut off Wavelength Measurements, NumericalAperture Measurements. Fiber Diameter Measurements,.Reflectance And Optical ReturnLoss, Field Measurements

UNIT-V OPTICALNETWORKS 9

Introduction- Optical NetworkConcepts: Optical NetworkingTerminology, Optical NetworkNodeAndSwitchingElements,WavelengthDivisionMultiplexedNetworks,Public TelecommunicationsNetworkOverview-OpticalNetworkTransmissionModes,Layers And Protocols: Synchronous Networks, Asynchronous Transfer Mode, Open System InterconnectionReferenceModel,OpticalTransportNetwork,InternetProtocol-Wavelength RoutingNetworks:RoutingAndWavelengthAssignment-OpticalSwitchingNetworks: OpticalCircuitSwitchedNetworks,OpticalPacketSwitchedNetworks,MultiprotocolLabel Switching,OpticalBurstSwitchingNetworks-OpticalNetworkDeployment:LongHaul Networks,Metropolitanareanetworks,Accessnetworks,LocalAreaNetworks-Optical Ethernet:Networkprotection,restorationandsurvivability.

TOTAL:45PERIODS

COURSEOUTCOMES

At the end of the course, the student will be able to understand the

CO1:RealizeBasicElementsInOpticalFibers,DifferentModesAnd Configurations.

CO2:AnalyzeTheTransmissionCharacteristicsAssociatedWithDispersionAnd Polarization Techniques.
CO3:DesignOpticalSourcesAndDetectorsWithTheirUseInOpticalCommunicationSystem.
CO4:ConstructFiberOpticReceiverSystems,MeasurementsAndTechniques. CO5:Design Optical Communication Systems And Its Networks.

TEXTBOOKS:

1. JohnM.Senior,“OpticalFiberCommunication”,PearsonEducation,FouthEdition.2010.

REFERENCES:

1. GredKeiser,"OpticalFiberCommunication”,McGrawHillEducation(India)PrivateLimited. FifthEdition, Reprint 2013.
2. GovindP.Agrawal, “Fiber-OpticCommunicationSystems”,ThirdEdition,JohnWiley&Sons,2004.
3. J.Gower,“OpticalCommunicationSystem”,PrenticeHallOfIndia,2001
4. RajivRamaswami,“OpticalNetworks“,SecondEdition,Elsevier,2004.
5. PChakrabarti,"OpticalFiberCommunication”,McGrawHillEducation(India)Private Limited,2016

CO’s-PO’s&PSO’sMAPPING

	O 1	O 2	O 3	O 4	O 5	O 6	O 7	O 8	O 9	O1 0	O1 1	O1 2	SO 1	SO 2	SO 3
1	3	3	2	3	3	1	-	-	-	-		1	2		2
2	3	3	2	1	3	2	-	-	-	-		2	2		2
3	3	3	3	3	2	1	-	-	-	-		1	2		2
4	3	3	2	2	2	1	-	-	-	-		1	2		2
5	3	3	3	3	2	1	-	-	-	-		1	2		2
	3	3	2	3	3	1	-	-	-	-		1	2		2

1-low,2-medium, 3-high,‘-'-no correlation

21152E54C AVIONICSSYSTEMS L TPC
300
3

COURSEOBJECTIVES:

- Toimpartknowledgeontheneedsfor avionicsforbothCivilandmilitaryaircraft.
- Toimpartknowledgeonavionicsarchitectureand Avionicsdatabus.
- Toimpartknowledgeunderstandthevariouscockpitdisplays andhumaninterfaces.
- Toimpartknowledgeontheconceptsofflightcontrolsystems, FMSandtheirimportance
- Toimpartknowledgeondifferentnavigationaidsandneedfor certification

UNITI INTRODUCTIONTOAVIONICS 9

Basics of Avionics-Basics of Cockpits – Need for Avionics in civil and military aircraft andspacesystems–IntegratedAvionicsArchitecture–MilitaryandCivilsystem–Typical avionics SystemandSubsystems–Designand Technologies –Requirementsand Importanceof illities of Avionic Systems.

UNITII DIGITALAVIONICSBUSARCHITECTURE 9

Evolution ofAvionics architecture– Avionics Data buses MIL-STD-1553, MIL-STD-1773,ARINC- 429, ARINC-629, AFDX/ARINC-664, ARINC-818 – Aircraft system Interface

UNITIII COCKPITDISPLAYSANDMAN-MACHINEINTERACTION 9

Trendsindisplaytechnology-CRT,LED,LCD,ELandplasmapanel -Touchscreen-Directvoice input (DVI) –-Civil cockpit and military cockpit: MFD, MFK, HUD, HDD, HMD,HOTAS –Glass cockpit.

UNITIV FLIGHTCONTROLSYSTEMS 9

IntroductiontoFlightcontrolsystemsandFMS–Longitudinalcontrol–LateralControl–Autopilot–Flightplanning–RadarElectronicWarfare-Certification-Militaryandcivil aircrafts.

UNITV NAVIGATIONSYSTEMS 9

Overviewofnavigationsystems-CommunicationSystems–Radionavigation–Types&Principles –FundamentalsofInertialSensors–INS – GNSS --GPS –ApproachandLanding Aids– ILS & MLS – Hybrid Navigation

COURSEOUTCOMES: **TOTAL:45PERIODS**

Uponcompletionofthecourse,studentswillbeable to:

CO1:ExplainthedifferentofAvionicsSystemsanditsneedforcivilandmilitaryaircrafts consideringthe reliability and safety aspects

CO2:Selectasuitablearchitectureanddatabusbasedontherequirements

CO3:Comparethedifferentdisplaytechnologiesusedincockpit

CO4:ExplaintheprinciplesofflightcontrolsystemsandtheimportanceofFMS

CO5:Explainthecommunicationandnavigationtechniquesusedinaircrafts

TEXTBOOK:

1. R.P.G.Collinson,“IntroductiontoAvionics”,SpringerPublications,ThirdEdition,2011.

REFERENCES:

1. CaryR.Spitzer,“TheAvionicsHandbook”,CRCPress,2000.
2. Middleton,D.H.“AvionicsSystems”,LongmanScientificandTechnical,LongmanGroupUK Ltd.,England,1989.Spitzer,C.R.“DigitalAvionicsSystems”,PrenticeHall,EnglewoodCliffs, N.J., U.S.A., 1987.
3. MyronKayton,WalterR.Fried“AvionicsNavigationSystems”2ndEdition,Wiley Publication,2008.

4. JimCurren,“TrendinAdvancedAvionics”,IOWAStateUniversity, 1992.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	3	2	-	-	-	-	-	3	3	3	2
2	3	3	3	2	2	2	-	-	-	-	-	3	3	2	2
3	3	3	3	3	1	2	-	-	-	-	-	3	2	3	2
4	2	3	3	2	2	1	-	-	-	-	-	2	2	1	2
5	3	3	2	2	2	1	-	-	-	-	-	2	2	2	2
CO	3	3	3	2	2	2	-	-	-	-	-	2	2	2	2

1-low,2-medium, 3-high,'-'-no correlation

21152E54B **4G/5GCOMMUNICATIONNETWORKS** **LT P C20 23**

COURSEOBJECTIVES

- Tolearnthe evolutionofwirelessnetworks.
- Togetacquaintedwiththe fundamentalsof5Gnetworks.
- Tostudythe processesassociated with5G architecture.
- Tostudyspectrumsharingandspectrumtrading.
- Tolearnthesecurityfeaturesin5G networks.

UNITI EVOLUTIONOFWIRELESSNETWORKS 6

Networksevolution:2G,3G,4G,evolutionofradioaccessnetworks,needfor5G.4Gversus5G,Next Generation core(NG-core), visualized Evolved Packet core(vEPC).

UNITII 5GCONCEPTS ANDCHALLENGES 6

Fundamentals of 5G technologies, overview of 5G core network architecture,5G new radioand cloud technologies, Radio Access Technologies (RATs), EPC for 5G.

UNITIII NETWORKARCHITECTUREANDTHEPROCESSES 6

5G architecture and core, network slicing, multi access edge computing(MEC)visualizationof 5G components, end-to-end system architecture, service continuity, relation to EPC, andedge computing. 5G protocols: 5G NAS,NGAP, GTP-U, IPSec and GRE.

UNITIV DYNAMICSPECTRUMMANAGEMENTANDMM-WAVES 6

Mobilitymanagement,Commandandcontrol,spectrumsharingandspectrumtrading,cognitive radio based on 5G, millimeter waves.

UNITV SECURITYIN5GNETWORKS 6

Security features in 5G networks, networkdomain security, user domain security, flow basedQoS framework,mitigating the threats in 5G.

30PERIODS

PRACTICALEXERCISES: **30PERIODS**

SIMULATIONUSINGMATLAB

1. 5G-Compliantwaveformgenerationandtesting
2. Modelingof5GSynchronizationsignalblocksandbursts
3. Channelmodelingin5Gnetworks
4. MultibandOFDMdemodulation
5. PerfectChannelestimation
6. Developmentof5gNewRadioPolarCoding

COURSEOUTCOMES

CO1:Tounderstandtheevolutionofwirelessnetworks.

CO2:Tolearntheconceptsof5Gnetworks.

CO3:To comprehend the 5G architecture and protocols.

CO4:Tounderstandthedynamicspectrummanagement.

CO5:To learn the security aspects in 5G networks.

TOTAL60PERIODS

TEXTBOOKS

1. 5GCorenetworks:PoweringDigitalization,StephenRommer,AcademicPress,2019
2. An Introduction to 5G Wireless Networks : Technology, Concepts and Use cases, Saro Velrajan,First Edition, 2020.

REFERENCES

1. 5G Simplified: ABCsof Advanced Mobile Communications Jyrki. T.J.Penttinen,Copyrighted Material.
2. 5GsystemDesign:AnendtoendPerspective,WanLeeAnthony,Springer Publications,2019.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	3	2	-	-	-	-	-	-	-	1	1	3
2	3	3	3	2	2	-	-	-	-	-	-	-	1	1	2
3	3	3	2	2	2	-	-	-	-	-	-		2	2	2
4	3	3	3	3	2	-	-	-	-	-	-	-	3	2	2
5	3	2	3	3	2	-	-	-	-	-	-	-	2	2	2
CO	3	2.8	2.6	2.6	2	-	-	-	-	-	-	-	1.8	1.6	2.2

1-low,2-medium, 3-high,'-'-no correlation

21152E56A **WIDEBANDGAPDEVICES** **LTPC2 023**

COURSEOBJECTIVES:

- Introducetheconcept ofwidebandgap(WBG)devicesanditsapplicationinrealworld
- AdvantagesanddisadvantagesofWBG devices
- ProvideanintroductiontobasicoperationofWBGpower devices
- LearnDesignprinciplesofmodernpowerdevices
- Abilitytodealhighfrequencydesigncomplexity

UNITI WBGDEVICESANDTHEIRAPPLICATIONINREALWORLD 6

Review of semiconductor basics, Operation and characteristics of the SiC Schottky BarrierDiode, SiC DMOSFET and GaN HEMT, Review of Wide bandgap semiconductortechnology -Advantages and disadvantages

UNITII SWITCHINGCHARACTERIZATIONOFWBG 6

Turn-onandTurn-offcharacteristicsofthedevice,Hardswitchinglossanalysis,Doublepulse test set-up

UNITIII DRIVERSFORWIDEBANDGAPDEVICES 6

Gatedriver,Impactofgateresistance,Gatedriversforwidebandgappowerdevices,Transient immunity integrated gate drivers

UNITIV HIGHFREQUENCYDESIGNCOMPLEXITYANDPCBDESIGNING 6

Effects of parasitic inductance, Effects of parasitic capacitance , EMI filter design for highfrequency power converters High frequency PCB design, Conventional power loop design,High frequency power loop optimization, Separation of power from signal PCB

UNITV APPLICATIONSOFWIDEBANDGAPDEVICES 6

Consumerelectronicsapplications,Wirelesspowertransferapplications,Electricvehicleapplications , Renewable energy sources applications

30PERIODS

PRACTICALEXERCISES: **30PERIODS**

1. ConductswitchinglossandMagneticlossonLowside
2. ConductDoublepulsetest (DPT)andlearnIEC60747-8/9standards
3. Conductexperimentsfor DiodereverserecoveryonHighside
4. ConductPoweranalysisandharmonicmeasurement
5. MeasureTurnon/offdelay, . Calculaterecoverysoftnessfactor,measurereverse recovery energy.

ListofEquipmentsneededfor30studentsinabatch(6students inbench)

1. 1GHzFlexichanneloscilloscopewith6 channels -#5
2. 2chAFGwith9inchtouchscreenand built-inDoublePulseTestapplicationtogenerate

atleast 2varyingpulsewidths,16Mptsmemory-#1

3. Powersupplies-ProgrammableDCPowerSupply,720W(forHighVoltageside)and ProgrammableSingleChannelDCPowerSupply, 192W(todriveGatedrivecircuit) - #1
4. VoltageProbestomeasureVgs(lowside)–passiveprobeordifferentialprobe200MHz-#15
5. VoltageProbesto measureVgs(highside) –1GHz,isolatedprobeswithMMCXadapter tips – #1 nos
6. CurrentProbestomeasuredraincurrent–30Awith120MzBW-#5

COURSEOUTCOMES:

Uponsuccessfulcompletionofthecoursethestudentwillbeableto **CO1:** Studentsmasterdesignprinciplesofpowerdevices

CO2: Studentsbecomefamiliarwithreliabilityissuesandtestingmethods

CO3: An ability to design and conduct experiments, as well as to analyze and interpret data

CO4: Student to get real life experience and to know practical applicationsofWBG

CO5: Indepthknowledge onpracticalusageofthistechnology

TOTAL:60PERIODS

TEXTBOOKS

1. A.Lidow,J.Strydom,M.D. Rooij,D.Reusch,GaNTransistorsforEfficient PowerConvertion, Wiley, 2014, ISBN-13: 978-1118844762.
2. G.Meneghesso,M.Meneghini,E.Zanoni,“GalliumNitride-enabledHighFrequencyand HighEfficiencyPower Conversion,”Springer InternationalPublishing, 2018, ISBN:978- 3-319-77993-5.

REFERENCES

1. F.Wang,Z.ZhangandE.A.Jones,CharacterizationofWideBandgapPowerSemiconductor Devices, IET, ISBN-13: 978-1785614910 (2018).
2. B.J.Baliga,“GalliumNitrideandSiliconCarbidePowerDevices,”WorldScientific PublishingCompany (3 Feb. 2017).
3. L.Corradini,D.Maksimovic,P.Mattavelli,R.Zane,“DigitalControlofHighFrequency Switched-Mode Power Converters”, Wiley, ISBN-13: 978-1118935101 (9th June, 2015).

CO’s-PO’s & PSO’s MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	3	2	-	-	-	-	-	-	-	1	1	3
2	3	3	3	2	2	-	-	-	-	-	-	-	1	1	2
3	3	3	2	2	2	-	-	-	-	-	-		2	2	2
4	3	3	3	3	2	-	-	-	-	-	-	-	3	2	2
5	3	2	3	3	2	-	-	-	-	-	-	-	2	2	2
CO	3	3	2.6	2.6	2	-	-	-	-	-	-	-	2	2	2

1-low,2-medium,3-high,‘-'-nocorrelation

1-low,2-medium, 3-high,‘-'-no correlation

21152E64A **SOFTWARE DEFINED RADIO** **LTP C20 23**

COURSEOBJECTIVES:

- Tointroducetheconceptsofsoftwareradios
- ToknowaboutRFimplementationchallengesforsoftwaredefinedradios
- Tounderstandthedigitalgenerationofsignals
- Tolearnthesoftwareandhardwarerequirementsforsoftwaredefinedradios.

UNITI INTRODUCTIONTOSOFTWARERADIO 6

TheNeedforSoftwareRadios.CharacteristicsandBenefitsofaSoftwareRadio.DesignPrinciples of a Software Radio.

UNITII RFIMPLEMENTATION 6

PurposeofRFfront–end,Dynamicrange,RFreceiverfront–endtopologies,Enhanced flexibilityoftheRFchainwithsoftwareradios,Importanceofthecomponentstooverall performance,Transmitterarchitecturesand theirissues,Noiseand distortion inthe RF chain, HybridDDS–PLLsystems,ApplicationsofDirectDigitalSynthesis.

UNITIII DIGITALGENERATIONOFSIGNALS 6

Comparison of direct digital synthesis with analog signal synthesis, Approaches to directdigital synthesis, Analysis of spurious signals, Performance of direct digitalsynthesissystems,Applications of direct digital synthesis.

UNITIV SMARTANTENNAS 6

Benefits of smart antennas, Structures for beamforming systems, Smart antenna algorithms,Hardware implementation of smart antennas, Digital Hardware Choices-Key hardwareelements.

UNITV HARDWAREANDSOFTWAREFORSDR&CASESTUDIES 6

DSP Processors, FPGA, ASICs. Trade-offs, Object oriented programming, Object Brokers,GNU Radio-USRP. Case Studies: SPEAK easy, JRTS, SDR-3000.

30PERIODS

PRACTICALEXERCISES: **30PERIODS**

1. StudyofSDRhardwarekit
2. DesignandImplementationofdigitalmodulationschemesusingSDR
3. Implementationofsynchronizationtechniquesusing SDR
4. ChannelCodingTechniquesusingSDR
5. StudyofchannelestimationtechniquesusingSDR
6. StudyofMIMOconcepts usingSDR

COURSEOUTCOMES:

Attheendofthiscourse,thestudentswillbeableto:

CO1: Demonstrateanunderstandingintheevolvingparadigmof Softwaredefinedradio andtechnologies for its implementation.

CO2:AnalyseRadiofrequencyimplementationissues

CO3:ImplementSmartantennatechniquesforsoftwaredefinedradio.

CO4:Comparevariousdigitalsynthesisprocedures.

CO5:Comprehendvarioushardwareandsoftwarerequirementsforsoftwaredefinedradios.

TOTAL:60PERIODS

TEXTBOOKS:

1. JeffreyHughReed,"SoftwareRadio:AModernApproachto Radio Engineering," PrenticeHall Professional, 2002.
2. TonyJRouphael,"RFandDSPfor SDR,"ElsevierNewnesPress,2008.

REFERENCES

1. P.Kenington,"RFandBasebandTechniquesforSoftwareDefinedRadio,"ArtechHouse, 2005.
2. PaulBurns, "SoftwareDefinedRadiofor3G,"ArtechHouse,2002.
3. Behrouz.F.Bourjney"SignalProcessingforSoftwaredefinedRadios",Lulu2008.

CO's-PO's&PSO'sMAPPING

CO	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12	SO1	SO2	SO3
1	3	3	2	2	2	2	-	-	-	1	-	3	3	2	2
2	3	3	3	2	2	2	-	-	-	1	-	2	3	2	2
3	3	3	3	2	2	2	-	-	-	1	-	2	3	2	3
4	3	3	3	2	2	2	-	-	-	1	-	2	2	2	2
5	3	3	3	3	2	2	-	-	-	1	-	2	2	2	2
CO	3	3	3	2	2	2	-	-	-	1	-	2	2	2	2

1-low,2-medium, 3-high,'-'-no correlation

21152E56A **WEARABLE DEVICES** **LTP C300 3**

OBJECTIVES:

Thestudentshouldbemadeto:

- Toknowthehardwarerequirementofwearablesystems
- Tounderstandthecommunicationandsecurityaspectsinthewearabledevices
- Toknowthe applicationsofwearable devicesinthefield of medicine

UNITI INTRODUCTIONTOWEARABLESYSTEMSANDSENSORS 9

WearableSystems-Introduction,NeedforWearableSystems,DrawbacksofConventionalSystemsforWearableMonitoring,ApplicationsofWearableSystems,TypesofWearable Systems,ComponentsofwearableSystems.Sensorsforwearablesystems-Inertiamovement sensors, Respiration activity sensor, Inductive plethysmography, Impedance plethysmography,pneumography,Wearablegroundreactionforcesensor.

UNNITII SIGNAL PROCESSING ANDENERGY HARVESTING FOR WEARABLEDEVICES 9

Wearabilityissues-physicalshapeandplacementofsensor,Technicalchallenges-sensor design,signalacquisition,samplingfrequencyforreducedenergyconsumption,Rejection of irrelevantinformation.PowerRequirements-Solarcell,Vibrationbased,Thermalbased, Humanbodyasaheatsourceforpowergeneration,Hybridthermoelectricphotovoltaicenergy harvests, Thermopiles.

UNITIII WIRELESSHEALTHSYSTEMS 9

Need for wireless monitoring, Definition of Body area network, BAN and Healthcare,Technical Challenges- System security and reliability, BAN Architecture – Introduction,Wireless communication Techniques.

UNITIV SMARTTEXTILE 9

Introduction to smart textile- Passive smart textile, active smart textile. FabricationTechniques- Conductive Fibres, Treated Conductive Fibres, Conductive Fabrics, ConductiveInks.Case study- smart fabric for monitoring biological parameters - ECG, respiration.

UNITV APPLICATIONSOFWEARABLESYSTEMS 9

MedicalDiagnostics,MedicalMonitoring-Patientswithchronicdisease,Hospitalpatients,Elderly patients, neural recording, Gait analysis, Sports Medicine.

device.CO3: Usethe

OUTCOMES:

Onsuccessfulcompletionofthiscourse,thestudentwillbe able toCO1: Describe

the concepts of wearable system. CO2: Explain the energy harvestings in wearable	conceptsof BAN in healthcare.

CO4:Illustratetheconceptofsmarttextile
CO5:Comparethevariouswearabledevicesinhealthcare system

TEXTBOOKS

TOTALPERIODS:45

1. AnnalisaBonfiglo andDanilo DeRossi,WearableMonitoringSystems,Springer,2011
2. ZhangandYuan-Ting,WearableMedicalSensorsandSystems,Springer, 2013
3. Edward Sazonov and Micheal R Neuman, Wearable Sensors: Fundamentals,Implement Elsevier, 2014
4. Mehmet R. Yuce and JamilY.Khan,Wireless BodyArea NetworksTechnology,Implement Stanford Publishing Pte.Ltd, Singapore, 2012

REFERENCES

1. Sandeep K.S, Gupta,TridibMukherjeeand KrishnaKumarVenkatasubramanian, BodyAreaNetworksS Sustainability, Cambridge University Press, 2013.
2. Guang-ZhongYang, BodySensorNetworks,Springer,2006.

CO’s-PO’s&PSO’sMAPPING

O’s	PO’s												PSO’s		
	1	2	3	4	5	6	7	8	9	0	1	2	1	2	3
1	3	2	1	1	2	-	-	1	-	-		-	1	-	1
2	3	2	1	1	2	-	-	1	-	-		-	1	-	1
3	3	2	1	1	2	-	-	1	-	-		-	1	-	1
4	3	2	1	1	2	-	-	1	-	-		-	1	-	1
5	3	2	1	1	2	-	-	1	-	-		-	1	-	1
Vg.	3	2	1	1	2	-	-	1	-	-		-	1	-	1

1-low,2-medium, 3-high,‘-’-no correlation

21152E56B **HUMANASSISTDEVICES** **LT PC**
30 03

COURSEOBJECTIVES:

- To study the roleandimportanceof machines that takes over the functionsof the heart and lungs,
- Tostudyvariousmechanicaltechniquesthathelpanon-functioning heart.
- Tolearnthe functioning oftheunitwhichdoestheclearanceofureafromtheblood
- To understandthetests to assessthe hearing loss and development ofelectronic devicesto compensate for the loss.
- Tostudyabout recenttechniquesusedinmodernclinicalapplications

UNITI HEARTLUNGMACHINEANDARTIFICIALHEART 9

Condition to be satisfied by the H/L System. Different types of Oxygenators, Pumps,Pulsatile and Continuous Types, Monitoring Process, Shunting, The Indication for CardiacTransplant,DrivingMechanism,BloodHandlingSystem,Functioninganddifferenttypes ofArtificial Heart, Schematic for temporary bypass of left ventricle.

UNITII CARDIACASSISTDEVICES 9

Assisted through Respiration, Right and left Ventricular Bypass Pump, Auxiliary ventricle,OpenChestandClosedChesttype,IntraAorticBalloonPumping,ProstheticCardiac valves,PrincipleofExternalCounterpulsationtechniques.

UNITIII ARTIFICIALKIDNEY 9

Indication and Principle of Haemodialysis, Membrane, Dialysate, types of filter andmembranes, Different types of hemodialyzers, Monitoring Systems, Wearable ArtificialKidney, Implanting Type.

UNITIV RESPIRATORYANDHEARINGAIDS 9

Ventilator and its types-Intermittent positive pressure, Breathing Apparatus OperatingSequence, Electronic IPPB unit with monitoring for all respiratory parameters. Types ofDeafness, Hearing Aids, SISI, maskingtechniques, wearable devices for hearingcorrection.

UNITV RECENTTRENDS 9

Transcutaneouselectricalnervestimulator,bio-feedback,Diagnosticandpoint-of-careplatforms.

COURSEOUTCOMES:

Attheendofthiscoursethestudentswillbeableto:

CO1:Explaintheprinciplesandconstructionofartificialheart

CO2:Understandvariousmechanicaltechniquesthatimprovetherapeutictechnology

CO3:Explain the functioning of the membrane or filter that cleanses the blood.

CO4:Describe the tests to assess the hearing loss and development of wearabledevices for thesame.

CO5:Analyze and research on electrical stimulation and biofeedback techniques in rehabilitationand physiotherapy.

TEXTBOOKS:

1. GrayEWnek,GrayLBrowlin – Encyclopedia ofBiomaterialsandBiomedicalEngineering –MarcelDekkerIncNewYork2004.
2. John.G.Webster–Bioinstrumentation-JohnWiley&Sons(Asia)PvtLtd-2004
3. JosephD.Bronzino,TheBiomedicalEngineeringHandbook,ThirdEdition:Three VolumeSet, CRC Press, 2006

REFERENCES:

1. Andreas.F.Vonracum,“Handbookofbiomaterialevaluation”,Mc-Millanpublishers,1980.
2. GrayE Wnek, GrayL Browlin, “Encyclopedia of Biomaterials and Biomedical Engineering”Marcel Dekker Inc New York 2004.
3. D.S.Sunder,“RehabilitationMedicine”,3rdEdition, JaypeeMedicalPublication, 2010

CO’s-PO’s&PSO’sMAPPING

	O1	O2	O3	PO	O5		O7	O8	O9	O10	O11	O12	SO1	SO2	SO3
	3	3	3	3	3	2	-	-	-	-	-	3	3	1	2
	3	3	3	2	2	3	-	-	-	-	-	2	2	2	2
	3	3	3	3	3	2	-	-	-	-	-	3	3	3	2
	3	3	1	1	3		-	-	-	-	-	2	3	1	3

	3	3	3	3	3	3	-	-	-	-	-	2	3	3	2

	3	3	2.6	2.4	2.8		-	-	-	-	-	2.4	2.8	2	2.2

1-low,2-medium, 3-high,'-'-no correlation

21152E56C BRAINCOMPUTERINTERFACEANDAPPLICATIONS L TPC
30 0 3

COURSEOBJECTIVES:

Thestudentshouldbemadeto:

- Tounderstandthebasicconceptsofbraincomputerinterface
- Tostudythevarioussignalacquisitionmethods
- Tostudythe signalprocessingmethodsused inBCI

UNITI INTRODUCTIONTOBCI 9

Fundamentalsof BCI–StructureofBCIsystem–Classificationof BCI– Invasive, Non-invasive andPartially invasive BCI – EEG signal acquisition - Signal Preprocessing –Artifacts removal.

UNITII ELECTROPHYSIOLOGICALSOURCES 9

Sensorimotor activity – Mu rhythm, Movement Related Potentials – Slow CorticalPotentials-P300 -Visual Evoked Potential - Activity of Neural Cells - MultipleNeuromechanisms.

UNITIII FEATUREEXTRACTIONMETHODS 9

Time/Space Methods – Fourier Transform, PSD –Wavelets – Parametric Methods – AR,MA,ARMAmodels – PCA – Linear and Non-Linear Features.

UNITIV FEATURETRANSLATIONMETHODS 9

LinearDiscriminantAnalysis–SupportVectorMachines-Regression–VectorQuantization–GaussianMixtureModeling–HiddenMarkovModeling–NeuralNetworks.

UNITV APPLICATIONSOFBCI 9

Functionalrestorationusing Neuroprosthesis-FunctionalElectricalStimulation,VisualFeedbackandcontrol-Externaldevicecontrol,Casestudy:BrainactuatedcontrolofmobileRobot.

COURSEOUTCOMES:

Onsuccessfulcompletionofthiscourse,thestudentwillbeableto
CO1:DescribeBCIsystemanditspotentialapplications.
CO2:Analyzeeventrelatedpotentialsandsensorymotorrhythms.
CO3:ComputefeaturessuitableforBCI.**CO4**:DesignclassifierforaBCIsystem.
CO5:ImplementBCIforvariousapplications.

TEXTBOOKS

TOTAL:45PERIODS

1. BernhardGraimann,BrendanAllison,GertPfurtscheller,“Brain-Computer Interfaces:Revolutionizing Human-Computer Interaction”, Springer, 2010.

REFERENCES

1. R.Spehlmann,“EEGPrimer”,ElsevierBiomedicalPress,1981.
2. ArnonKohen, “BiomedicalSignalProcessing”, VolIand II, CRCPressInc, Boca Rato,Florida, 1986.
3. BishopC.M.,“NeuralNetworksforPatternRecognition”,Oxford,ClarendonPress,1995.

CO’s-PO’s&PSO’sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	2	2	-	-	-	-	-	2	3	3	3
2	3	3	3	2	2	1	-	-	-	-	-	2	2	2	2
3	3	3	3	2	2	1	-	-	-	-	-	1	1	2	2
4	3	3	3	1	3	2	-	-	-	-	-	2	2	3	3
5	3	3	3	3	3	2	-	-	-	-	-	2	2	2	2
CO	**3**	**3**	**3**	**2**	**2.4**	**1.6**	**-**	**-**	**-**	**-**	**-**	**1.8**	**2**	**2.4**	**2.4**

1-low,2-medium, 3-high,‘-’-nocorrelation

21152E55A WIRELESSSENSORNETWORKDESIGN LTPC
30 03

COURSEOBJECTIVES:

- Tounderstandthefundamentalsofwirelesssensornetwork
- TogainknowledgeontheMACand RoutingProtocols ofWSN
- Togetexposedto6LOWPANtechnology
- To acquire knowledge on the protocols required for developing real time applications using WSN and 6LOWPAN.
- TogainknowledgeaboutoperatingsystemrelatedtoWSN and6LOWPAN

UNITI INTRODUCTION 9

PrincipleofWirelessSensorNetwork-Introductiontowirelesssensornetworks-Challenges, Comparisonwithadhocnetwork,NodearchitectureandNetworkarchitecture,design principles,Serviceinterfaces,Gateway,Shortrangeradiocommunicationstandards-IEEE802.15.4, Zigbee andBluetooth. Physical layer and transceiver design considerations.

UNITII MACANDROUTING PROTOCOLS 9

MACprotocols–fundamentals,lowdutycycleprotocolsandwakeupconcepts,contention andSchedule-basedprotocols-SMAC,BMAC,TRAMA,Routingprotocols–Requirements, Classification
-SPIN,DirectedDiffusion,COUGAR,ACQUIRE,LEACH,PEGASIS.

UNITIII 6LOWPAN 9

6LoWPANArchitecture-protocolstack,AdaptationLayer,Linklayers–Addressing, Routing-Mesh-Under-Route-Over,HeaderCompression-Statelessheadercompression-Context-basedheadercompression,FragmentationandReassembly,Mobility–types, Mobile IPv6, Proxy Home Agent, Proxy MIPv6, NEMO –Routing – MANET, ROLL, Borderrouting.

Publish/subscribe, Web service paradigms, Common Protocols -Web serviceprotocols,MQtelemetry transport for sensor networks (MQTT-S), ZigBee compact application protocol(CAP),Service discovery, Simple network management protocol (SNMP), Real-time transportand sessions, Industry- Specific protocols.

UNITV TOOLS 9

TinyOS – Introduction, NesC, Interfaces, modules, configuration, Programming in TinyOSusing NesC, TOSSIM, Contiki – Structure, Communication Stack, Simulation environment –Cooja simulator, Programming

TOTAL:45PERIODS

COURSEOUTCOMES:

CO1: To be able to design solutions forWSNs applications

CO2: To be able to develop efficient MAC and Routing Protocols**CO3**: To be able to design solutions for 6LOWPAN applications

CO4:Tobeabletodevelopefficientlayeredprotocolsin6LOWPAN

CO5:TobeabletouseTinyOSandContikiOSinWSNsand6LOWPANapplications

REFERENCES:

1. HolgerKarl, Andreaswillig, “Protocoland ArchitectureforWirelessSensor Networks”, JohnWiley Publication, 2006.
2. AnnaForster,“IntroductiontoWirelessSensorNetworks”,Wiley,2017.
3. ZachShelbySensinodeandCarstenBormann, “6LoWPAN:The WirelessEmbedded Internet” John Wiley and Sons, Ltd, Publication, 2009.
4. PhilipLevis,“TinyOSProgramming”,2006–www.tinyos.net.
5. TheContikiOperatingSystem.http://www.sics.se/contiki.

CO’s-PO’s&PSO’sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	O7	O8	O9	O10	O11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	2	1	-	-	-	-	2	2	3	1	1
2	3	3	2	2	2	1	-	-	-	-	-	2	3	2	2
3	3	3	3	2	2	1	-	-	-	-	-	3	3	2	2
4	3	3	3	3	2	2	-	-	-	-	-	2	2	1	2
5	2	-	1	1	3	2	-	-	-	-	-	2	2	2	1
CO	**2.8**	**3**	**2.2**	**2**	**2.2**	**1.4**	**-**	**-**	**-**	**-**	**2**	**2.2**	**2.6**	**1.6**	**1.6**

1-low,2-medium, 3-high,‘-'-no correlation

21152E65B	MEMS DESIGN	LTP C20 23

COURSEOBJECTIVES:

- Tounderstandthebasicelectricalandmechanicalconceptsof MEMSdesign
- Tounderstandthedesignaspectsofelectrostatic sensorsandactuators
- Tounderstandthe designaspectsofthermalsensorsand actuators
- Tounderstandthedesignaspectsofpiezoelectricsensors andactuators
- Tounderstandthe designaspectsofmagneticsensorsand actuators

UNITI ESSENTIALELECTRICANDMECHANICALCONCEPTS 6

Conductivity of semiconductors, Crystal planes and orientations, stress and strain, flexuralbeam bending analysis under simple loading conditions, Dynamic system, resonantfrequency and quality factor

UNITII ELECTROSTATICSESNING ANDACTUATION 6

Parallel plate capacitor, Applications of parallel plate capacitors- inertial sensor, pressuresensor, flow sensor, tactile sensor, parallel plate actuators, interdigitated finger capacitors,applications of comb drive devices.

UNITIII THERMALSENSINGANDACTUATION 6

Fundamentalsofthermaltransfer, Sensorsandactuators basedonthermalexpansion, Themalcouples, Thermal resistors, Applications- Infrared sensors, flow sensors, Inertial sensors,other sensors

UNITIV PIEZOELECTRICSENSINGANDACTUATION 6

Mathematical description of piezoelectric effects, Cantilever piezoelectric actuator model,properties of piezoelectric materials –Quartz, PZT,PVDF, ZnO , Applications – Acousticsensors, Tactilesensors

UNITV MAGNETICSENSINGANDACTUATION 6

Concepts and principles- magnetization and nomenclatures, principles of micromagneticactuators, fabrication of micro magnetic components- deposition, design and fabrication ofmagnetic coil, MEMS magnetic actuators

30PERIODS

PRACTICALEXERCISES: **30PERIODS**

1. Designandsimulationofpiezoelectriccantilever
2. Designandsimulationofthermocouples
3. Designandsimulationofcombdriveactuators

COURSEOUTCOMES:

Uponcompletionofthiscourse,thestudentswillbeable to

CO1:UnderstandthebasicsofMEMSdesignaspects.
CO2:Applytheknowledgeinthedevelopmentofelectrostaticsensorsandactuators.
CO3: Apply the knowledge in the development of thermal sensors and actuators.**CO4**:Applytheknowledgeinthedevelopmentofpiezoelectric sensors and actuators.**CO5**: Apply the knowledge in the development of magnetic sensors and actuators.

TOTAL:60PERIODS

TEXTBOOKS

1. ChangLiu,“FoundationsofMEMS”, PearsoneducationIndialimited,2006

REFERENCES

1. MurtyB.S, ShankarP, RajB, Rath, B.B,MurdayJ, TextbookofNanoscienceand Nanotechnology, Springer publishing, 2013.
2. SergeyEdwardLyshevski, “MEMSandNEMS:Systems,Devices,andStructures”, CRCPress, 2002
3. TaiRanHsu,MEMSandMicrosystems DesignandManufacture,TataMcgrawHill,2002
4. VinodKumarKhannaNanosensors:Physical,Chemical,andBiological,CRCpress,2012.

CO’s-PO’s&PSO’sMAPPING

CO	PO1	O2	PO	O4	O5	O6	O7	O8	O9	O10	O11	PO12	SO1	SO2	SO3
1	3	3	2	2	2	2	-	-	-	-	-	1	3	2	2
2	3	3	3	2	2	2	-	-	-	-	-	2	3	2	2
3	3	3	3	2	2	2	-	-	-	-	-	2	3	2	2
4	3	3	3	2	2	2	-	-	-	-	-	2	3	2	2
5	3	3	3	2	2	2	-	-	-	-	-	2	3	2	2
CO	**3**	**3**	2.8	2	2	2	**-**	**-**	-	**-**	**-**	**1.8**	**3**	**2**	**2**

1-low,2-medium, 3-high,‘-’-nocorrelation

1152E65C/21152E55C FUNDAMENTALSOFNANOELECTRONICS LTPC 202 3

COURSEOBJECTIVES:

- Tounderstandtheconceptsofnano electronics andquantumelectronics
- Tounderstandtheconceptsofnano electronicdevices,transistors,tunnelingdevicesand superconducting devices
- Tounderstandthebasicsofnanotubedevices

UNITI INTRODUCTIONTONANOELECTRONICS 6

Scalingtonano-Lightasawaveandparticle-Electronsaswavesandparticles-originof quantummechanics-Generalpostulatesofquantummechanics-Timeindependent Schrodingerwaveequation-Electronconfinement-Quantumdots,wiresandwell-Spinand angularmomentum

UNITII QUANTUMELECTRONICS 6

Quantumelectronicdevices-ShortchannelMOStransistor-Splitgatetransistor-Electron wavetransistor-Electronwavetransistor-Electronspintransistor-Quantumcellularautomata-Quantum dot array, Quantum memory.

UNITIII NANOELECTRONICTRANSISTORS 6

Coulomb blockade - Coulomb blockade in Nano capacitors - Coulomb blockade in tunneljunctions - Single electron transistors, Semiconductor nanowire FETs and SETs, MolecularSETsand molecular electronics - Memory cell.

UNIT IV NANOELECTRONICTUNNELINGANDSUPERCONDUCTINGDEVICES 6

Tunnel effect -Tunneling element -Tunneling diode - Resonant tunneling diode - Threeterminal resonant tunneling devices- Superconducting switching devices- Cryotron-Josephson tunneling device.

UNITV NANOTUBESANDNANOSTRUCTUREDEVICES 6

Carbon Nanotube -Fullerenes -Types ofnanotubes – Formation of nanotubes–Assemblies – Purification of carbon nanotubes – Electronic properties – Synthesis of carbon nanotubes – Carbon nanotube interconnects – Carbon nanotube FETs and SETs –Nanotube for memoryapplications- Nano structures and nano structured devices.

30PERIODS

PRACTICALEXERCISES: 30PERIODS

AD/AnyotherrelevantsoftwarebasedSimulations

1. FieldEffectTransistors
2. SingleElectronTransistors
3. Tunnelingdevices

COURSEOUTCOMES:

Uponcompletionofthiscourse,thestudentswillbeable to

CO1:Understandthebasicsofnanoelectronicsincludingquantumwires,dotsandwells

CO2:Usethemechanismbehindquantumelectronicdevices

CO3:Analyzethekeyperformanceaspectsoftunnelingand superconducting nanoelectronic devices

CO4:Applytheknowledgeinthedevelopmentofnanotubesandnanostructuredevices

TOTAL:60PERIODS

TEXTBOOKS

1. Hanson,FundamentalsofNanoelectronics, Pearsoneducation,2009.

REFERENCES

1. JanDienstuhl,KarlGoser,andPeterGlösekötter,NanoelectronicsandNanosystems:From Transistors to Molecular and Quantum Devices, Springer-Verlag, 2004.

2. MirceaDragomanandDanielaDragoman,Nanoelectronics:PrinciplesandDevices,Artech House, 2009.

3. RobertPuers,LivioBaldi,MarcelVandeVoordeandSebastiaanE.VanNooten, Nanoelectronics: Materials, Devices, Applications, Wiley, 2017.

4. BrajeshKumarKaushik,Nanoelectronics:Devices,CircuitsandSystems,Elsevierscience, 2018

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	2	1	-	-	-	-	-	2	2	1	1
2	3	3	3	2	2	2	-	-	-	-	-	2	3	1	1
3	3	3	3	2	2	2	-	-	-	-	-	2	3	1	1
4	3	3	2	2	2	2	-	-	-	-	-	2	3	1	1
5	3	3	3	3	3	3	-	-	-	-	-	2	3	1	2
CO	**3**	**3**	**.6**	**.2**	**.2**	**2**	-	-	-	-	-	**2**	**2.8**	**1**	**1.2**

1-low,2-medium, 3-high,'-'-no correlation

21152E64B **SOFTWARE DEFINED NETWORKS** **LTP C20 23**

COURSEOBJECTIVES:

- Tounderstandtheneedfor SDNand itsdataplane operations
- Tounderstandthefunctions ofcontrolplane
- Tocomprehendthemigrationofnetworking functionsto SDNenvironment
- Toexplore varioustechniquesofnetworkfunctionvirtualization
- Tocomprehendtheconceptsbehindnetwork virtualization

UNITI SDN:BACKGROUNDANDDATAPLANE 6

Evolving Network Requirements – The SDN Approach – SDN and NFV-Related Standards– SDNData Plane – OpenFlow Logical Network Device – OpenFlow Protocol.

UNITII SDNCONTROLPLANE6

SDN Control Plane Architecture: Southbound Interface, Northbound Interface – ControlPlane Functions – ITU-T Model – OpenDaylight – REST – Cooperation and Coordinationamong Controllers.

UNITIII UNITTITLE 6

SDN Application Plane Architecture – Network Services Abstraction Layer – TrafficEngineering – Measurement and Monitoring – Security – Data Center Networking -- - Mobility and Wireless – Information-centric Networking

UNITIV NETWORKFUNCTIONVIRTUALIZATION 6

NFVConcepts–BenefitsandRequirements–ReferenceArchitecture–NFVInfrastructure

– Virtualized Network Functions – NFV Management and Orchestration – NFV Use cases – SDN and NFV

UNITV NETWORKVIRTUALIZATION 6

Virtual LANs – OpenFlow VLAN Support – Virtual Private Networks – NetworkVirtualization – OpenDaylight's Virtual Tenant Network – CoSoftware-DefinedInfrastructure

30PERIODS

PRACTICALEXERCISES: **30PERIODS**

1. InstallingMininetsimulator
2. Creatinga1controller, 3nodetopology,POX controller
3. Abilitytoview,read/writeFlowtablerules(fordifferent applications-sayfirewall, Learningswitch etc.), POX, Open vSwitch
4. BuildingaSDNbasedapplication

COURSEOUTCOMES:

Afterthesuccessful completionofthiscourse, thestudentwillbeabletoCO1: Describe the motivation behind SDN and its data plane (K2) **CO2**: Identify the functions of control plane (K3)

CO3:ApplySDNtonetworkingapplications(K3)

CO4:Applyvariousoperationsofnetworkfunctionvirtualization

CO5:ExplainvarioususecasesofSDN

TOTAL:60PERIODS

TEXTBOOKS

1. WilliamStallings, "FoundationsofModernNetworking:SDN,NFV,QoE,IoTand Cloud",Pearson Education, 1st Edition, 2015.
2. ThomasDNadeau,KenGray, "SDN:SoftwareDefinedNetworks",O'ReillyMedia, 2013.

REFERENCES

1. FeiHu, "NetworkInnovationthroughOpenFlowandSDN: PrinciplesandDesign", 1stEdition, CRC Press, 2014.
2. PaulGoransson,ChuckBlackTimothyCulver,"SoftwareDefinedNetworks: AComprehensive Approach", 2nd Edition, Morgan Kaufmann Press, 2016.
3. OswaldCoker,SiamakAzodolmolky,"Software-DefinedNetworkingwithOpenFlow", 2ndEdition, O'Reilly Media, 2017.

CO's-PO's&PSO'sMAPPING

O	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12	SO1	SO2	SO3
1	3	3	3	3	3	2	-	-	-	-	-	3	3	3	2
2	3	3	3	2	2	2	-	-	-	-	-	3	3	2	2
3	3	3	3	3	1	2	-	-	-	-	-	3	2	3	2
4	2	3	3	2	2	1	-	-	-	-	-	2	2	1	2
5	3	3	2	2	2	1	-	-	-	-	-	2	2	2	2
O	3	3	3	2	2	2	-	-	-	-	-	2	2	2	2

1-low,2-medium, 3-high,'-'-nocorrelation

21152E64C	MASSIVEMIMONETWORKS	L TPC
		202 3

URSEOBJECTIVES:

- TogainknowledgeaboutmassiveMIMO networks.
- TounderstandthemassiveMIMOpropagationchannels.
- TolearnaboutchannelestimationinsinglecellandmulticellmassiveMIMO systems.
- Tocomprehendtheconcepts of massiveMIMOdeployment inthecontextofsinglecellandmulticell deployment.

ITI ASSIVEMIMONETWORKS 6

finitionofMassiveMIMO, CorrelatedRayleighFading, SystemModelfor UplinkandDownlink,BasicImpact ofSpatial Channel Correlation, Channel Hardening and Favourable Propagation, Local Scattering SpatialCorrelation Model

ITII EMASSIVEMIMO PROPAGATIONCHANNEL 6

vorablePropagationandDeterministicChannels-CapacityUpperBound-DistancefromFavorablePropagation-FavorablePropagationandLinear Processing-Singular Values andFavorablePropagation, FavorablePropagationand Random Channels-Independent Rayleigh Fading-Uniformly Random Line-of-Sight (UR-LoS)-IndependentRayleigh Fading versus UR-LoS - Finite-Dimensional Channels

ITIII NGLE-CELLSYSTEMS 6

plinkPilotsandChannelEstimation-OrthogonalPilots-De-SpreadingoftheReceivedPilotSignal-MMSE Channel Estimation, Uplink Data Transmission - Zero-Forcing -Maximum-Ratio,Downlink Data Transmission-Linear Precoding-Zero-Forcing-Maximum-Ratio, Discussion- Interpretation of the Effective SINR Expressions-Implications for Power Control-Scaling Laws and Upper Bounds on the SINR - Near-Optimality of LinearProcessing when M >> K - Net Spectral Efficiency - Limiting Factors: Number of Antennas and Mobility

ITIV ULTI-CELLSYSTEMS 6

link Pilots and Channel Estimation, Uplink Data Transmission - Zero-Forcing -Maximum-Ratio, Downlink DataTransmission -Zero-Forcing - Maximum-Ratio, Discussion -Asymptotic Limits with Infinite Numbers of BaseStation Antennas - The Effects of Pilot Contamination - Non-SynchronousPilot Interference

ITV ASESTUDIES 6

gle-Cell Deployment Example: Fixed Broadband Access in Rural Area, Multi-Cell Deployment:liminariesandAlgorithms,Multi-CellDeploymentExamples:MobileAccess-enario-SuburbanScenario-MinimumPer-TerminalThroughputPerformance-Additional

Observations-ComparisonofPowerControlPolicies

30PERIODS

ACTICALEXERCISES: 30 PERIODS

plementationof(UsingMatlab)

1. MassiveMIMO hybridbeamforming
2. SinglecellmassiveMIMOdownlinkcommunications
3. MulticellmassiveMIMOdownlinkcommunications.
4. PrecodinginmassiveMIMOsinglecellandmulticelldownlinkcommunications

5. ChannelestimationinmassiveMIMOsystem

URSEOUTCOMES:

CO1: UnderstandandexplainmassiveMIMOnetworks.

CO2: AnalyzemassiveMIMOpropagationchannelsandtheircapacitybounds

CO3:Examinechannelestimationtechniquesforsinglecellsystem.

CO4: Analyzechannelestimationtechniquesformulticellsystem.

CO5: ExplaintheconceptsunderliningthedeploymentofsingleandmulticellmassiveMIMOsystems.

TOTAL:60PERIODS

XTBOOKS

1.ThomasL.Marzetta,ErikG.Larsson,HongYang,HienQuocNgo,"Fundamentalsof MassiveMIMO",CambridgeUniversityPress2016.(UNITSII-V)

2. EmilBjörnson, JakobHoydisandLuca Sanguinetti(2017),"MassiveMIMONetworks:Spectral,Energy, and Hardware Efficiency", Foundations and Trends, Now, 2017. (UNIT I)

FERENCES

1.LongZhao,HuiZhao,KanZheng,"WeiXiangMassiveMIMOin5GNetworks:Selected Applications",Springer2018.

2.LeiboLiu,GuiqiangPeng,ShaojunWei,"MassiveMIMODetectionAlgorithmandVLSI Architecture",Springer2019.

3.ShahidMumtaz, JonathanRodriguez, LinglongDai,"mmWaveMassiveMIMOAParadigm for 5G", Elsevier, 2017

CO's-PO's&PSO'sMAPPING

CO	O1	O2	O3	PO	O5	O6	O7	O8	O9	O10	O11	O12	SO1	SO2	SO3
1	3	2	1	1	2	2	-	-	-	-	-	2	3	1	2
2	3	3	2	2	2	2	-	-	-	-	-	1	2	2	1
3	3	2	2	2	2	2	-	-	-	-	-	1	3	3	2
4	3	3	2	2	2	2	-	-	-	-	-	1	3	1	3
5	3	2	2	2	2	2	-	-	-	-	-	2	3	3	2
CO	3	2.4	1.8	1.8	2	2	-	-	-	-	-	1.4	3	2	2

1-low,2-medium,3-high,'-'-nocorrelation

21152E65A **ADVANCEDWIRELESSCOMMUNICATION TECHNIQUES** **LTPC**

30 03

COURSEOBJECTIVES

- Tounderstandtheevolving paradigmofcooperativecommunication
- Tounderstand conceptsrelatedtogreenwireless communication
- Toenablethestudentto understandthedifferent powersavingstrategiesandenergy efficient signal, system and network design.
- Toexposethestudenttotheenergysavingtechniquesadoptedinexistingwireless components
- Toprovideunderstandingonprotocolsand networksrelatedtogreenfuturewireless communication technologies.

UNITI COOPERATIVECOMMUNICATIONSANDGREENCONCEPTS 9

Networkarchitecturesandresearchissuesincooperativecellularwirelessnetworks;CooperativecommunicationsinOFDMandMIMOcellularrelaynetworks:issuesand approaches;Fundamentaltrade-offsonthedesignof greenradionetworks, Greenmodulationand coding schemes.

UNITII COOPERATIVETECHNIQUES 9

Cooperativetechniquesforenergyefficiency,Cooperativebasestationtechniquesfor cellularwirelessnetworks;Turbobasestations;Antennaarchitecturesforcooperation; Cooperativecommunicationsin3GPPLTE-Advanced,Partialinformationrelayingand Coordinatedmulti-pointtransmissioninLTE-Advanced.

UNITIII RELAY-BASEDCOOPERATIVECELLULARNETWORKS 9

Distributed space-time block codes ; Collaborative relaying in downlink cellular systems ;Radio resource optimization; Adaptive resource allocation ; Cross-layer scheduling designfor cooperative wireless two-way relay networks ; Network coding in relay-based networks.

UNITIV GREENRADIONETWORKS 9

Base Station Power-Management Techniques- Opportunistic spectrum and loadmanagement, Energy-saving techniques in cellular wireless base stations , Power-management for base stationsin smart grid environment, Cooperative multi cell processingtechniques for energy-efficient cellular wireless communications.

UNITV ACCESSTECHNIQUESFORGREENRADIONETWORKS 9

Cross-layer design of adaptive packet scheduling for green radio networks; Energy-efficientrelayingfor cooperative cellular wireless networks ; Energy performance in TDD-CDMAmultihop cellular networks ; Resource allocation for green communication in relay-basedcellular networks ; Green Radio Test-Beds and Standardization Activities.

TOTAL:45PERIODS

COURSEOUTCOMES:

CO1:Thestudentwouldbeabletoappreciatethenecessityandthedesignaspectsof cooperativecommunication

CO2:Thestudentwouldbeabletoappreciatethenecessityandthedesignaspectsof greenwireless communication.

CO3:Thestudentwouldbeabletoevolvenewtechniquesinwirelesscommunication

CO4:Thestudentswouldbeabletodemonstratethefeasibilityofusingmathematical models usingsimulation tools.

CO5:Thestudentwouldbeabletodemonstratetheimpactofthegreenengineering solutions in aglobal, economic, environmental and societal context.

TEXTBOOKS

1. EkramHossain,DongInKim,VijayK.Bhargava,“CooperativeCellular WirelessNetworks”,Cambridge University Press, 2011.
2. EkramHossain,VijayK.Bhargava(Editor),GerhardP.Fettweis(Editor),“Green RadioCommunication Networks”, Cambridge University Press, 2012.

REFERENCES

1. F.RichardYu,Yu,ZhangandVictorC.M.Leung"GreenCommunications andNetworking", CRC press, 2012.
2. RamjeePrasadandShingoOhmori,DinaSimunic,"TowardsGreenICT",River Publishers,2010.
3. JinsongWu,SundeepRanganandHonggangZhang,"GreenCommunications:Theoretical Fundamentals, Algorithms and Applications", CRC Press, 2012.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	1	1	-	-	-	-	-	2	3	3	3
2	3	3	3	2	2	1	-	-	-	-	-	2	3	2	3
3	3	2	2	1	2	1	-	-	-	-	-	2	2	1	1
4	3	3	3	3	2	1	-	-	-	-	-	2	3	1	2
5	3	3	3	2	1	2	-	-	-	-	-	2	2	3	1
CO	**3**	**2.8**	**2.8**	**2**	**1.6**	**1.2**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**2**	**2**

1-low,2-medium, 3-high,'-'-no correlation

21160E75A **PRINCIPLESOFMANAGEMENT** **L 3**

COURSEOBJECTIVES:

- Sketchthe EvolutionofManagement.
- Extractthefunctionsandprinciplesofmanagement.
- Learntheapplicationofthe principlesinanorganization.
- Studythe various HRrelatedactivities.
- Analyzethe positionofselfandcompanygoalstowardsbusiness.

UNITI INTRODUCTIONTOMANAGEMENTANDORGANIZATIONS 9

Definitionof Management– Science orArt–Manager VsEntrepreneur- typesofmanagers-managerialrolesandskills–EvolutionofManagement–Scientific,humanrelations,system andcontingencyapproaches–Typesof Businessorganization- Soleproprietorship, partnership,company-publicandprivatesectorenterprises-Organizationcultureand Environment–CurrenttrendsandissuesinManagement.

UNITII PLANNING 9

Natureandpurposeofplanning–Planningprocess–Typesofplanning–Objectives–Setting objectives – Policies – Planning premises – Strategic Management – Planning Toolsand Techniques – Decision making steps and process.

UNITIII ORGANISING 9

Nature and purpose–Formaland informalorganization–Organizationchart–Organization structure – Types – Line and staff authority – Departmentalization – delegation of authority–Centralization and decentralization – Job Design - Human Resource Management – HRPlanning, Recruitment, selection, Training and Development, Performance Management,Careerplanningand management.

UNITIV DIRECTING 9

Foundationsofindividualandgroupbehaviour–Motivation–Motivationtheories–Motivationaltechniques–Jobsatisfaction–Jobenrichment–Leadership–typesand theoriesofleadership–Communication–Processofcommunication–Barrierin communication–Effectivecommunication–CommunicationandIT.

UNITV CONTROLLING 9

Systemandprocessofcontrolling–Budgetaryandnon-Budgetarycontroltechniques–Use of computers and IT in Management control – Productivity problems and management– Control and performance – Direct and preventive control – Reporting.

TOTAL:45PERIODS

COURSEOUTCOMES:

CO1: Upon completion of the course, students will be able to have clear understandingofmanagerialfunctionslikeplanning,organizing,staffing, leading & controlling.

CO2:Havesamebasicknowledgeoninternationalaspectofmanagement.

CO3:Abilitytounderstand managementconceptof organizing.**CO4**:Abilitytounderstandmanagement concept of directing. **CO5**: Ability to understand management concept of controlling.

TEXTBOOKS:

1. HaroldKoontzandHeinzWeihrich“Essentialsofmanagement”TataMcGrawHill,1998.
2. Stephen P. Robbins and MaryCoulter, “ Management”, Prentice Hall (India)Pvt. Ltd., 10th Edition, 2009.

REFERENCES:

1. RobertKreitnerandMamataMohapatra,“Management”,Biztantra,2008.
2. Stephen A. Robbins and David A. Decenzo and Mary Coulter, “Fundamentals of Management” Pearson Education, 7th Edition, 2011.
3. TripathyPCandReddyPN,“PrinciplesofManagement”,TataMcgrawHill,1999.

CO’s-PO’s&PSO’sMAPPING

CO’s	PO’s												PSO’s		
	1	2	3	4	5	6	7	8	9	10	1	12	1	2	3
1	3		-	-	-	1	-	-	-	-	-	-	2	1	1
2	-	1	1	-	-	-	-	-	-	-	-	-	2	1	-
3	1		-	2	-	-	1	-	2	-	1	1	-	-	2
4	-	1	1	1	2	-	-	1	2	-	-	-	1	1	1
5	1		-	-	1	1	-	-	-	3	-	1	1	-	1
AVg.	1.66	1	1	1.5	1.5	1	1	1	2	3	1	1	1.5	1	1.25

1-low,2-medium, 3-high,‘-’-no correlation

21160E75B **TOTALQUALITYMANAGEMENT** **LTPC**

300

3

COURSEOBJECTIVES:

- Teachtheneedforquality, itsevolution, basicconcepts,contributionofqualitygurus, TQMframework, Barriers and Benefits of TQM.
- ExplaintheTQMPrinciplesforapplication.
- Define the basics of Six Sigma and applyTraditional tools, New tools, Benchmarking andFMEA.
- Describe Taguchi's Quality Loss Function, Performance Measures and apply TechniqueslikeQFD, TPM, COQ and BPR.
- IllustrateandapplyQMSandEMS inanyorganization.

UNITI INTRODUCTION 9

Introduction-Needforquality-Evolutionofquality-Definitionofquality-Dimensionsof productandservicequality–DefinitionofTQM--BasicconceptsofTQM-GurusofTQM (Brief introduction)
--TQMFramework-BarrierstoTQM–BenefitsofTQM.

UNITII TQMPRINCIPLES 9

Leadership-DemingPhilosophy,QualityCouncil,QualitystatementsandStrategic planning-CustomerSatisfaction–CustomerPerceptionofQuality,Feedback,Customer complaints,ServiceQuality,KanoModelandCustomerretention –Employeeinvolvement–Motivation,Empowerment,TeamandTeamwork,Recognition&RewardandPerformance Appraisal--Continuousprocessimprovement–JuranTrilogy,PDSAcycle,5SandKaizen-Supplierpartnership–Partnering,Supplierselection,SupplierRatingandRelationship development.UNITIIITQMTOOLS&TECHNIQUESI9

Thesevent raditionaltoolsofquality-Newmanagementtools-Six-sigmaProcess Capability-Benchmarking-Reasonstobenchmark,Benchmarkingprocess,WhattoBench Mark,UnderstandingCurrentPerformance,Planning,StudyingOthers,Learningfromthe data,Usingthefindings,PitfallsandCriticismsofBenchmarking-FMEA-Intent, Documentation,Stages:DesignFMEAandProcessFMEA.

UNITIV TQMTOOLS&TECHNIQUES II 9

Qualitycircles–QualityFunctionDeployment(QFD)-Taguchiqualitylossfunction– TPM –Concepts,improvementneeds–Performancemeasures-CostofQuality-BPR.

UNITV QUALITYMANAGEMENTSYSTEM 9

Introduction-Benefits of ISO Registration-ISO 9000 Series of Standards-Sector-SpecificStandards - AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements-Implementation-Documentation- Internal Audits-Registration-ENVIRONMENTAL MANAGEMENTSYSTEM: Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001-Benefits of EMS.

TOTAL:45PERIODS

COURSEOUTCOMES:

CO1: AbilitytoapplyTQMconceptsinaselectedenterprise.

CO2: AbilitytoapplyTQMprinciplesinaselectedenterprise.

CO3: Ability tounderstandSixSigmaand applyTraditional tools,New tools,Benchmarking andFMEA.

CO4: AbilitytounderstandTaguchi'sQualityLossFunction,Performance Measures andapplyQFD, TPM, COQ and BPR.

CO5: AbilitytoapplyQMSandEMSinanyorganization.

CO’s-PO’s&PSO’sMAPPING

’s	PO’s												PSO’s		
	1		3		5	6	7	8	9	10	11	12	1	2	3
												3	2		3
						3						3		2	
					3				3					2	3
					3	2	3	2				3	3	2	
			3			3	3	2							
g.		5	3		3	.6	3	2	3			3	2.	2	3

1-low, 2-medium, 3-high,‘-'-no correlation TEXT

BOOK:

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Besterfield,MaryB.Sacre, HemantUrdhwareshe and RashmiUrdhwareshe, “Total Quality Management”, Pearson Education Asia, RevisedThird Edition, Indian Reprint, Sixth Impression,2013.

REFERENCES:

1. Joel.E.Ross,“TotalQualityManagement–TextandCases”,Routledge.,2017.
2. Kiran.D.R,“Total Quality Management:Key concepts and case studies,Butterworth–Heinemann Ltd, 2016.
3. Oakland, J.S. “TQM –Text with Cases”, Butterworth –Heinemann Ltd., Oxford, ThirdEdition,2003.
4. Suganthi,L andAnand Samuel,“Total Quality Management”,Prentice Hall (India)Pvt. Ltd.,2006 .

160E75C	**INDUSTRIALMANAGEMENT**	**L**
		3

URSEOBJECTIVES

- To study the basicconceptsofmanagement;approachestomanagement;contributors to management studies; various forms ofbusinessorganizationand trade unions function in professional organizations.
- Tostudytheplanning;organizingandstaffingfunctionsof managementinprofessional organization.
- Tostudytheleading;controllinganddecisionmakingfunctionsofmanagementin professional organization.
- Tolearntheorganizationaltheoryinprofessionalorganization.
- Tolearntheprinciplesofproductivityandmodernconceptsinmanagementinprofessional organization.

IT–I RODUCTIONTOMANAGEMENT 9

Management: Introduction; Definition and Functions – Approaches to the study of Management – Mintzberg's Ten Managerial Roles – Principlesof Taylor;Fayol; Weber;Parker– Formsof Organization: SoleProprietorship; Partnership; Company (Private and Public); Cooperative– Public Sector Vs Private SectorOrganization – Business Environment: Economic; Social; Political; Legal – Trade Union: Definition; Functions;Merits & Demerits.

IT–II NCTIONSOFMANAGEMENT-I 9

Planning: Characteristics; Nature; Importance; Steps; Limitation; Planning Premises;Strategic Planning; Vision& Mission statement in Planning– Organizing: Organizing Theory; Principles; Types; Departmentalization;Centralization and Decentralization; Authority & Responsibility – Staffing: SystemsApproach; Recruiting andSelection Process; Human Resource Development (HRD) Concept and Design.

IT–III NCTIONSOFMANAGEMENT-II 9

Directing (Leading): Leadership Traits; Style; Morale; Managerial Grids (Blake-Mounton, Reddin) – Communication: Purpose; Model; Barriers – Controlling: Process; Types; Levels; Guidelines; Audit (External,Internal, Merits); Preventive Control – Decision Making: Elements; Characteristics; Nature; Process;Classifications.

IT–IV GANIZATIONTHEORY 9

OrganizationalConflict:PositiveAspects;Individual;Role;Interpersonal;IntraGroup;InterGroup;Conflict Management – Maslow's hierarchy of needs theory; Herzberg's motivation-hygiene theory;McClelland's three needs motivation theory; Vroom's valence-expectancy theory – Change Management:Concept of Change; Lewin's Process of Change Model; Sources of Resistance; Overcoming Resistance;Guidelines to managing Conflict.

IT–V ODUCTIVITYANDMODERNTOPICS 9

Productivity:Concept;Measurements;AffectingFactors;MethodstoImprove– ModernTopics(concept,feature/characteristics,procedure,meritsanddemerits):BusinessProcessReengineering(BPR); Benchmarking; SWOT/SWOCAnalysis;TotalProductiveMaintenance;EnterpriseResource nning(ERP);ManagementofInformationSystems(MIS).

TOTAL:45PERIODS

MANDATORYCOURSESI

21147MC51A INTRODUCTIONTOWOMENANDGENDERSTUDIES LTPC

3000

COURSEOUTLINE

UNITI CONCEPTS

Sex vs. Gender, masculinity, femininity, socialization, patriarchy, public/ private,essentialism, binaryism, power, hegemony, hierarchy, stereotype, gender roles, genderrelation, deconstruction, resistance, sexual division of labour.

UNITII FEMINISTTHEORY

Liberal,Marxist,Socialist,Radical,Psychoanalytic,postmodernist,ecofeminist.

UNITIII WOMEN'SMOVEMENTS:GLOBAL,NATIONALANDLOCAL

RiseofFeminisminEuropeandAmerica.Women's Movement in India.

UNITIV GENDERANDLANGUAGE

LinguisticForms and Gender.Genderand narratives.

UNITV GENDERANDREPRESENTATION

Advertisingandpopularvisualmedia.

GenderandRepresentationinAlternativeMedia.Gender and social media.

TOTAL:45PERIODS

21147MC51B ELEMENTSOFLITERATURE LTPC

30 00

OBJECTIVE:

- To make the students aware about the finer sensibilities of human existence through an art form. The students will learn to appreciate different forms of literature as suitable modes of expressing human experience.

1. **COURSECONTENTS**

IntroductiontoElementsofLiterature

1. Relevanceofliterature

a) EnhancesReading,thinking,discussingandwritingskills.

b) Developsfinersensibilityforbetterhumanrelationship.

c) Increasesunderstandingoftheproblemofhumanitywithout bias.Providingspaceto reconcile and get a cathartic effect.

2. Elementsoffiction

a) Fiction,fact andliterarytruth.

b) Fictionalmodesand patterns.

c) Plotcharacterandperspective.

3. Elementsofpoetry

a) Emotionsandimaginations.

b) Figurativelanguage.

c) (Simile,metaphor,conceit,symbol,punandirony).

d) Personificationandanimation.

e) Rhetoricand trend.

4. Elementsofdrama

a) Dramaasrepresentationalart.

b) Contentmodeand elements.

c) Theatricalperformance.

d) Dramaasnarration,mediationandpersuasion.

e) Featuresoftragedy,comedyandsatire.

3. READINGS:

1. AnIntroductiontotheStudyofEnglishLiterature,W.H.Hudson,Atlantic,2007.

2. AnIntroductiontoLiteraryStudies,MarioKlarer,Routledge,2013.

3. TheExperienceofPoetry, GrahamMode, OpencollegeofArtswithOpen UnvPress,1991.

4. TheElementsofFiction: ASurvey,UlfWolf(ed),Wolfstuff,2114.

5. TheElementsofDrama,J.L.Styan,LiteraryLicensing,2011.Tex
tbook:

*Reference Books::To bedecided bytheteacher andstudent, onthebasisof individualstudentsoasto enable him or her to write the term paper.

4. OTHERSESSION:

*Tutorials:

*Laboratory:

*Project:Thestudentswill writeaterm papertoshowtheirunderstandingof aparticularpieceofliterature

5. *ASSESSMENT:

HA:

Quizzes-HA:

PeriodicalExamination:one

Project/Lab:one(under theguidanceoftheteachersthestudentswilltakeavolumeofpoetry,fictionor drama and write a term paper to show their understanding of it in a given context; sociological,psychological, historical, autobiographical etc.

FinalExam:

OUTCOMEOFTHECOURSE:

TOTAL:45 PERIODS

- Studentswillbeabletounderstandtherelevanceofliteratureinhumanlifeandappreciate its aspects in developing finer sensibilities.

21147MC51C FILM APPRECIATION LTP C30 00

In this course on film appreciation, the students will be introduced broadly to thedevelopment of filmas an art and entertainment form. It will also discuss the language of cinema as it evolved over a century. The students will be taught as to how to read a film and appreciate the various nuances ofa film as a text. The students will be guided to study film joyfully.

Theme-A:TheComponentofFilms

A-1:Thematerialandequipment
A-2:Thestory,screenplayandscript
A-3:Theactors,crewmembers,andthedirector

A-4:Theprocessoffilmmaking…structureofafilm

Theme-B:EvolutionofFilmLanguage

B-1:Filmlanguage,form,movementetc.
B-2:Earlycinema…**silentfilm**(ParticularlyFrench)
B-3:Theemergenceoffeaturefilms:**BirthofaNation**

B-4:Talkies
Theme-C:FilmTheoriesandCriticism/Appreciation

C-1:Realisttheory;Auteurists
C-2:Psychoanalytic,Ideological,
FeministsC-3:Howtoreadfilms?

C-4:FilmCriticism/Appreciation

Theme–D:DevelopmentofFilms

D-
1:RepresentativeSovietfilmsD-
2: Representative
JapanesefilmsD-3:
Representative Italianfilms

D-4:RepresentativeHollywoodfilmandthestudiosystem

Theme-E:IndianFilms

E-1:Theearlyera
E-
2:Theimportantfilmsmadebythedirect
orsE-3: The regional films

E-4:ThedocumentariesinIndia

READING:

AReadercontainingimportantarticlesonfilmswillbepreparedandgiventothe students.Thestudentsmustreadthemandpresentintheclassandhavediscussiononthese.

21147MC51D DISASTERRISKREDUCTIONANDMANAGEMENT L T PC
3 0 00

COURSEOBJECTIVE

- Toimpart knowledgeonconceptsrelatedto disaster,disasterriskreduction,disaster management
- Toacquaintwiththeskillsfor planningandorganizingdisasterresponse

UNITI HAZRADS,VULNERABILITYANDDISASTERRISKS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Types of Disasters: Natural,Human induced,Climate changeinduced–Earthquake,Landslide,Flood,Drought,Fireetc–Technologicaldisasters-Structuralcollapse,Industrialaccidents,oilspills-Causes,Impacts includingsocial,Economic,political,environmental,health,psychosocial,etc.-Disaster vulnerabilityprofileofIndiaandTamilNadu-Globaltrendsindisasters:urbandisasters,pandemics, Complex emergencies, --
,InterrelationsbetweenDisastersandSustainabledevelopmentGoals

UNITII DISASTERRISKREDUCTION(DRR) 9

SendaiFrameworkforDisasterRiskReduction,Disastercycle-Phases,Cultureofsafety, prevention, mitigationandpreparednesscommunityBasedDRR,Structural- nonstructural measures,Rolesandresponsibilitiesof-community,PanchayatiRajInstitutions/Urban LocalBodies(PRIs/ULBs),States,Centre,andotherstakeholders-EarlyWarningSystem–AdvisoriesfromAppropriateAgencies.-RelevanceofindigenousKnowledge,appropriate technologyandLocalresources.

UNITIII DISASTERMANAGEMENT 9

ComponentsofDisasterManagement–Preparednessofrescueandrelief,mitigation, rehabilitation and reconstruction- Disaster Risk Management and post disaster management–CompensationandInsurance-DisasterManagementAct(2005)andPolicy-Otherrelatedpolicies,plans,programmersandlegislation-InstitutionalProcessesand FrameworkatStateandCentralLevel-(NDMA–SDMA-DDMA-NRDF-CivicVolunteers)

UNITIV TOOLSANDTECHNOLOGYFORDISASTERMANAGEMENT 9

Earlywarningsystems-ComponentsofDisasterRelief:Water,Food,Sanitation,Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response andPreparedness,– RoleofGISandInformationTechnologyComponentsinPreparedness, Risk Assessment,ResponseandRecoveryPhasesofDisaster–DisasterDamageAssessment.-ElementsofClimateResilientDevelopment–StandardoperationProcedurefordisaster response–FinancialplanningfordisasterManagement

UNITV DISASTERMANAGEMENT:CASESTUDIES 9

Discussionon selected case studies to analysethe potential impacts and actions in thecontest ofdisasters-LandslideHazardZonation:EarthquakeVulnerabilityAssessmentofBuildings andInfrastructure:CaseStudies,DroughtAssessment:CaseStudies,CoastalFlooding: StormSurgeAssessment,Floods:FluvialandPluvialFlooding:CaseStudies;ForestFire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigationand Management and field works related to disaster management.- Field work-Mock drill -

TOTAL:45PERIODS

TEXTBOOKS:

1 Taimpo(2016),DisasterManagement andPreparedness,CRCPublications
2 Singh R (2017), Disaster Management Guidelines for earthquakes, Landslides, Avalanches and tsunami, Horizon Press Publications
3 SinghalJ.P. “Disaster Management”, LaxmiPublications, 2010.ISBN-10:9380386427ISBN-13:978-9380386423
4 TusharBhattacharya,“DisasterScienceandManagement”,McGrawHill IndiaEducation Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]

REFERENCES

1. Govt.ofIndia:DisasterManagementAct,Government ofIndia,NewDelhi,2005.
2. GovernmentofIndia,NationalDisasterManagementPolicy,2009.
3. ShawR(2016),CommunitybasedDisaster riskreduction, OxfordUniversityPress

COURSEOUTCOME:

CO1: To impart knowledge on the concepts of Disaster, Vulnerability and Disaster Riskreduction(DRR)

CO2: ToenhanceunderstandingonHazards,VulnerabilityandDisasterRisk Assessmentprevention and risk reduction

CO3: Todevelopdisasterresponseskillsbyadoptingrelevanttoolsandtechnology

CO4: EnhanceawarenessofinstitutionalprocessesforDisasterresponseinthecountryand

CO5: Developrudimentaryabilitytorespondtotheirsurroundingswithpotential Disaster response in areas where they live, with due sensitivity

CO's-PO's&PSO'sMAPPING

O's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	0	11	2	1	2	3
1	3	3	2	3	-	-	2	2	-	-	2	-	2	-	1
2	3	3	3	3	-	-	2	1	-	-	2	-	2	-	1
3	3	3	3	3	-	-	2	2	-	-	-	-	2	-	1
4	3	3	2	3	-	-	2	1	-	-	2	-	2	-	1
5	3	3	2	3	-	-	2	2	-	-	2	-	3	-	1
VG	3	3	3	3	-	-	2	2	-	-	2	-	2	-	1

1-low,2-medium, 3-high,'-'-no correlation

MANDATORYCOURSESII

21147MC61A WELL-BEINGWITHTRADITIONALPRACTICES-YOGA,AYURVEDAANDSIDDHA LTP C

3000

COURSEOBJECTIVES:

- Toenjoylifehappilywithfunfillednewstyleactivitiesthathelptomaintainhealthalso
- Toadapt afewlifestylechangesthatwillpreventmanyhealthdisorders
- Tobe coolandhandbilleveryemotionverysmoothlyineverywalkoflife
- Tolearntoeatcosteffectivebuthealthyfoodsthat arerichinessentialnutrients
- Todevelopimmunitynaturallythatwillimproveresistanceagainstmanyhealthdisorders

UNITI HEALTHANDITSIMPORTANCE 2+4

Health:Definition-Importanceofmaintaininghealth-Moreimportanceonpreventionthantreatment Tentypesofhealthonehastomaintain-Physicalhealth-Mentalhealth-Socialhealth-Financialhealth-Emotionalhealth-Spiritualhealth-Intellectualhealth-Relationshiphealth - Environmental health - Occupational/Professional heath.

Presenthealthstatus-Thelifeexpectancy-presentstatus-mortalityrate-dreadful diseases-Non-communicablediseases(NCDs)theleadingcauseofdeath-60%-heart disease–cancer–diabetes-chronicpulmonarydiseases-riskfactors–tobacco–alcohol-unhealthydiet-lackofphysical activities.

Types of diseases and disorders - Lifestyle disorders – Obesity – Diabetes -Cardiovasculardiseases–Cancer–Strokes – COPD - Arthritis- Mental health issues.

Causesoftheabovediseases/disorders-Importanceofpreventionofillness-Takescareofhealth-Improves quality of life - Reduces absenteeism - Increase satisfaction - Saves time

Simple lifestyle modifications to maintain health - Healthy Eating habits (Balanceddiet according to age)Physical Activities (Stretching exercise, aerobics, resisting exercise) - Maintaining BMI-Importance and actions to betaken

UNITII DIET 4+6

Roleofdietinmaintaining health -energyoneneedstokeepactivethroughouttheday -nutrientsoneneedsforgrowthandrepair-helpsonetostaystrongandhealthy-helpsto preventdiet-related illness,such as somecancers-keepsactive and-helpsone tomaintaina healthyweight-helpstoreduceriskofdevelopinglifestyledisorderslikediabetes–arthritis –hypertension –PCOD–infertility–ADHD–sleeplessness-helpstoreducetheriskofheartdiseases-keeps the teeth and bones strong.

BalancedDietandits7Components-Carbohydrates–Proteins–Fats–Vitamins–Minerals-FibreandWater.

Food additives and their merits & demerits - Effects of food additives - Types of food additives - Food additivesand processed foods - Food additives and their reactions

DefinitionofBMIandmaintainingitwithdiet
Importance-ConsequencesofnotmaintainingBMI-differentstepstomaintainoptimalBM

Commoncookingmistakes
Differentcookingmethods,meritsanddemeritsofeachmethod

UNITIII ROLEOFAYURVEDA&SIDDHASYSTEMSINMAINTAININGHEALTH 4+4

AYUSHsystemsandtheir roleinmaintaininghealth-preventiveaspectofAYUSH-AYUSHasasofttherapy.

Secretsoftraditionalhealthyliving-TraditionalDietandNutrition-Regimen of Personaland SocialHygiene - Dailyroutine(Dinacharya) - Seasonal regimens(Ritucharya) - basic sanitation and healthy living environment - Sadvritta (good conduct) - for conducivesocial life.

Principles of Siddha & Ayurveda systems - Macrocosm and Microcosm theory - Pancheekarana Theory / (FiveElement Theory) 96 fundamental Principles - Uyir Thathukkal (Tri-Dosha Theory) - Udal Thathukkal

Preventionofillnesswithourtraditionalsystemofmedicine
Primary Prevention - To decrease the number of new cases of a disorder or illness - Healthpromotion/education, and - Specific protective measures - Secondary Prevention - To lowerthe rate of established cases of a disorder or illness in the population (prevalence) - TertiaryPrevention - To decrease the amount of disability associated with an existing disorder.

UNITIV MENTALWELLNESS 3+4

Emotionalhealth-Definitionandtypes-Threekeyelements:thesubjectiveexperience-thephysiologicalresponse-thebehavioralresponse-Importanceofmaintainingemotional health-Roleofemotionsindailylife-Shorttermandlongtermeffectsofemotional disturbances - Leading a healthy life with emotions - Practices for emotional health - Recognize how thoughts influence emotions - Cultivate positive thoughts - Practice self-compassion - Expressing a full range of emotions.

Stressmanagement-Stressdefinition-Stressindailylife-Howstressaffectsone's life -Identifyingthecauseofstress-Symptomsofstress-Managingstress(habits,tools,training, professional help) - Complications of stress mismanagement.

Sleep-Sleepanditsimportanceformentalwellness-Sleepanddigestion.
Immunity-Typesandimportance-Waystodevelopimmunity

UNIT VYOGA2+12

Definitionand importanceof yoga- Typesofyoga - HowtoChoosetheRightKindforindividuals according to their age - The Eight Limbs of Yoga - Simple yogasanas for cureand prevention of health disorders - What yoga can bring to our life.

TOTAL:45PERIODS

TEXTBOOKS:

1. NutritionandDietetics-AshleyMartin,PublishedbyWhiteWord Publications,New York, NY 10001, USA
2. YogaforBeginners_35SimpleYogaPosesto CalmYour MindandStrengthenYour Body,by Cory Martin, Copyright © 2015 by Althea Press, Berkeley, California

REFERENCES:

1. WHATWEKNOWABOUTEMOTIONALINTELLIGENCEHowItAffectsLearning, Work, Relationships, and Our Mental Health, by Moshe Zeidner, Gerald Matthews, and Richard D. Roberts
2. ABradford Book,The MITPress, Cambridge, Massachusetts,London,England The Mindful Self-CompassionWorkbook,KristinNeff, Ph.DChristopherGermer, Ph.D,Published byThe Guilford Press A Division of Guilford Publications, Inc.370 Seventh Avenue, Suite 1200, NewYork, NY 10001

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4799645/
2. **Simplelifestylemodificationstomaintainhealth** https://www.niddk.nih.gov/health-information/diet-nutrition/changing-habits-better-health#:~:text=Make%20your%20new%20healthy%20habit,t%20have%20time%20to%20cook.
3. **Readmore**:https://www.legit.ng/1163909-classes-food-examples-functions.html
4. https://www.yaclass.in/p/science-state-board/class-9/nutrition-and-health-5926
5. **Benefitsofhealthyeating**https://www.cdc.gov/nutrition/resources-

publications/benefits-of-healthy-eating.html

6. **Food additives**

https://www.betterhealth.vic.gov.au/health/conditionsandtreatments/food-additives

7. **BMI** https://www.hsph.harvard.edu/nutritionsource/healthy-weight/https://www.who.int/europe/news-room/fact-sheets/item/a-healthy-lifestyle---who-recommendations
8. **Yoga**https://www.healthifyme.com/blog/types-of-yoga/https://yogamedicine.com/guide-types-yoga-styles/
   Ayurveda:https://vikaspedia.in/health/ayush/ayurveda-1/concept-of-healthy-~~living-in~~-ayurveda
9. **Siddha**:http://www.tkdl.res.in/tkdl/langdefault/Siddha/Sid_Siddha_Concepts.asp
10. **CAM:**https://www.hindawi.com/journals/ecam/2013/376327/
11. **Preventive**herbs:https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3847409/

COURSEOUTCOMES:

After completing the course, the students will be able to:**CO1**:Learntheimportanceofdifferentcomponents of health**CO2**:Gain confidence to lead a healthy life
CO3:Learnnewtechniquestopreventlifestylehealthdisorders
CO4:Understandtheimportanceofdietandworkoutsinmaintaininghealth

21147MC61B HISTORYOFSCIENCEANDTECHNOLOGYININDIA L TPC
3000

UNIT-I CONCEPTSANDPERSPECTIVES

Meaningof History

Objectivity, Determinism, Relativism, Causation, Generalization in History; Moral judgmentin history Extent of subjectivity, contrast with physical sciences, interpretation andspeculation, causation verses evidence, concept of historical inevitability, HistoricalPositivism.

Science and Technology-Meaning, Scope and Importance, Interaction of science, technology& society, Sources of history on science and technology in India.

UNIT-II HISTORIOGRAPHYOFSCIENCEANDTECHNOLOGYININDIA

IntroductiontotheworksofD.D.Kosambi,Dharmpal,DebiprasadChattopadhyay,Rehman, S.IrfanHabib,DeepakKumar,DhruvRaina,andothers.

UNIT-III SCIENCEANDTECHNOLOGYINANCIENTINDIA

Technologyinpre-historicperiod
Beginning of agriculture and its impact on technologyScience and Technology during Vedic and Later VedictimesScience and technology from 1st century AD to C-1200.

UNIT-IV SCIENCEANDTECHNOLOGYINMEDIEVALINDIA

LegacyoftechnologyinMedievalIndia,InteractionswithArabs
Development in medical knowledge, interaction between Unani andAyurveda andalchemyAstronomy and Mathematics: interaction with Arabic Sciences
ScienceandTechnologyontheeveofBritishconquest

UNIT-V SCIENCEANDTECHNOLOGYINCOLONIALINDIA

Science and the EmpireIndianresponsetoWesternScience
Growthoftechno-scientific institutions

UNIT-VI SCIENCEANDTECHNOLOGYINAPOST-INDEPENDENTINDIA

Science,Technologyand Developmentdiscourse
Shaping of the Science and Technology PolicyDevelopmentsinthefieldofScienceandTechnologyScience and technology in globalizingIndia
SocialimplicationsofnewtechnologiesliketheInformationTechnologyandBiotechnology

TOTAL:45PERIODS

21147MC61C POLITICALANDECONOMICTHOUGHTFORAHUMANESOCIETY LTPC

3000

Pre-Requisite**:**None.(Desirable:UniversalHumanValues1,UniversalHumanValues2)

COURSEOBJECTIVES:

- This course will begin with a short overview of human needs and desires and how different political-economic systems tryto fullfillthem. Inthe process, wewillend witha critique ofdifferent systems and their implementations in the past, with possible future directions.

COURSETOPICS:

Considerations for humane society, holistic thought, human being's desires, harmony in self, harmony in relationships, society, and nature, societal systems. **(9 lectures, 1 hour each)**

(Refs:ANagaraj, MKGandhi, JCKumarappa)

Capitalism–Freemarkets,demand-supply,perfectcompetition,laissez-faire, monopolies,imperialism. Liberal democracy. **(5 lectures)**

(Refs:Adamsmith, JSMill)

Fascismandtotalitarianism.WorldwarIandII.Coldwar.**(2lectures)**

Communism–Modeofproduction,theoryoflabour,surplusvalue,classstruggle,dialectical materialism, historical materialism, Russian and Chinese models.

(Refs:Marx,Lenin,Mao,MNRoy)**(5lectures)**

Welfarestate.Relationwithhumandesires.Empoweredhumanbeings,satisfaction.**(3lectures)**

Gandhian thought. Swaraj, Decentralized economy & polity, Community. Control over one'slives.Relationship with nature. **(6 lectures)**

(Refs:MKGandhi,Schumacher,Kumarappa) Essential

elements of Indian civilization. **(3**

lectures)(Refs:PtSundarlal,RCMazumdar,

Dharampal)

Technologyasdriverofsociety,Roleofeducationinshapingofsociety.Futuredirections.**(4lectures)**(Refs:NandkishoreAcharya,DavidDixon,LevisMumford)

Conclusion(2lectures)

Totallectures:39

PreferredTextbooks: SeeReferenceBooks

Reference Books: Authors mentioned along with topics above. Detailed reading list willbeprovided.

ADING:

dsems	30
dsem	20
meAssign	10
mpaper	40

TOTAL:45PERIODS

COURSEOUTCOME:

- The students will get an understanding of how societies are shaped by philosophy, political and economic system, how theyrelate to fulfilling human goals & desires with some case studies of how different attempts have been made in the past and how they have fared.

21147MC61D STATE,NATIONBUILDINGANDPOLITICSININDIA L TPC
3000

COURSEOBJECTIVE:

Theobjectiveofthecourseistoprovideanunderstandingofthestate, howitworksthrough its main organs, primacy of politics and political process, the concept of sovereignty and its changing contours in a globalized world. In the light of this, an attempt will be made to acquaint the students with the main development and legacies of national movement and constitutional development in India, reasons for adoptinga Parliamentary-federal system, the broad philosophy of the Constitutionof India and the changing nature of Indian Political System. Challenges/ problems and issues concerningnational integration and nation-building will also be discussed in the contemporary context with the aimof developing afuture vision for a better India.

TOPICS:

UnderstandingtheneedandroleofStateandpolitics.

DevelopmentofNation-State,sovereignty,sovereigntyinaglobalizedworld.

OrgansofState–Executive,Legislature,Judiciary.Separationofpowers,formsofgovernment-unitary-federal, Presidential-Parliamentary,
TheideaofIndia.

1857andthenationalawakening.

1885IndianNationalCongressanddevelopmentofnationalmovement–itslegacies. Constitution making and the Constitution of India.
Goals,objectiveand philosophy.Whyafederals
ystem?
Nationalintegrationandnation-building.

Challenges of nation-building – State against democracy(Kothari)New social movements.
The changing nature of Indian Political System, the futurescenario.What can we do?

OUTCOMEOFTHECOURSE:

It is expected that this course will make students aware of the theoretical aspect of the state, its organs, its operationalization aspect, the background and philosophy behind the founding of the present political system, broad streams and challenges of national integration and nation-buildingin India. It will equip the students with the real understandingof our political system/ process in correct perspective and make them sit up and think for devising ways for better participation in the system with a view to making the governance and delivery system better for the common man who is often left unheard and unattended in our democratic setup besides generating a lot of dissatisfaction and difficulties for the system.

SUGGESTEDREADING:

i. SunilKhilnani,TheIdeaofIndia.PenguinIndia Ltd.,NewDelhi.

ii. MadhavKhosla,TheIndianConstitution,OxfordUniversityPress.NewDelhi, 2012.

iii. BrijKishoreSharma,IntroductiontotheIndianConstitution,PHI,NewDelhi,latestedition.

iv. SumantraBose,TransformingIndia:ChallengestotheWorld'sLargestDemocracy, Picador India, 2013.

v. AtulKohli,DemocracyandDiscontent:India'sGrowingCrisisofGovernability, CambridgeUniversity Press, Cambridge, U. K., 1991.

vi. M.P.SinghandRekhaSaxena,IndianPolitics:ContemporaryIssuesandConcerns,PHI, New Delhi, 2008, latest edition.

vii. RajniKothari,RethinkingDemocracy,OrientLongman,NewDelhi,2005.

TOTAL:45PERIODS

21174MC61E	INDUSTRIALSAFETY	LTPC3 00 0

COURSEOBJECTIVES

- ToUnderstandtheIntroductionandbasicTerminologies safety.
- Toenablethestudentsto learnabouttheImportantStatutoryRegulationsand standards.
- ToenablestudentstoConductandparticipatethevariousSafetyactivitiesintheIndustry.
- TohaveknowledgeaboutWorkplaceExposuresand Hazards.
- To assess the various Hazards and consequences through various Risk Assessment Techniques.

UNITI SAFETYTERMINOLOGIES

Hazard-Types of Hazard- Risk-Hierarchy of Hazards Control Measures-Lead indicators- lagIndicators-Flammability- Toxicity Time-weighted Average (TWA) - Threshold LimitValue(TLV)-ShortTermExposureLimit(STEL)-Immediatelydangeroustolifeor health(IDLH)-acuteandchronicEffects-RoutesofChemicalEntry-PersonnelProtective Equipment-HealthandSafetyPolicy-MaterialSafetyDataSheetMSDS

UNITII STANDARDSANDREGULATIONS

IndianFactories Act-1948-Health- Safety-Hazardous materialsandWelfare- ISO

45001:2018 occupational health and safety (OH&S) - Occupational Safety and Health AuditIS14489:1998- Hazard Identification and Risk Analysis- code of practice IS 15656:2006

UNITIIISAFETYACTIVITIES

Toolbox Talk- Role of safety Committee- Responsibilities of Safety Officers and SafetyRepresentatives- Safety Training and Safety Incentives- Mock Drills- On-site EmergencyAction Plan- Off-site Emergency Action Plan- Safety poster and Display- Human ErrorAssessment

UNITIVWORKPLACEHEALTHANDSAFETY

Noise hazard- Particulate matter- musculoskeletal disorder improper sitting poster and liftingErgonomics RULE & REBA- Unsafe act & Unsafe Condition- Electrical Hazards- CraneSafety- Toxic gas Release

UNITV HAZARDIDENTIFICATIONTECHNIQUES

JobSafetyAnalysis-PreliminaryHazardAnalysis-FailuremodeandEffectsAnalysis-Hazard andOperability-FaultTreeAnalysis-EventTreeAnalysisQualitativeandQuantitativeRisk Assessment-ChecklistAnalysis-Rootcauseanalysis-What-IfAnalysis-andHazardIdentification and Risk Assessment

TOTAL:45PERIODS

COURSEOUTCOMES:

Courseoutcomesoncompletionofthiscoursethestudentwillbeable:

CO1:Understandthebasicconceptofsafety.

CO2:ObtainknowledgeofStatutoryRegulationsandstandards.

CO3:KnowaboutthesafetyActivitiesoftheWorkingPlace.

CO4:AnalyzeontheimpactofOccupationalExposuresandtheirRemedies

CO5:ObtainknowledgeofRiskAssessmentTechniques.

TEXTBOOKS

1. R.K.JainandProf.Sunil S.RaoIndustrial Safety,HealthandEnvironmentManagement Systems KHANNA PUBLISHER
2. L. M. DeshmukhIndustrialSafetyManagement: HazardIdentificationandRisk Control McGraw-Hill Education

REFERENCES

1. FrankLees(2012)‘Lees’LossPreventioninProcessIndustries.Butterworth-Heinemann publications, UK, 4th Edition.
2. JohnRidley&JohnChanning(2008)SafetyatWork:Routledge,7thEdition.
3. DanPetersen(2003)TechniquesofSafetyManagement:ASystemApproach.
4. AlanWaring.(1996).Safetymanagementsystem:Chapman&Hall,England
5. SocietyofSafetyEngineers,USA

ONLINERESOURCES

ISO45001:2018occupationalhealthand safety(OH&S) InternationalOrganization forStandardization https://www.iso.org/standard/63787.html

Indian Standard code of practice on occupational safety and health audithttps://law.resource.org/pub/in/bis/S02/is.14489.1998.pdf

Indian Standard code of practice on Hazard Identification and Risk Analysis IS 15656:2006 https://law.resource.org/pub/in/bis/S02/is.15656.2006.pdf

CO's-PO's&PSO'sMAPPING

ourse Outcome s	Statement	ProgramOutcome														
		1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12	SO1	SO2	SO3
CO1	nderstand thebasic conceptofsafety.		3								3	1	3	3	3	3
CO2	tain knowledgeof StatutoryRegulations andstandards.		3								2	1	3	3	3	3
CO3	now about thesafety vities of theWorking Place.		2								2	1	2	3	3	3
CO4	alyzeontheimpact of Occupational Exposuresand theirRemedies		3								2	1	3	3	3	3
CO5	inknowledgeofRisk Assessment Techniques.		2								2	2	3	3	3	3
Industrialsafety			3								2	1	3	3	3	3

1-low,2-medium, 3-high,'-'-no correlation

2115274A	**WEARABLE DEVICES**	**LTP C300 3**

OBJECTIVES:

Thestudentshouldbemadeto:

- Toknowthehardwarerequirementofwearablesystems
- Tounderstandthecommunicationandsecurityaspectsinthewearabledevices
- Toknowthe applicationsofwearable devicesinthefield of medicine

UNITI INTRODUCTIONTOWEARABLESYSTEMSANDSENSORS 9

WearableSystems-Introduction,NeedforWearableSystems,DrawbacksofConventional

SystemsforWearableMonitoring,ApplicationsofWearableSystems,TypesofWearable Systems,ComponentsofwearableSystems.Sensorsforwearablesystems-Inertiamovement sensors, Respiration activity sensor, Inductive plethysmography, Impedanceplethysmography, pneumography, Wearable ground reaction force sensor.

UNITII SIGNALPROCESSINGANDENERGYHARVESTINGFOR WEARABLEDEVICES 9

Wearabilityissues-physicalshapeandplacementofsensor,Technicalchallenges-sensordesign,signalacquisition,samplingfrequencyforreducedenergyconsumption,Rejection of irrelevantinformation.PowerRequirements-Solarcell,Vibrationbased,Thermalbased, Humanbodyasaheatsourceforpowergeneration,Hybridthermoelectricphotovoltaic energyharvests,Thermopiles.

UNITIII WIRELESSHEALTHSYSTEMS 9

Need for wireless monitoring, Definition of Body area network, BAN and Healthcare,Technical Challenges- System security and reliability, BAN Architecture – Introduction,Wireless communication Techniques.

UNITIV SMARTTEXTILE 9

Introductiontosmarttextile-Passivesmarttextile,activesmarttextile.Fabrication Techniques-ConductiveFibres,TreatedConductiveFibres,ConductiveFabrics,Conductive Inks.Casestudy-smartfabricformonitoringbiologicalparameters -ECG,respiration.

UNITV APPLICATIONSOFWEARABLESYSTEMS 9

MedicalDiagnostics,MedicalMonitoring-Patientswithchronicdisease,Hospitalpatients,Elderly patients, neural recording, Gait analysis, Sports Medicine.

OUTCOMES:

Onsuccessfulcompletionofthiscourse,thestudentwillbe able toCO1: Describe the concepts of wearable system. CO2: Explain the energy harvestings in wearable device.CO3: Use the concepts of BAN in health care.
CO4:Illustratetheconceptofsmarttextile
CO5:Comparethevariouswearabledevicesinhealthcare system

TOTALPERIODS:45

TEXTBOOKS

5. AnnalisaBonfigloandDaniloDeRossi,WearableMonitoringSystems, Springer, 2011
6. ZhangandYuan-Ting,WearableMedicalSensorsandSystems,Springer, 2013
7. Edward Sazonov and Micheal R Neuman, Wearable Sensors: Fund ment
8. Mehmet R. Yuce and JamilY.Khan,Wireless Body Area Networks Technology,Implementation applications,PanStanfordPublishingPte.Ltd,Singapore,2012

REFERENCES

3. Sandeep K.S, Gupta, Tridib Mukherjee and Krishna Kumar Venkatasubramanian,BodyAreaNetworksSafety,Security,and Sustainability, Cambridge University Press, 2013.
4. Guang-ZhongYang, BodySensorNetworks,Springer,2006.

CO's-PO's&PSO'sMAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	0	11		1	2	3
1	3	2	1	1	2	-	-	1	-	-	-		1	-	1
2	3	2	1	1	2	-	-	1	-	-	-		1	-	1
3	3	2	1	1	2	-	-	1	-	-	-		1	-	1
4	3	2	1	1	2	-	-	1	-	-	-		1	-	1
5	3	2	1	1	2	-	-	1	-	-	-		1	-	1
AVg.	3	2	1	1	2	-	-	1	-	-	-		1	-	1

1-low,2-medium, 3-high,'-'-nocorrelation

PRIST
DEEMED TO BE
UNIVERSITY
NAAC ACCREDITED
THANJAVUR – 613 403 - TAMIL NADU

SCHOOLOFENGINEERINGANDTECHNOLOGY

DEPARTMENTOF
ELECTRONICS&COMMUNICATIONENGINEERING

PROGRAMHANDBOOK

B.TECH-FULLTIME

[REGULATION2020]

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

PROGRAMMEEDUCATIONALOBJECTIVES:

PEO1:Toenablegraduatestopursueresearch,orhaveasuccessfulcareerinacademiaorindustries associated with Electronics and Communication Engineering, or as entrepreneurs.

PEO2: To provide students with strong foundational concepts and also advanced techniques and tools in order to enable them to build solutions or systems of varying complexity.

PEO3:Topreparestudents tocriticallyanalyze existingliteratureinanarea of specializationand ethically develop innovative and research oriented methodologies to solve the problems identified.

PROGRAMMEOUTCOMES:

EngineeringGraduateswillbeableto:

A. **Engineering knowledge**: Applytheknowledgeof mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

B. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

C. **Design/development of solutions**: Design solutions for complex engineering problems and design systemcomponents or processes that meet thespecifiedneeds withappropriateconsiderationfor the public health and safety, and the cultural, societal, and environmental considerations.

D. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

E. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

F. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

G. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

H. **Ethics**:Applyethicalprinciples andcommit toprofessionalethics andresponsibilities and norms of the engineering practice.

I. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

J. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

K. **Project management and finance**: Demonstrate knowledge and understanding of the engineering andmanagement principlesandapplythesetoone‘sownwork, asamember andleader ina team, to manage projects and in multidisciplinary environments.

L. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

MAPPINGOFPROGRAMMEEDUCATIONALOBJECTIVESWITHPROGRAMME OUTCOMES

Abroadrelationbetweentheprogrammeobjectiveandtheoutcomes is giveninthefollowingtable

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMMEOUTCOMES												
	A	B	C	D	E	F	G	H	I	J	K	L	M
1	3	3	2	3	2	1	1	2	1	1	3	1	3
2	3	3	3	3	3	1	1	1	1	1	1	2	2
3	3	3	3	3	3	2	2	3	1	2	2	2	2

Contribution 1: Reasonable 2:Significant 3:Strong

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

B.TECH(FULLTIME)–ECE–R-2020 I -

VIII SEMESTERS CURRICULUM

SEMESTER I

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
THEORY						
1.	20147S11	CommunicativeEnglish	4	0	0	4
2.	20148S12	EngineeringMathematicsI	4	0	0	4
3.	20149S13	EngineeringPhysics	3	0	0	3
4.	20149S14	EngineeringChemistry	3	0	0	3
5.	20154S15	EngineeringGraphics	2	0	4	4
6.	20150S16	ProblemSolvingandBasics ofPython Programming	3	0	0	3
PRACTICALS						
7.	20150L17	ProblemSolvingandBasics ofPython ProgrammingLab	0	0	4	2
8.	20149L18	PhysicsandChemistryLaboratory	0	0	4	2
		SoftSkillsCourse				
9.	201AGIT	InductionTrainingProgramme				2
		TOTAL	**19**	**0**	**12**	**27**

SEMESTER II

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
THEORY						
1.	20147S21	TechnicalEnglish	4	0	0	4
2.	20148S22	EngineeringMathematicsII	4	0	0	4
3.	20149S23B	PhysicsforElectronicsEngineering	3	0	0	3
4.	20153S24B	CircuitAnalysis	4	0	0	4
5.	20153S25B	BasicElectricalAndInstrumentationEngineering	3	0	0	3
6.	20152S26B	ElectronicDevices	3	0	0	3
PRACTICALS						
7.	20154L27	EngineeringPracticesLaboratory	0	0	4	2
8.	20152L28B	CircuitsandDevicesLaboratory	0	0	4	2
		SoftSkillsCourse				
9.	201AGIC	IndianConstitution				2
10.	201ASBE	BasicBehavioralEtiquette				2
		TOTAL	21	0	8	**29**

SEMESTER III

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
THEORY						
1.	20148S31B	LinearAlgebraandPartialDifferential Equations	4	0	0	4
2.	20152S32	ControlSystemsEngineering	3	0	0	3
3.	20152S33	FundamentalsofDataStructuresInC	3	0	0	3
4.	20152C34	DigitalElectronics	3	0	0	3
5.	20152C35	SignalsandSystems	4	0	0	4

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
6.	20152C36	ElectronicCircuits-I	3	0	0	3
PRACTICALS						
7.	20152L37	FundamentalsofDataStructuresInC Laboratory	0	0	4	2
8.	20152L38	AnalogandDigitalCircuits Laboratory	0	0	4	2
9.	20152L39	InterpersonalSkills/Listening& Speaking	0	0	2	1
		SoftSkillsCourse				
10.	201AGGS	IntroductiontoGenderStudies				2
		TOTAL	20	0	10	**27**

SEMESTER IV

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
THEORY						
1.	20148S41B	ProbabilityandRandomProcesses	4	0	0	4
2.	20152C42	ElectronicCircuitsII	3	0	0	3
3.	20152C43	CommunicationTheory	3	0	0	3
4.	20152C44	ElectromagneticFields	4	0	0	4
5.	20152C45	LinearIntegratedCircuits	3	0	0	3
6.	20149S46	EnvironmentalScienceand Engineering	3	0	0	3
PRACTICALS						
7.	20152L47	CircuitsDesignandSimulation Laboratory	0	0	4	2
8.	20152L48	LinearIntegratedCircuitsLaboratory	0	0	4	2
		SoftSkillsCourse				
9.	201AGCE	CommunityEngagement				2
10.	201ASGS	Technical,GeneralAptitudeandSkillset Development				2
		TOTAL	20	0	8	**28**

SEMESTERV

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
THEORY						
1.	20152C51	DigitalCommunication	3	0	0	3
2.	20152C52	Discrete-TimeSignalProcessing	4	0	0	4
3.	20152S53	ComputerArchitectureand Organization	3	0	0	3
4.	**201_ _OE54_**	**OpenElective – I**	3	0	0	3
5.	20152C55	CommunicationNetworks	3	0	0	3
6.	**20152E56_**	**Elective–I**	3	0	0	3
PRACTICALS						
7.	20152L57	DigitalSignalProcessingLaboratory	0	0	4	2
8.	20152L58	CommunicationSystemsLaboratory	0	0	4	2
9.	20152L59	CommunicationNetworks Laboratory	0	0	4	2
		SoftSkillsCourse				
10.	201AGIE	InnovationandEntrepreneurship				2
		TOTAL	22	**0**	12	**27**

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

SEMESTER VI

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
THEORY						
1.	20152C61	Microprocessorsand Microcontrollers	3	0	0	3
2.	20152C62	VLSIDesign	3	0	0	3
3.	20152C63	WirelessCommunication	3	0	0	3
4.	20152S64	PrinciplesofManagement	3	0	0	3
5.	20152C65	TransmissionLinesandRFSystems	3	0	0	3
6.	**20152E66_**	**Elective–II**	3	0	0	3
PRACTICALS						
7.	20152L61	Microprocessorsand MicrocontrollersLaboratory	0	0	4	2
8.	20152L62	VLSIDesignLaboratory	0	0	4	2
9.	20152L63	ProfessionalCommunication	0	0	2	1
10.	20152L64	TechnicalSeminar	0	0	2	1
		SoftSkillsCourse				
11.	201ASTT	TechnicalTraining				2
		TOTAL	18	0	12	**26**

SEMESTER VII

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
THEORY						
1.	20152C71	AntennasandMicrowave Engineering	3	0	0	3
2.	20152C72	OpticalCommunication	3	0	0	3
3.	20152C73	EmbeddedandRealTimeSystems	3	0	0	3
4.	**201_ _OE74_**	**OpenElective – II**	3	0	0	3
5.	20152C75	AdhocandWirelessSensor Networks	3	0	0	3
6.	**20152E76_**	**Elective–III**	3	0	0	3
PRACTICALS						
7.	20152L77	EmbeddedLaboratory	0	0	4	2
8.	20152L78	AdvancedCommunication Laboratory	0	0	4	2
		TOTAL	18	0	8	**22**

SEMESTERVIII

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
THEORY						
1.	**20152E81_**	**Elective–IV**	3	0	0	3
2.	**20152E82_**	**Elective–V**	3	0	0	3
PRACTICALS						
3.	20152P83	ProjectWork	0	0	20	10
4.	20152PEE	ProgrammeExit Examination	0	0	0	2
		SoftSkillsCourse				
5.	201AGPE	ProfessionalEthicsandHumanValues				2
6.	201ASIM	InterviewSkillsTrainingandMockTest				2
		TOTAL	6	0	20	**22**
		TOTALNO.OFCREDITS:				**208**

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

LISTOF ELECTIVES

ELECTIVE-I(SEMESTERV)

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
1.	20152E56A	ObjectOriented Programming	3	0	0	3
2.	20152E56B	MedicalElectronics	3	0	0	3
3.	20152E56C	OperatingSystems	3	0	0	3
4.	20152E56D	RoboticsandAutomation	3	0	0	3
5.	20152E56E	NanoTechnologyand Applications	3	0	0	3
6.	20152E56F	HumanRights	3	0	0	3
7.	20152E56G	TotalQualityManagement	3	0	0	3

ELECTIVE–II(SEMESTERVI)

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
1.	20152E66A	CryptographyandNetwork Security	3	0	0	3
2.	20152E66B	AdvancedDigitalSignal Processing	3	0	0	3
3.	20152E66C	MEMSand NEMS	3	0	0	3
4.	20152E66D	MultimediaCompressionand Communication	3	0	0	3
5.	20152E66E	CMOSAnalogIC Design	3	0	0	3
6.	20152E66F	WirelessNetworks	3	0	0	3
7.	20152E66G	IntellectualPropertyRights	3	0	0	3

ELECTIVE–III(SEMESTERVII)

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
1.	20152E76A	AdvancedWireless Communication	3	0	0	3
2.	20152E76B	CognitiveRadio	3	0	0	3
3.	20152E76C	FoundationSkills in IntegratedProduct Development	3	0	0	3
4.	20152E76D	MachineLearning Techniques	3	0	0	3
5.	20152E76E	ElectronicsPackagingandTest ing	3	0	0	3
6.	20152E76F	MixedSignalIC Design	3	0	0	3
7.	20152E76G	DisasterManagement	3	0	0	3

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE– IV(SEMESTERVIII)

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
1.	20152E81A	ElectroMagnetic Interferenceand Compatibility	3	0	0	3
2.	20152E81B	LowPowerSoCDesign	3	0	0	3
3.	20152E81C	PhotonicNetworks	3	0	0	3
4.	20152E81D	CompressiveSensing	3	0	0	3
5.	20152E81E	DigitalImageProcessing	3	0	0	3

ELECTIVE-V(SEMESTERVIII)

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
1.	20152E82A	Video Analytics	3	0	0	3
2.	20152E82B	DSPArchitectureandProgramming	3	0	0	3
3.	20152E82C	SatelliteCommunication	3	0	0	3
4.	20152E82D	SoftComputing	3	0	0	3
5.	20152E82E	PrinciplesofSpeechProcessing	3	0	0	3
6.	20152E82F	FundamentalsofNano Science	3	0	0	3

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

LISTOFOPENELECTIVES

OPENELECTIVE–I(SEMESTERV)

Sl. No	DEPT	COURSE CODE	COURSETITLE	L	T	P	C
1.	CSE	20150OE54A	DatabaseManagementSystems	3	0	0	3
2.		20150OE54B	CloudComputing	3	0	0	3
3.	EEE	20153OE54A	IndustrialNanoTechnology	3	0	0	3
4.		20153OE54B	EnergyConservationand Management	3	0	0	3
5.	MECH	20154OE54A	RenewableEnergySources	3	0	0	3
6.		20154OE54B	AutomotiveSystems	3	0	0	3
7.	CIVIL	20155OE54A	AirPollutionandControl Engineering	3	0	0	3
8.		20155OE54B	GeographicInformationSystem	3	0	0	3

OPENELECTIVE–II(SEMESTERVII)

Sl. No	DEPT	COURSE CODE	COURSETITLE	L	T	P	C
1.	CSE	20150OE74A	IntroductiontoCProgramming	3	0	0	3
2.		20150OE74B	DataStructuresandAlgorithms	3	0	0	3
3.	EEE	20153OE74A	BasicCircuitTheory	3	0	0	3
4.		20153OE74B	IntroductiontoRenewable EnergySystems	3	0	0	3
5.	MECH	20154OE74A	IndustrialSafety	3	0	0	3
6.		20154OE74B	TestingofMaterials	3	0	0	3
7.	CIVIL	20155OE74A	GreenBuildingDesign	3	0	0	3
8.		20155OE74B	WasteWaterTreatment	3	0	0	3

B.TECH(FULLTIME)–ECE–R-2020

COURSESTRUCTUREANDCREDITSDISTRIBUTION

Sem.	CoreCourses				Elective Courses				Foundation Courses		Program Exit Examination		CGPA Credits	Non-CGPA Credits		Total Credits
	Theory Courses		Practical Courses		Dept. Elective		OpenElective									
	Nos.	redit	Nos.	Credits	Nos.	Credits	Nos.	Credits	Nos.	Credits	Nos.	Credits		Nos.	Credits	
I	02	07	02	04	-	-	-	-	04	14	-	-	25	01	02	**27**
II	03	10	02	04	-	-	-	-	03	11	-	-	25	02	04	**29**
III	05	16	03	05	-	-	-	-	01	04	-	-	25	01	02	**27**
IV	05	16	02	04	-	-	-	-	01	04	-	-	24	02	04	**28**
V	04	13	03	06	01	03	01	03	-	-	-	-	25	01	02	**27**
VI	05	15	02	04	01	03	-	-	-	-	-	-	24	01	02	**26**
VII	04	12	02	04	01	03	01	03	-	-	-	-	22	-	-	**22**
VIII	-	-	01	10	02	06	-	-	-	-	1	2	18	02	04	**22**
TOTALCREDITS													**188**		20	**208**

SEMESTERI

20147S11 **COMMUNICATIVEENGLISH**

L	T	P	C
4	0	0	4

OBJECTIVES:

- Todevelopthebasicreadingandwritingskillsoffirstyearengineeringandtechnologystudents.
- Tohelplearnersdeveloptheirlisteningskills,whichwill,enablethemlistentolecturesand comprehend them by asking questions; seeking clarifications.
- Tohelplearnersdeveloptheirspeakingskillsandspeakfluentlyinrealcontexts.
- Tohelplearnersdevelopvocabularyofa generalkindbydevelopingtheir readingskills

UNIT ISHARINGINFORMATIONRELATEDTOONESELF/FAMILY&FRIENDS12

Reading- short comprehension passages, practice in skimming-scanning and predicting- **Writing**- completing sentences- - developing hints. **Listening-** short texts- short formal and informalconversations. **Speaking-** introducing oneself - exchanging personal information- **Languagedevelopment**- Wh-Questions- asking and answering-yes or no questions- parts of speech. **Vocabularydevelopment**-- prefixes- suffixes- articles.- count/ uncount nouns.

UNIT V EXTENDEDWRITING 12

Reading- longer texts- close reading –**Writing-** brainstorming -writing short essays – developing anoutline- identifying main and subordinate ideas- dialogue writing-**Listening** – listening to talks- conversations- **Speaking** – participating in conversations- short group conversations- **Languagedevelopment**-modal verbs- present/ past perfect tense - **Vocabulary development**- collocations-fixedand semi-fixed expressions.

TOTAL:60PERIODS

OUTCOMES:

Attheendofthecourse, learnerswillbeableto:

- Readarticlesofa generalkindinmagazinesand newspapers.
- Participateeffectivelyininformalconversations;introducethemselvesandtheirfriendsandexpress opinions in English.

SKILL DEVELOPMENT **EMPLOYABILITY** **ENTREPRENEURSHIP**

- ComprehendconversationsandshorttalksdeliveredinEnglish
- WriteshortessaysofageneralkindandpersonallettersandemailsinEnglish.

TEXTBOOKS:

1. Board of Editors.**Using English** A Coursebook for Undergarduate Engineers and Technologists**.** Orient BlackSwan Limited, Hyderabad: 2015
2. Richards,C.Jack. **InterchangeStudents'Book-2**NewDelhi:CUP,2015.

REFERENCES:

1. Bailey,Stephen. **AcademicWriting:Apracticalguideforstudents**.NewYork:Rutledge,2011.
2. Means,L. Thomas and Elaine Langlois. **English & Communication For Colleges.** CengageLearning,USA:2007
3. Redston, Chris &Gillies Cunningham **Face2Face** (Pre-intermediate Student's Book& Workbook) Cambridge University Press, New Delhi: 2005
4. Comfort,Jeremy,etal.**SpeakingEffectively:DevelopingSpeakingSkillsforBusinessEnglish.** CambridgeUniversityPress,Cambridge:Reprint2011
5. DuttP.KiranmaiandRajeevanGeeta.**BasicCommunicationSkills,**FoundationBooks:2013.

SEMESTERI

20148S12 ENGINEERINGMATHEMATICSI

	L	T	P	C
	4	0	0	4

OBJECTIVES:

- The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariablecalculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

UNIT I DIFFERENTIALCALCULUS 12

Representationoffunctions-Limitofafunction-Continuity-Derivatives-Differentiationrules-Maxima and Minima of functions of one variable.

UNIT II FUNCTIONSOFSEVERALVARIABLES 12

Partial differentiation – Homogeneous functions and Euler‗s theorem – Total derivative – Change ofvariables – Jacobians – Partial differentiation of implicit functions – Taylor‗s series for functions of twovariables – Maxima and minima of functions of two variables – Lagrange‗s method of undeterminedmultipliers.

UNIT III INTEGRALCALCULUS 12

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts,Trigonometric integrals, Trigonometric substitutions, Integration of rational functions bypartial fraction,Integration of irrational functions - Improper integrals.

UNIT IV MULTIPLEINTEGRALS 12

Double integrals – Change of order of integration – Double integrals in polar coordinates – Areaenclosedbyplanecurves – Tripleintegrals – Volume ofsolids – Changeof variables indoubleandtripleintegrals.

UNIT V DIFFERENTIALEQUATIONS 12

Higher order linear differential equations with constant coefficients- Method of variation of parameters– Homogenous equation of Euler‗s and Legendre‗s type – System of simultaneous linear differentialequations with constant coefficients - Method of undetermined coefficients.

TOTAL:60PERIODS

OUTCOMES:

Aftercompletingthiscourse, studentsshoulddemonstratecompetencyinthefollowingskills:

- Useboththelimitdefinitionandrulesofdifferentiationtodifferentiatefunctions.
- Applydifferentiationtosolvemaximaandminimaproblems.
- EvaluateintegralsbothbyusingRiemannsumsandbyusingtheFundamentalTheoremof Calculus.
- Apply integration to computemultipleintegrals,area,volume,integralsin polarcoordinates,in addition to change of order and change of variables.
- Evaluateintegralsusingtechniquesofintegration,suchassubstitution,partialfractionsandintegration by parts.
- Determineconvergence/divergenceofimproperintegralsandevaluateconvergent improper integrals.
- Applyvarioustechniquesinsolvingdifferentialequations.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

TEXTBOOKS :

1. GrewalB.S.,―HigherEngineeringMathematics‖,KhannaPublishers,NewDelhi,43rdEdition, 2014.
2. JamesStewart,"Calculus:EarlyTranscendentals",CengageLearning,7thEdition,NewDelhi, 2015. [ForUnitsI& III- Sections1.1, 2.2, 2.3,2.5, 2.7(Tangentsproblemsonly),2.8, 3.1 to 3.6, 3.11, 4.1,4.3,5.1(Areaproblemsonly),5.2,5.3,5.4(excludingnetchangetheorem),5.5,7.1-7.4 and7.8].

REFERENCES:

1. Anton,H,Bivens,IandDavis,S,"Calculus",Wiley,10thEdition, 2016.
2. Jain R.K. and Iyengar S.R.K., ―Advanced Engineering Mathematics‖, Narosa Publications, New Delhi, 3rd Edition, 2007.
3. Narayanan, S. and Manicavachagom Pillai, T. K., ―Calculus" Volume I andII, S. ViswanathanPublishers Pvt. Ltd., Chennai, 2007.
4. SrimanthaPalandBhunia,S.C,"EngineeringMathematics"OxfordUniversityPress, 2015.
5. Weir,M.DandJoelHass,"ThomasCalculus",12thEdition,PearsonIndia,2016.

SEMESTERI

20149S13	**ENGINEERINGPHYSICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

- ToenhancethefundamentalknowledgeinPhysicsanditsapplicationsrelevanttovarious streams of Engineering and Technology.

UNIT I PROPERTIESOFMATTER 9

Elasticity – Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength – torsionalstress anddeformations –twistingcouple-torsionpendulum:theoryandexperiment -bendingof beams - bending moment – cantilever: theory and experiment – uniform and non-uniform bending:theory and experiment - I-shaped girders - stress due to bending in beams.

UNIT II WAVESANDFIBEROPTICS 9

Oscillatorymotion–forcedanddampedoscillations:differentialequationanditssolution– plane progressive waves – wave equation. Lasers : population of energy levels, Einstein's A and Bcoefficients derivation – resonant cavity, optical amplification (qualitative) – Semiconductor lasers:homojunction and heterojunction – Fiber optics: principle, numerical aperture and acceptance angle -types of optical fibres (material, refractive index, mode) – losses associated with optical fibers - fibreoptic sensors: pressure and displacement.

UNIT III THERMALPHYSICS 9

Transfer of heat energy – thermalexpansionof solids andliquids – expansionjoints - bimetallic strips - thermal conduction, convection and radiation – heat conductions in solids – thermal conductivity - Forbe's and Lee's disc method: theory and experiment - conduction through compound media (seriesand parallel) – thermal insulation – applications: heat exchangers, refrigerators, ovens and solar waterheaters.

UNIT V CRYSTALPHYSICS 9

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems,Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordinationnumber and packing factor for SC, BCC, FCC, HCP and diamond structures - crystal imperfections:point defects, line defects – Burger vectors, stacking faults – role of imperfections in plasticdeformation - growth of single crystals: solution and melt growth techniques.

TOTAL: 45 PERIODS

OUTCOMES:

Uponcompletionofthis course,

- Thestudentswillgainknowledgeonthebasicsofpropertiesof matter andits applications,
- Thestudentswillacquireknowledgeontheconceptsofwavesandopticaldevicesandtheir applications in fibre optics,
- The studentswillhave adequate knowledgeontheconceptsofthermalpropertiesofmaterials and their applications in expansion joints and heat exchangers,
- Thestudentswillgetknowledgeonadvancedphysicsconceptsofquantumtheoryandits applications in tunneling microscopes, and
- The students will understand the basics of crystals, their structures and different crystal growthtechniques.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

TEXTBOOKS:

1. Bhattacharya,D.K.&Poonam,T.―EngineeringPhysics‖.OxfordUniversityPress, 2015.
2. Gaur,R.K.&Gupta,S.L.―EngineeringPhysics‖.DhanpatRaiPublishers, 2012.
3. Pandey,B.K.&Chaturvedi,S.―EngineeringPhysics‖.CengageLearningIndia, 2012.

REFERENCES:

1. Halliday,D.,Resnick,R.&Walker,J.―Principles ofPhysics‖.Wiley, 2015.
2. Serway, R.A. & Jewett, J.W. ―Physics for Scientists and Engineers‖. Cengage Learning, 2010.
3. Tipler,P.A.&Mosca,G.―PhysicsforScientistsandEngineerswithModernPhysics'.W.H.Freeman, 2007.

SEMESTERI

20149S14	**ENGINEERINGCHEMISTRY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- Preparation,propertiesandapplicationsofengineeringmaterials.
- Typesoffuels,calorificvaluecalculations,manufactureofsolid,liquidandgaseousfuels.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuelcells.

UNIT II SURFACECHEMISTRYANDCATALYSIS 9

Adsorption: Types of adsorption – adsorption of gases on solids – adsorption of solute from solutions – adsorption isotherms – Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – contacttheory – kinetics of surface reactions, unimolecular reactions, Langmuir - applications of adsorption onpollution abatement. Catalysis: Catalyst – types of catalysis – criteria –autocatalysis – catalytic poisoningandcatalytic promoters -acidbasecatalysis – applications (catalyticconvertor) – enzyme catalysis– Michaelis – Menten equation.

UNIT IV FUELSANDCOMBUSTION 9

Fuels: Introduction - classification of fuels - coal - analysis of coal (proximate and ultimate) - carbonization - manufactureof metallurgical coke(OttoHoffmannmethod) - petroleum - manufactureofsynthetic petrol (Bergius process) - knocking - octane number - diesel oil - cetane number - natural gas -compressed natural gas (CNG) - liquefied petroleum gases (LPG) - power alcohol and biodiesel.Combustion of fuels: Introduction - calorific value - higher and lower calorific values-theoreticalcalculation ofcalorificvalue-ignitiontemperature-spontaneous ignitiontemperature-explosiverange -flue gas analysis (ORSAT Method).

UNIT V ENERGYSOURCESANDSTORAGEDEVICES 9

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission andfusion-nuclear chainreactions - nuclear energy-lightwater nuclear power plant -breeder reactor - solarenergyconversion- solar cells - wind energy. Batteries, fuelcells andsupercapacitors:Types of batteries– primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H_2-O_2fuel cell.

TOTAL:45PERIODS

OUTCOMES:

- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques willfacilitatebetter understandingof engineeringprocesses andapplications for further learning.

SKILL DEVELOPMENT **EMPLOYABILITY** **ENTREPRENEURSHIP**

TEXTBOOKS:

1. S.S.DaraandS. S. Umare, ―ATextbookofEngineeringChemistry‖, S.Chand& CompanyLTD, New Delhi, 2015
2. P. C. Jain and Monika Jain, ―Engineering Chemistry‖ Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015
3. S. Vairam, P. Kalyani andSuba Ramesh, ―EngineeringChemistry‖, WileyIndia PVT, LTD, New Delhi, 2013.

REFERENCES:

1. FriedrichEmich,―EngineeringChemistry‖,ScientificInternationalPVT,LTD,NewDelhi, 2014.
2. PrasantaRath,―EngineeringChemistry‖,CengageLearningIndiaPVT,LTD,Delhi,2015.
3. Shikha Agarwal, ―Engineering Chemistry-Fundamentals and Applications‖, Cambridge University Press, Delhi, 2015.

SEMESTERI

20154S15 **ENGINEERINGGRAPHICS**

L	T	P	C
2	0	4	4

OBJECTIVES:

- Todevelopinstudents,graphicskillsforcommunicationofconcepts,ideasanddesignof Engineering products.
- Toexposethemtoexistingnationalstandardsrelatedtotechnicaldrawings.

CONCEPTSANDCONVENTIONS(NotforExamination) **1**

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANECURVESANDFREEHANDSKETCHING 7+12

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse,parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes ofsquare and circle – Drawing of tangents and normal to the above curves.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of ThreeDimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views ofobjects

UNIT II PROJECTIONOFPOINTS,LINESANDPLANESURFACE 6+12

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection ofplanes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTIONOFSOLIDS 5+12

Projectionofsimple solidslike prisms,pyramids,cylinder,cone and truncated solidswhen the axisisinclined to one of the principal planes by rotating object method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OFSURFACES 5+12

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of theprincipal planes and perpendicular to the other – obtaining true shape of section. Development of lateralsurfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

UNIT V ISOMETRICANDPERSPECTIVEPROJECTIONS 6+12

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids-Prisms,pyramids,cylinders,cones-combinationoftwosolidobjectsinsimple verticalpositions -Perspectiveprojectionofsimplesolids-Prisms,pyramidsandcylindersbyvisualraymethod.

TOTAL:90PERIODS OUTCOMES:

Onsuccessfulcompletionofthiscourse, thestudentwillbeableto:

- Familiarizewiththefundamentalsandstandardsof Engineeringgraphics
- Performfreehandsketchingofbasicgeometricalconstructionsandmultipleviewsof objects.
- Projectorthographicprojectionsoflinesandplanesurfaces.
- Drawprojectionsandsolidsanddevelopmentofsurfaces.
- Visualizeandtoproject isometricandperspectivesectionsofsimplesolids.

TEXTBOOKS:

1. NatrajanK.V.,―AtextbookofEngineeringGraphics‖,DhanalakshmiPublishers,Chennai, 2009.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

2. Venugopal K. and Prabhu Raja V., ―Engineering Graphics‖, New Age International (P) Limited, 2008.

REFERENCES:

1. Bhatt N.D. and Panchal V.M., ―Engineering Drawing‖, Charotar Publishing House, 50th Edition, 2010.
2. Basant Agarwal and Agarwal C.M., ―Engineering Drawing‖, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Gopalakrishna K.R., ―Engineering Drawing‖ (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
4. Luzzader, Warren.J. and Duff,John M., ―Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
5. N S Parthasarathy And Vela Murali, ―Engineering Graphics‖, Oxford University, Press, New Delhi, 2015.
6. ShahM.B.,andRanaB.C.,―EngineeringDrawing‖,Pearson,2ndEdition,2009.

PublicationofBureauofIndianStandards:

- IS 10711– 2001:TechnicalproductsDocumentation–Sizeandlayoutofdrawingsheets.
- IS9609(Parts 0&1)–2001:TechnicalproductsDocumentation– Lettering.
- IS10714(Part 20)–2001&SP46 –2003:Linesfortechnicaldrawings.
- IS11669– 1986&SP46–2003:DimensioningofTechnicalDrawings.
- IS15021(Parts 1to4) –2001:Technicaldrawings–ProjectionMethods.

SEMESTERI

20150S16 PROBLEMSOLVINGANDBASICSOFPYTHONPROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

- Toknowthebasics ofalgorithmicproblemsolving
- ToreadandwritesimplePythonprograms.
- TodevelopPythonprogramswithconditionalsandloops.
- TodefinePythonfunctionsandcall them.
- TousePythondata structures–-lists, tuples,dictionaries.
- Todoinput/outputwithfilesinPython.

UNIT I ALGORITHMICPROBLEMSOLVING 9

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudocode, flow chart, programming language), algorithmic problem solving, simple strategies for developingalgorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list ofsorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA,EXPRESSIONS,STATEMENTS 9

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs:exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROLFLOW,FUNCTIONS 9

Conditionals: Boolean values and operators, conditional (if),alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root,gcd,exponentiation,sumanarrayofnumbers,linearsearch,binarysearch.

UNIT IV LISTS,TUPLES,DICTIONARIES 9

Lists:listoperations,listslices,listmethods,listloop,mutability,aliasing,cloninglists,list parameters;Tuples:tupleassignment,tupleasreturnvalue;Dictionaries:operationsandmethods; advancedlistprocessing-listcomprehension;Illustrativeprograms:selectionsort,insertionsort, mergesort,histogram.

UNIT V FILES,MODULES,PACKAGES 9

Filesandexception:textfiles, readingandwritingfiles, formatoperator;commandlinearguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

TOTAL:45PERIODS

OUTCOMES:

Uponcompletionofthecourse, studentswillbeableto

- Developalgorithmicsolutionstosimplecomputationalproblems
- Read,write, executebyhandsimplePythonprograms.
- StructuresimplePythonprogramsfor solvingproblems.
- DecomposeaPythonprogramintofunctions.
- RepresentcompounddatausingPythonlists,tuples,dictionaries.
- Readandwritedata from/tofilesinPythonPrograms.

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

TEXTBOOKS:

1. AllenB. Downey, ``ThinkPython:HowtoThinkLikea Computer Scientist‘‘, 2nd edition, Updated for Python 3, Shroff/O‘Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)
2. Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

REFERENCES:

1. JohnVGuttag, ―IntroductiontoComputationandProgramming UsingPython‘‘, Revisedand expanded Edition, MIT Press , 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, ―Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. TimothyA. Budd,―ExploringPython‖,Mc-GrawHillEducation(India)PrivateLtd.,,2015.
4. KennethA.Lambert,―FundamentalsofPython:FirstPrograms‖,CENGAGELearning,2012.
5. Charles Dierbach, ―Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, ―Practical Programming: An Introduction toComputer Science using Python 3‖, Second edition, Pragmatic Programmers, LLC, 2013.

SEMESTERI

20150L17 PROBLEMSOLVINGANDBASICSOFPYTHONPROGRAMMINGLAB

L	T	P	C
0	0	4	2

OBJECTIVES

- Towrite, test,anddebugsimplePythonprograms.
- ToimplementPythonprograms withconditionalsandloops.
- UsefunctionsforstructuringPythonprograms.
- RepresentcompounddatausingPythonlists,tuples,dictionaries.
- Readandwritedatafrom/tofilesinPython.

LISTOFPROGRAMS

1. ComputetheGCDoftwo numbers.
2. Findthesquarerootofa number(Newton‘smethod)
3. Exponentiation(power ofa number)
4. Findthemaximumofa listofnumbers
5. Linear searchandBinarysearch
6. Selectionsort,Insertionsort
7. Mergesort
8. Firstnprimenumbers
9. Multiplymatrices
10. Programsthattakecommandlinearguments(wordcount)
11. Findthemostfrequentwordsinatextreadfromafile
12. SimulateellipticalorbitsinPygame
13. SimulatebouncingballusingPygame

PLATFORMNEEDED

- Python3interpreterforWindows/Linux

OUTCOMES

Uponcompletionofthecourse, studentswillbeableto:

- Write,test, anddebugsimplePythonprograms.
- ImplementPythonprogramswithconditionalsandloops.
- DevelopPythonprogramsstep-wisebydefiningfunctionsandcallingthem.
- UsePythonlists,tuples,dictionariesforrepresentingcompounddata.
- Readandwritedatafrom/tofilesinPython.

TOTAL:60PERIODS

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

SEMESTERI

20149L18 PHYSICSANDCHEMISTRYLABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

LISTOFEXPERIMENTS: PHYSICSLABORATORY(Any5Experiments)

1. Determinationofrigiditymodulus–Torsionpendulum
2. DeterminationofYoung's modulusbynon-uniformbendingmethod
   a) Determinationofwavelength,andparticlesizeusingLaser
   b) Determinationofacceptanceangleinanopticalfiber.
3. Determinationofthermalconductivity ofabadconductor–Lee'sDisc method.
4. Determinationofvelocityofsoundandcompressibilityofliquid–Ultrasonicinterferometer
5. Determinationofwavelengthofmercuryspectrum–spectrometergrating
6. Determinationofbandgapofasemiconductor
7. Determinationofthicknessofathinwire–Air wedgemethod

TOTAL:30PERIODS

OUTCOMES:

Uponcompletionofthecourse, thestudentswillbeableto

applyprinciplesofelasticity,opticsandthermalpropertiesforengineeringapplications.

CHEMISTRYLABORATORY:(Anysevenexperimentstobeconducted) OBJECTIVES:

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- Toacquaintthestudentswiththedeterminationofmolecularweightofapolymerby viscometery.

1. EstimationofHClusingNa_2CO_3asprimarystandardandDeterminationofalkalinityinwater sample.
2. Determinationoftotal,temporary&permanenthardnessofwater byEDTAmethod.
3. DeterminationofDOcontentofwater samplebyWinkler'smethod.
4. Determinationofchloridecontentofwatersamplebyargentometric method.
5. EstimationofcoppercontentofthegivensolutionbyIodometry.
6. DeterminationofstrengthofgivenhydrochloricacidusingpHmeter.
7. Determinationofstrengthofacidsina mixtureofacidsusingconductivity meter.
8. Estimationofironcontent ofthegivensolutionusingpotentiometer.
9. Estimation of iron contentof the watersample usingspectrophotometer(1,10-Phenanthroline /thiocyanate method).
10. Estimationofsodiumandpotassiumpresent inwaterusingflamephotometer.
11. DeterminationofmolecularweightofpolyvinylalcoholusingOstwaldviscometer.
12. Pseudofirstorderkinetics-ester hydrolysis.
13. Corrosionexperiment-weightlossmethod.
14. DeterminationofCMC.
15. Phasechangeinasolid.
16. Conductometrictitrationofstrongacidvsstrongbase.

OUTCOMES:

Thestudentswillbeoutfittedwithhands-onknowledgeinthequantitativechemicalanalysisof water quality related parameters.

TOTAL:30PERIODS

TEXTBOOKS:

1. Vogel'sTextbookofQuantitativeChemicalAnalysis(8^{TH}edition, 2014)

SEMESTERI

201AGIT	**INDUCTIONTRAININGPROGRAMME**	**L**	**T**	**P**	**C**
		0	**0**	**0**	**2**

The *InductionProgram*is designed to makethe newlyjoined studentsfeelcomfortable,sensitize them towards exploring theiracademic interests and activities, reducing competition and making them work for excellence, promote bonding within them, build relations between teachers and students, give a broaderview of life, and building of character.

uctionprogram	**3weeksduration**
uctionprogramforstudentstobeoffered right at the start of the first year.	• Physicalactivity • CreativeArts • UniversalHumanValues • Literary • ProficiencyModules • LecturesbyEminentPeople • VisitstolocalAreas • FamiliarizationtoDept./Branch&Innovations

TheactivitiesduringtheInductionProgramwould haveanInitialPhase, aRegularPhase and a Closing Phase. The Initial and Closing Phases would be two days each.

SEMESTERII

20147S21 **TECHNICALENGLISH**

L	T	P	C
4	0	0	4

OBJECTIVES:

TheCoursepreparessecondsemesterengineeringandTechnologystudentsto:

- Developstrategiesandskillstoenhancetheirabilitytoreadandcomprehendengineeringand technology texts.
- Fostertheirabilitytowriteconvincingjobapplications andeffectivereports.
- Developtheir speakingskillstomaketechnicalpresentations,participateingroupdiscussions.
- Strengthen their listening skill which will help themcomprehend lectures and talks in their areas of specialization.

UNIT I INTRODUCTIONTECHNICALENGLISH 12

Listening- Listening to talks mostly of a scientific/technical nature and completing information-gap exercises- **Speaking** –Asking for and giving directions- **Reading** – reading short technical texts from journals-newsapapers-**Writing-**purposestatements–extendeddefinitions–issue-writinginstructions – checklists-recommendations-**Vocabulary Development-** technical vocabulary **LanguageDevelopment** –subject verb agreement - compound words.

UNIT II READINGANDSTUDYSKILLS 12

Listening- Listening to longer technical talks and completing exercises based on them - **Speaking** – describing a process-**Reading** – reading longer technical texts- identifying the various transitions in atext- paragraphing- **Writing-** interpreting cgarts, graphs- **Vocabulary Development-**vocabulary used informal letters/emails and reports **Language Development-** impersonal passive voice, numericaladjectives.

UNIT III TECHNICALWRITINGANDGRAMMAR 12

Listening- Listeningtoclassroomlectures/ talkls onengineering/technology-**Speaking** – introductiontotechnical presentations- **Reading** – longer texts both general and technical, practice in speed reading;**Writing**-Describing a process, use of sequence words- **Vocabulary Development-** sequence words-Misspelled words. **Language Development-** embedded sentences

UNIT IV REPORTWRITING 12

Listening- Listening to documentaries and making notes. **Speaking** – mechanics of presentations- **Reading** –readingfor detailedcomprehension- **Writing-** email etiquette- job application– cover letter – Résumé preparation(via email and hard copy)- analytical essays and issue based essays-- **VocabularyDevelopment-** finding suitable synonyms-paraphrasing-. **Language Development-** clauses- ifconditionals.

UNIT V GROUPDISCUSSIONANDJOBAPPLICATIONS 12

Listening- TED/Ink talks; **Speaking** –participating in a group discussion **-Reading**– reading andunderstanding technical articles **Writing**– Writing reports- minutes of a meeting- accident and survey-**Vocabulary Development- verbal analogies Language Development-** reported speech

TOTAL PERIODS 60

OUTCOMES:

Attheendofthecourselearnerswillbeableto:

- Readtechnicaltexts andwritearea-specifictexts effortlessly.
- Listenandcomprehendlecturesandtalksintheir areaofspecialisationsuccessfully.
- Speakappropriatelyandeffectivelyinvariedformalandinformalcontexts.
- Writereportsandwinningjobapplications.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

TEXTBOOKS:

1. Boardofeditors. **FluencyinEnglishACoursebookforEngineeringandTechnology.** Orient Blackswan, Hyderabad: 2016
2. Sudharshana.N.PandSaveetha.C.**EnglishforTechnicalCommunication**.Cambridge University Press: New Delhi, 2016.

REFERENCES:

1. Raman,MeenakshiandSharma,Sangeetha**-TechnicalCommunicationPrinciples and Practice.**Oxford University Press: New Delhi,2014.
2. Kumar,Suresh.E.**EngineeringEnglish**.OrientBlackswan:Hyderabad,2015
3. Booth-L.Diana**,ProjectWork,**OxfordUniversityPress**,**Oxford:2014.
4. Grussendorf,Marion,**EnglishforPresentations,**OxfordUniversityPress, Oxford:2007
5. Means,L.ThomasandElaineLanglois,**English&CommunicationForColleges.** CengageLearning,USA:2007

AdditionalReading:

StudentscanbeaskedtoreadTagore,ChetanBhagatandforsupplementary reading.

SEMESTER II

20148S22	**ENGINEERINGMATHEMATICSII**	**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**

OBJECTIVES:

This course is designed to cover topics such as MatrixAlgebra, Vector Calculus, Complex Analysis and Laplace Transform. Matrix Algebra is one of the powerful tools to handle practical problems arising in the field of engineering. Vector calculus can be widely used for modelling the various laws of physics. The various methods of complex analysis and Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

UNIT I MATRICES 12

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem– Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II VECTORCALCULUS 12

Gradient and directional derivative – Divergence and curl - Vector identities – Irrotational andSolenoidal vector fields – Lineintegral over a planecurve – Surfaceintegral - Area of a curved surface -Volume integral - Green‘s, Gauss divergence and Stoke‘s theorems – Verification and application inevaluatingline, surfaceand volume integrals.

UNIT III ANALYTICFUNCTIONS 12

Analyticfunctions–NecessaryandsufficientconditionsforanalyticityinCartesianandpolar coordinates-Properties–Harmonicconjugates–Constructionofanalyticfunction–Conformal mapping–Mappingbyfunctions$w = z + c, cz, z^{-1}, z^2$-Bilineartransformation.

UNIT IV COMPLEXINTEGRATION 12

Line integral - Cauchy‘s integral theorem – Cauchy‘s integral formula – Taylor‘s and Laurent‘s series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of realintegrals – Use of circular contour and semicircular contour.

UNIT V LAPLACETRANSFORMS 12

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulsefunction– Basic properties –Shiftingtheorems -Transforms of derivatives andintegrals – Initial and final value theorems – Inverse transforms – Convolution theorem – Transform of periodic functions–Applicationtosolutionoflinear secondorder ordinarydifferential equations with constant coefficients.

TOTAL:60PERIODS

OUTCOMES:

Aftersuccessfullycompletingthecourse,thestudentwillhaveagoodunderstandingofthefollowing topics and their applications:

- Eigenvalues and eigenvectors, diagonalizationofamatrix, Symmetricmatrices, Positivedefinite matrices and similar matrices.
- Gradient,divergenceandcurlofa vector pointfunctionandrelatedidentities.
- Evaluation of line, surface and volume integrals using Gauss, Stokes and Green‘s theorems and their verification.
- Analyticfunctions,conformalmappingandcomplexintegration.
- Laplacetransformandinversetransformofsimplefunctions,properties,variousrelated theorems and application to differential equations with constant coefficients.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

TEXTBOOKS :

1. Grewal B.S., —Higher Engineering Mathematics‖, Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. KreyszigErwin, "AdvancedEngineeringMathematics ", JohnWiley andSons, 10thEdition, New Delhi, 2016.

REFERENCES:

1. BaliN.,GoyalM.andWatkinsC.,—AdvancedEngineeringMathematics‖,FirewallMedia (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
2. JainR.K.andIyengarS.R.K.,—AdvancedEngineeringMathematics‖,Narosa Publications,NewDelhi, 3rdEdition,2007.
3. O'Neil,P.V. —Advanced Engineering Mathematics‖, CengageLearning India Pvt.,Ltd,NewDelhi,2007.
4. Sastry,S.S, —Engineering Mathematics", Vol.I&II, PHILearningPvt. Ltd, 4thEdition,NewDelhi, 2014.
5. Wylie,R.C.andBarrett,L.C.,—AdvancedEngineeringMathematics—TataMcGrawHill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

SEMESTER II

20149S23B PHYSICSFORELECTRONICSENGINEERING

	L	T	P	C
	3	0	0	3

OBJECTIVES:

To understand the essential principles of Physics of semiconductor device and Electron transport properties. Become proficient in magnetic, dielectric and optical properties of materials and nano devices.

UNIT I ELECTRICALPROPERTIESOFMATERIALS 9

Classicalfree electrontheory-Expressionforelectricalconductivity–Thermalconductivity,expression - Wiedemann-Franz law–Success andfailures - electrons in metals –Particleina threedimensional box–degenerate states – Fermi- Dirac statistics – Density of energy states – Electron in periodic potential:Bloch thorem – metals and insulators - Energy bands in solids– tight binding approximation - Electroneffective mass – concept of hole.

UNIT III MAGNETICANDDIELECTRICPROPERTIESOFMATERIALS 9

Magnetism in materials – magnetic field and induction – magnetization - magnetic permeability andsusceptibility–types of magnetic materials – microscopic classification of magnetic materials - Ferromagnetism: origin and exchange interaction- saturation magnetization and Curie temperature – Domain Theory. Dielectric materials: Polarization processes – dielectric loss – internal field – Clausius-Mosotti relation- dielectric breakdown – high-k dielectrics.

UNIT IV OPTICALPROPERTIESOFMATERIALS 9

Classification of optical materials – carrier generation and recombination processes - Absorptionemission and scattering of light in metals, insulators and Semiconductors (concepts only) - photo current in a P- N diode –solarcell –photo detectors- LED – Organic LED– Laser diodes–excitons- quantum confinedStarkeffect–quantumdotlaser.

UNIT V NANOELECTRONICDEVICES 9

Introduction - electron density in bulk material – Size dependence of Fermi energy– quantumconfinement – quantum structures - Density of states in quantum well, quantum wire and quantum dot structures – Zener-Bloch oscillations – resonant tunneling – quantum interference effects – mesoscopic structures: conductance fluctuations and coherent transport –Coulomb blockade effects - Single electron phenomena and Single electron Transistor– magnetic semiconductors– spintronics - Carbon nanotubes: Propertiesandapplications.

TOTAL:45PERIODS

OUTCOMES:

Attheendofthecourse, thestudentswillableto

- Gainknowledgeonclassicalandquantumelectrontheories, andenergybandstructuues,
- Acquireknowledgeonbasicsofsemiconductorphysicsanditsapplicationsinvarious devices,
- Get knowledgeonmagneticanddielectricpropertiesofmaterials,
- Havethenecessaryunderstandingonthefunctioningofopticalmaterialsfor optoelectronics,

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

- Understandthebasicsofquantumstructuresandtheirapplicationsinspintronicsand carbon electronics.

TEXTBOOKS:

1. Kasap, S.O. ―Principlesof Electronic Materialsand Devices‖,McGraw-Hill Education, 2007.
2. UmeshKMishra&JaspritSingh,―SemiconductorDevicePhysicsandDesign‖,Springer, 2008.
3. Wahab, M.A. ―Solid State Physics: Structure and Propertiesof Materials‖.Narosa Publishing House, 2009.

REFERENCES:

1. Garcia, N. &Damask,A.―PhysicsforComputerScience Students‖. SpringerVerlag, 2012.
2. Hanson,G.W.―FundamentalsofNanoelectronics‖.PearsonEducation, 2009
3. Rogers,B.,Adams,J.&Pennathur,S.―Nanotechnology:UnderstandingSmallSystems‖. CRC Press, 2014

SEMESTER II

20153S24B CIRCUITANALYSIS LT PC
4 004

OBJECTIVES:

- TointroducethebasicconceptsofDC andAC circuitsbehavior
- To study the transient and steady state response of the circuits subjected to step and sinusoidal excitations.
- TointroducedifferentmethodsofcircuitanalysisusingNetworktheorems,dualityand topology.

UNIT I BASICCIRCUITSANALYSISANDNETWORKTOPOLOGY 12

Ohm‘s Law – Kirchhoff‘s laws – Mesh current and node voltage method of analysis for D.C and A.C. circuits - Network terminology - Graph of a network - Incidence and reduced incidence matrices– Trees –Cutsets - Fundamental cutsets - Cutset matrix – Tie sets - Link currents and Tie set schedules - Twig voltages and Cutset schedules, Duality and dual networks.

- Network reduction: voltage and current division, source transformation – star delta conversion.

UNITIIIRESONANCEANDCOUPLEDCIRCUITS 12

Resonance- Series resonance- Parallelresonance- Variationof impedancewithfrequency - Variationin current through and voltage across L and C with frequency – Bandwidth - Q factor - Selectivity. Self inductance - Mutual inductance - Dot rule - Coefficient of coupling - Analysis of multiwinding coupled circuits - Series, Parallel connection of coupled inductors - Single tuned anddouble tuned coupled circuits.

UNITIVTRANSIENTANALYSIS 12

Natural response-Forced response - Transient response of RC, RL and RLC circuits to excitation by Step Signal, Impulse Signal and exponential sources - Complete response of RC, RLand RLC Circuits to sinusoidal excitation.

UNIT V TWOPORT NETWORKS 12

Twoportnetworks,Zparameters,Yparameters,Transmission(ABCD)parameters,Hybrid(H) Parameters, Interconnection of two port networks, Symmetrical properties of T and π networks.

TOTAL:60PERIODS

OUTCOMES:

Attheendofthecourse, thestudentshouldbeableto:

- Developthecapacitytoanalyzeelectricalcircuits,applythecircuittheoremsinrealtime
- DesignandunderstandandevaluatetheACandDCcircuits.

TEXTBOOKS:

1. WilliamH.Hayt,Jr. JackE. KemmerlyandStevenM.Durbin,―EngineeringCircuitAnalysis‖ ,McGrawHillScienceEngineering,EighthEdition,11th Reprint 2016.
2. Joseph Edminister and Mahmood Nahvi,―ElectricCircuits‖, Schaum‘sOutline Series, Tata McGraw Hill Publishing Company, New Delhi, Fifth Edition Reprint 2016.

REFERENCES:

1. CharlesK.Alexander,MathewN.O.Sadiku,―FundamentalsofElectricCircuits‖,FifthEdition, McGraw Hill, 9th Reprint 2015.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

2. A.BruceCarlson,―Cicuits:EngineeringConceptsandAnalysisofLinearElectricCircuits‖, Cengage Learning, India Edition 2nd Indian Reprint 2009.
3. AllanH.Robbins,WilhelmC.Miller,―CircuitAnalysisTheoryandPractice‖,Cengage Learning, Fifth Edition, 1st Indian Reprint 2013.

SEMESTERII

20153S25B BASIC ELECTRICAL AND INSTRUMENTATION ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

Toimpartknowledgeon

- OperationofThreephaseelectricalcircuitsandpower measurement
- WorkingprinciplesofElectricalMachines
- WorkingprincipleofVariousmeasuringinstruments

UNIT I ACCIRCUITSANDPOWERSYSTEMS 9

Three phase power supply – Star connection – Delta connection – Balanced and Unbalanced Loads- Power equation – Star Delta Conversion – Three Phase Power Measurement - Transmission & Distribution of electrical energy – Over head Vs Underground system – Protection of power system – types of tariff – power factor improvement

UNIT II TRANSFORMER 9

Introduction - Ideal Transformer – Accounting For Finite Permeability And Core Loss– Circuit Model Of Transformer – Per Unit System – Determination Of Parameters Of Circuit Model Of Transformer – Voltage Regulation – Name Plate Rating – Efficiency – Three Phase Transformers - Auto Transformers

UNITIIIDC MACHINES 9

Introduction – Constructional Features– Motoringandgenerationprinciple - Emf AndTorque equation – Circuit Model – Methods of Excitation and magnetisation characteristics – Starting and Speed Control – Universal Motor

UNITIVACMACHINES 9

Principleof operationofthree-phaseinductionmotors –Construction–Types –Equivalent circuit, Single phase Induction motors -Construction– Types–starting and speed control methods. Alternator- working principle–Equation of induced EMF – Voltage regulation, Synchronous motors-working principle-starting methods -– Torque equation – Stepper Motors – Brushless DC Motors

UNIT V MEASUREMENTANDINSTRUMENTATION 9

Type of Electrical and electronic instruments – Classification- Types of indicating Instruments – Principles of Electrical Instruments –Multimeters, Oscilloscopes- Static and Dynamic Characteristics of Measurement – Errors in Measurement – Transducers - Classification of Transducers: Resistive, Inductive, Capacitive, Thermoelectric, piezoelectric, photoelectric, Hall effect and Mechanical

TOTAL:45PERIODS

OUTCOMES:

Attheendofthecoursethestudentswillbeableto

- Understandtheconceptofthreephasepowercircuitsandmeasurement.
- Comprehendtheconceptsinelectricalgenerators,motorsandtransformers
- Chooseappropriatemeasuringinstrumentsforgivenapplication

TEXTBOOKS:

1. DPKothariandI.JNagarath,―BasicElectricalandElectronicsEngineering‖,McGrawHill Education (India) Private Limited, Third Reprint ,2016
2. GiorgioRizzoni,―PrinciplesandApplicationsofElectricalEngineering‖,McGrawHill Education (India) Private Limited, 2010
3. S.K.Bhattacharya―BasicElectricalandElectronicsEngineering‖,PearsonIndia, 2011

REFERENCES:

1. DelToro,‖ElectricalEngineeringFundamentals‖,PearsonEducation,NewDelhi,2015.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

2. LeonardSBobrow,—FoundationsofElectricalEngineering‖,OxfordUniversityPress,2013
3. RajendraPrasad,‖FundamentalsofElectricalengineering‖,PrenticeHallofIndia,2006.
4. MittleN.,—BasicElectricalEngineering‖,TataMcGrawHillEdition,24th reprint2016
5. A.E.Fitzgerald,DavidEHigginbothamandArvinGrabel,—BasicElectricalEngineering‖, McGraw Hill Education (India) Private Limited, 2009.

SEMESTERII

20152S26B ELECTRONICDEVICES LTPC
3003

OBJECTIVES:

Toacquaint thestudents withthe construction, theoryandoperationofthebasic electronic devices suchasPNjunctiondiode, Bipolar andFieldeffectTransistors, Power controldevices, LED, LCDand other Opto-electronic devices

UNIT I SEMICONDUCTORDIODE 9

PN junction diode, Current equations, Energy Band diagram, Diffusion and drift current densities, forward and reverse bias characteristics, Transition and Diffusion Capacitances, Switching Characteristics, Breakdown in PN Junction Diodes.

UNIT II BIPOLARJUNCTIONTRANSISTORS 9

NPN -PNP -Operations-Early effect-Current equations – Input and Output characteristics of CE, CB, CC - Hybrid -π model - h-parameter model, Ebers Moll Model- Gummel Poon-model, Multi Emitter Transistor.

UNIT III FIELDEFFECTTRANSISTORS 9

JFETs – Drain and Transfer characteristics,-Current equations-Pinch off voltage and its significance-MOSFET-Characteristics- Threshold voltage -Channel length modulation, D-MOSFET, E-MOSFET-Characteristics – Comparison of MOSFET with JFET.

UNITIVSPECIALSEMICONDUCTOR DEVICES 9

Metal-Semiconductor Junction- MESFET, FINFET, PINFET, CNTFET, DUAL GATE MOSFET, Schottky barrier diode-Zener diode-Varactor diode –Tunnel diode- Gallium Arsenide device, LASER diode, LDR.

UNIT V POWERDEVICESANDDISPLAYDEVICES 9

UJT, SCR, Diac, Triac, Power BJT- Power MOSFET- DMOS-VMOS. LED, LCD, Photo transistor,Opto Coupler, Solar cell, CCD.

TOTAL:45PERIODS

OUTCOMES:

Attheendofthecoursethestudentswillbeableto:

- ExplaintheV-Icharacteristicofdiode,UJTandSCR
- Describetheequivalencecircuitsoftransistors
- Operate the basic electronic devices such as PN junction diode, Bipolar and Field effect Transistors, Power control devices, LED, LCD and other Opto-electronicdevices

TEXTBOOKS:

1. DonaldANeaman,―Semiconductor PhysicsandDevices‖,FourthEdition,TataMcGrawHill Inc.2012.
2. Salivahanan.S,SureshKumar.N,Vallavaraj.A,―ElectronicDevicesandcircuits‖,ThirdEdition, Tata McGraw- Hill, 2008.

REFERENCES:

1. RobertBoylestadandLouisNashelsky,―ElectronDevicesandCircuitTheory‖Pearson PrenticeHall, 10th edition, July 2008.
2. R.S.Sedha,―ATextBookofAppliedElectronics‖S.ChandPublications, 2006.
3. Yang,―FundamentalsofSemiconductordevices‖,McGrawHillInternationalEdition,1978.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

SEMESTERII

20154L27 ENGINEERINGPRACTICESLABORATORY LTPC
0042

OBJECTIVES:

Toprovideexposuretothestudentswithhandsonexperienceonvariousbasicengineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUPA (CIVIL &MECHANICAL)

I CIVILENGINEERINGPRACTICE 13

Buildings:

Studyofplumbingandcarpentrycomponentsofresidentialandindustrialbuildings.Safetyaspects.

PlumbingWorks:

1. Study of pipeline joints, its location and functions: valves, taps,couplings, unions, reducers,elbows in household fittings.
2. Studyofpipeconnectionsrequirementsfor pumpsandturbines.
3. Preparationofplumbinglinesketchesfor watersupplyandsewageworks.
4. Hands-on-exercise:
   Basicpipeconnections–Mixedpipematerialconnection–Pipeconnectionswith different joining components.
5. Demonstrationofplumbingrequirementsofhigh-risebuildings.

CarpentryusingPowerToolsonly:

1. Studyofthejointsinroofs,doors,windowsandfurniture.
2. Hands-on-exercise:
   Woodwork,jointsbysawing,planingandcutting.

II MECHANICALENGINEERINGPRACTICE 18

Welding:

(a) Preparationofbuttjoints,lapjointsandT-jointsbyShieldedmetalarcwelding.
(b) Gasweldingpractice

BasicMachining:

SimpleTurningandTaperturning
Drilling Practice

SheetMetalWork:

Forming&Bending:
Modelmaking–Traysandfunnels.
Different type of joints.

Machineassemblypractice:

Studyofcentrifugalpump
Study of air conditioner

Demonstrationon:

Smithyoperations,upsetting,swaging,settingdownandbending.Example– Exercise – Production of hexagonal headed bolt.
Foundryoperationslikemouldpreparationfor gear andstepconepulley.
Fitting–Exercises –PreparationofsquarefittingandV–fittingmodels.

GROUPB(ELECTRICAL&ELECTRONICS)

III ELECTRICALENGINEERINGPRACTICE 13

Residentialhousewiringusingswitches, fuse, indicator, lampandenergy meter.
Fluorescent lamp wiring.
Stair casewiring
Measurementofelectricalquantities–voltage,current,power&powerfactorinRLCcircuit.
Measurementofenergyusingsinglephaseenergy meter.
Measurementofresistanceto earthofanelectricalequipment.

IV ELECTRONICSENGINEERINGPRACTICE 16

StudyofElectroniccomponentsandequipments–Resistor,colourcodingmeasurementofAC signal parameter (peak-peak, rms period, frequency) using CR.
StudyoflogicgatesAND,OR,EX-ORandNOT.
GenerationofClockSignal.
Solderingpractice–ComponentsDevicesandCircuits–UsinggeneralpurposePCB.
MeasurementofripplefactorofHWRandFWR.

TOTAL:60 PERIODS

OUTCOMES:
Onsuccessfulcompletionofthiscourse, thestudentwillbeableto

- Fabricatecarpentrycomponentsandpipeconnectionsincludingplumbingworks.
- Useweldingequipmentstojointhestructures.
- Carryoutthebasicmachining operations
- Makethemodelsusingsheetmetalworks
- Illustrateoncentrifugalpump,Airconditioner,operationsofsmithy,foundaryand fittings
- Carryoutbasichome electricalworksandappliances
- Measuretheelectricalquantities
- Elaborateonthecomponents, gates,solderingpractices.

SEMESTER II

20152L28B CIRCUITSANDDEVICESLABORATORY LTPC
0042

OBJECTIVES:

- Tolearnthecharacteristicsofbasicelectronic devicessuchasDiode,BJT,FET, SCR
- TounderstandtheworkingofRL,RCandRLCcircuits
- To gain hand on experience in Thevinin & Norton theorem, KVL & KCL, and Super Position Theorems

1. CharacteristicsofPNJunctionDiode
2. ZenerdiodeCharacteristics&RegulatorusingZenerdiode
3. CommonEmitterinput-outputCharacteristics
4. CommonBaseinput-outputCharacteristics
5. FETCharacteristics
6. SCRCharacteristics
7. ClipperandClamper&FWR
8. VerificationsOfThevinin&Nortontheorem
9. VerificationsOfKVL&KCL
10. VerificationsOfSuperPositionTheorem
11. verificationsofmaximumpowertransfer&reciprocitytheorem
12. DeterminationOfResonanceFrequencyofSeries&ParallelRLC Circuits
13. TransientanalysisofRLandRCcircuits

TOTAL:60PERIODS

OUTCOMES:
Attheendofthecourse,thestudentshouldbeableto:

- Analyzethecharacteristicsofbasicelectronicdevices
- DesignRL andRCcircuits
- VerifyThevinin&NortontheoremKVL&KCL,andSuperPositionTheorems

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

SEMESTER II

201AGIC **INDIAN CONSTITUTION** **LTPC**
0002

Aim:

- Tounderstandthesalient featuresoftheIndianConstitution

Objectives:

- Tomakethestudentsunderstandabout theDemocraticRuleandParliamentarianAdministration.
- ToappreciatethesalientfeaturesoftheIndianConstitution.
- ToknowthefundamentalRightsandConstitutionalRemedies.
- To make familiar with powers and positions of the Union Executive, Union Parliament and the Supreme Court.
- ToexercisetheadultfranchiseofvotingandappreciatetheElectoralsystemofIndian Democracy.

Outcomes

- DemocraticvaluesandcitizenshipTrainingaregained.
- AwarenessonFundamentalRightsareestablished.
- ThefunctionsofunionGovernmentandStateGovernmentsarelearnt.
- ThepowerandfunctionsoftheJudiciarylearnt thoroughly.
- AppreciationofDemocraticParliamentaryRuleislearnt.

UNIT I:TheMakingOfIndianconstitution

TheConstituent AssemblyOrganizationCharacter –Work–Salientfeaturesoftheconstitution–Written and Detailed Constitution – Socialism – Secularism – Democracy and Republic.

UNITII:FundamentalRightsAndFundamentalDutiesOfTheCitizens

Right of Equality – Right of Freedom – Right against Exploitation – Right to Freedom ofReligion – Cultural and Educational Rights – Right to Constitutional Remedies – FundamentalDuties.

UNITIII:DirectivePrinciplesOfStatePolicy

Socialism Principles–GandhianPrinciples–LiberalandGeneralPrinciples–Differencesbetween Fundamental Rights and Directive principles.

UNITIV:TheUnionExecutive,UnionparliamentAndSupremeCourt

Powers and positions of the President – Qualification Method of Election of President and vicepresident – Prime Minister Rajya Sabha- Lok Sabha – The Supreme Court – High Court – Functions and position of Supreme court and High Court.

UNITV:StateCouncil–ElectionSystemAndPartliamentaryDemocracyInIndia

State council of Ministers – Chief Minister – Election system in India- Main features – ElectionCommission - Features of Indian Democracy.

References:

1. PalekarS.A.IndianConstitutionGovernmentandpolitics,ABDPublications, India.
2. AiyerAlladi,Krishnaswami,Constitutionandfundamentalrights1955.
3. MarkandanK.C.DirectivePrinciplesintheIndianConstitution1966.
4. KashyapSubashCOurParliament,NationalBook,TrustNewDelhi 1989.

SEMESTER III

20148S31B LINEARALGEBRAANDPARTIALDIFFERENTIALEQUATIONS

L	T	P	C
4	0	0	4

OBJECTIVES:

- To introduce the basicnotionsofgroups,rings,fieldswhich will then be used to solve related problems.
- Tounderstandtheconceptsofvectorspace,lineartransformationsanddiagonalization.
- Toapplytheconceptofinnerproductspacesinorthogonalization.
- Tounderstandtheproceduretosolvepartialdifferentialequations.
- To give an integrated approach to number theory and abstract algebra, and provide a firm basis for further reading and study in the subject.

UNIT I VECTORSPACES 12

Vector spaces – Subspaces – Linear combinations and linear systemof equations – Linear independenceand linear dependence – Bases and dimensions.

UNIT II LINEARTRANSFORMATIONANDDIAGONALIZATION 12

Linear transformation - Null spaces and ranges - Dimension theorem - Matrix representation of a lineartransformations - Eigenvalues and eigenvectors - Diagonalizability.

UNIT III INNERPRODUCTSPACES 12

Innerproduct,norms- Gram Schmidtorthogonalization process-Adjointoflinearoperations- Leastsquare approximation.

UNIT IV PARTIALDIFFERENTIALEQUATIONS 12

Formation–Solutions of first order equations –Standardtypes and equations reducible tostandardtypes– Singular solutions – Lagrange‘s linear equation – Integral surface passing through a given curve – Classificationof partialdifferential equations - Solutionof linear equations of higher order withconstantcoefficients – Linear non-homogeneous partial differential equations.

UNIT V FOURIERSERIESSOLUTIONSOFPARTIALDIFFERENTIALEQUATIONS 12

Dirichlet‘s conditions – GeneralFourier series – Halfrangesineandcosineseries - Methodofseparationof variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steadystate solution of two-dimensional heat equation – Fourier series solutions in Cartesian coordinates.

TOTAL:60PERIODS

OUTCOMES:

Uponsuccessfulcompletionofthecourse,studentsshouldbe ableto:

- Explainthefundamentalconceptsofadvancedalgebraandtheirroleinmodern mathematics and applied contexts.
- Demonstrateaccurateandefficientuseofadvancedalgebraictechniques.
- Demonstratetheirmasterybysolvingnon-trivialproblemsrelatedtotheconceptsandby proving simple theorems about the statements proven by the text.
- Able to solve various types of partial differential equations.
  Able to solve engineering problems using Fourier series.

TEXTBOOKS:

1. Grewal B.S., ―Higher Engineering Mathematics‖, Khanna Publishers, New Delhi, 43rd Edition, 2014.

2. Friedberg,A.H.,Insel,A.J.andSpence,L.,―LinearAlgebra‖,PrenticeHallofIndia,New Delhi, 2004.

REFERENCES:

1. Burden,R.L.andFaires,J.D,"NumericalAnalysis",9th Edition,CengageLearning,2016.
2. James,G.―AdvancedModernEngineeringMathematics‖,PearsonEducation,2007.
3. Kolman,B.Hill,D.R.,―IntroductoryLinearAlgebra‖,PearsonEducation,NewDelhi,First Reprint, 2009.
4. Kumaresan,S.,―LinearAlgebra–AGeometricApproach‖,Prentice–HallofIndia,New Delhi, Reprint, 2010.
5. Lay,D.C.,―LinearAlgebraanditsApplications‖,5th Edition,PearsonEducation,2015.
6. O'Neil,P.V.,―AdvancedEngineeringMathematics‖,CengageLearning,2007.
7. Strang,G.,―Linear Algebraanditsapplications‖,Thomson(Brooks/Cole),NewDelhi, 2005.
8. Sundarapandian,V.―NumericalLinearAlgebra‖,PrenticeHallofIndia,NewDelhi,2008.

SEMESTER III

20152S32 CONTROLSYSTEMSENGINEERING LTPC 3003

OBJECTIVES:

- Tointroducethecomponentsandtheirrepresentationofcontrolsystems
- To learn various methods for analyzing the time response, frequency response and stability ofthe systems.
- Tolearnthevariousapproachforthestatevariableanalysis.

UNIT I SYSTEMSCOMPONENTSANDTHEIRREPRESENTATION 9

Control System: Terminology and Basic Structure-Feed forward and Feedback control theory-Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models-DC and AC servo Systems-Synchronous -Multivariable control system

UNIT II TIMERESPONSEANALYSIS 9

Transient response-steady stateresponse-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and system- type number-PID control-Analytical design for PD, PI,PID control systems

UNIT III FREQUENCYRESPONSEANDSYSTEMANALYSIS 9

Closed loop frequency response-Performance specification in frequency domain-Frequency response of standard second order system- Bode Plot - Polar Plot- Nyquist plots-Design of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation

UNIT IV CONCEPTSOFSTABILITYANALYSIS 9

Conceptofstability-Bounded-InputBounded-Outputstability-Routhstabilitycriterion-Relativestability-Root locus concept-Guidelines for sketching root locus-Nyquist stability criterion.

UNIT V CONTROLSYSTEMANALYSISUSINGSTATEVARIABLEMETHODS 9

State variable representation-Conversion of state variable models to transfer functions-Conversion oftransfer functions to state variable models-Solution of state equations-Concepts of Controllability andObservability-Stability of linear systems-Equivalence between transfer function and state variablerepresentations-State variable analysis of digital control system-Digital control design using statefeedback.

TOTAL:45PERIODS

OUTCOMES:

Uponcompletionofthecourse,thestudentshouldbeableto:

- Identifythevariouscontrolsystemcomponentsandtheirrepresentations.
- Analyzethevarioustimedomainparameters.
- Analysisthevariousfrequencyresponseplotsandits system.
- Applytheconceptsofvarioussystemstabilitycriterions.
- Designvarioustransfer functionsof digitalcontrolsystemusingstatevariablemodels.

TEXTBOOK:

1. M.Gopal,―ControlSystem–PrinciplesandDesign‖,TataMcGrawHill,4thEdition,2012.

REFERENCES:

1. J.NagrathandM.Gopal,―ControlSystem Engineering‖,NewAge InternationalPublishers, 5th Edition, 2007.
2. K.Ogata,‘ModernControlEngineering’,5thedition,PHI,2012.

3. S.K.Bhattacharya,ControlSystemEngineering,3rdEdition,Pearson,2013.
4. Benjamin.C.Kuo,―Automaticcontrolsystems‖,PrenticeHallofIndia,7thEdition,1995.

SEMESTER III

20152S33 FUNDAMENTALSOFDATASTRUCTURESINC

LTPC 3 003

OBJECTIVES:

- TolearnthefeaturesofC
- Tolearnthelinearandnon-lineardatastructures
- Toexploretheapplicationsoflinearandnon-lineardatastructures
- Tolearntorepresent datausinggraphdatastructure
- Tolearnthebasicsortingandsearchingalgorithms

UNIT I CPROGRAMMINGBASICS 9

Structure of a C program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in C – Managing Input and Output operations – Decision Making andBranching – Looping statements. Arrays – Initialization – Declaration – One dimensional and Two-dimensional arrays. Strings- String operations – String Arrays. Simple programs- sorting-searching – matrix operations.

UNIT II FUNCTIONS,POINTERS,STRUCTURESANDUNIONS 9

Functions – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic. Structures and unions - definition – Structure within a structure - Union - Programsusing structures and Unions – Storage classes, Pre-processor directives.

UNIT III LINEARDATASTRUCTURES 9

Arrays and its representations – Stacks and Queues – Linked lists – Linked list-based implementation ofStacks and Queues – Evaluation of Expressions – Linked list based polynomial addition.

UNIT IV NON-LINEARDATASTRUCTURES 9

Trees – Binary Trees – Binary tree representation and traversals –Binary Search Trees – Applications of trees. Set representations - Union-Find operations. Graph and its representations – Graph Traversals.

UNIT V SEARCHINGANDSORTING ALGORITHMS 9

LinearSearch–BinarySearch.BubbleSort,Insertionsort–Mergesort–Quicksort-Hashtables–Overflow handling.

TOTAL:45PERIODS

OUTCOMES:

Uponcompletionofthecourse, studentswillbeableto:

- Implementlinearandnon-lineardatastructureoperationsusingC
- Suggestappropriatelinear /non-linear datastructureforanygivendata set.
- Applyhashingconceptsfor a givenproblem
- Modifyorsuggestnewdatastructurefor anapplication
- Appropriatelychoosethesortingalgorithmforanapplication

TEXTBOOKS:

1. Pradip Dey and Manas Ghosh, ―Programming in C, Second Edition, Oxford University Press, 2011.
2. EllisHorowitz,Sartaj Sahni,Susan Anderson-Freed, ―Fundamentalsof Data Structuresin C, Second Edition, University Press, 2008.

REFERENCES:

1. MarkAllenWeiss,―DataStructuresandAlgorithmAnalysisinC,SecondEdition,Pearson Education, 1996
2. AlfredV.Aho,JohnE.HopcroftandJeffreyD.Ullman,―DataStructuresandAlgorithms, Pearson Education, 1983.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

3. RobertKruse,C.L.Tondo,BruceLeung,ShashiMogalla,―DataStructuresandProgram Design in C, Second Edition, Pearson Education, 2007
4. Jean-PaulTremblayandPaulG.Sorenson,―AnIntroductiontoDataStructureswith Applications, Second Edition, Tata McGraw-Hill, 1991.

SEMESTER III

20152C34 **DIGITALELECTRONICS** **L T P C**
3 00 3

OBJECTIVES:

- TopresenttheDigitalfundamentals, Booleanalgebraanditsapplicationsindigitalsystems
- Tofamiliarizewiththedesignofvariouscombinationaldigitalcircuitsusinglogicgates
- Tointroducetheanalysisanddesignproceduresforsynchronousandasynchronous sequential circuits
- Toexplainthevarioussemiconductor memoriesandrelatedtechnology
- Tointroducetheelectroniccircuitsinvolvedinthemakingoflogicgates

UNITI DIGITALFUNDAMENTALS 9
Number Systems – Decimal, Binary, Octal, Hexadecimal, 1_s and 2_s complements, Codes – Binary,BCD, Excess 3, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum ofproducts and product of sums, Minterms and Maxterms, Karnaugh map Minimization and Quine-McCluskey method of minimization.

UNIT II COMBINATIONALCIRCUITDESIGN 9
Design of Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder – Carry look aheadAdder, BCD Adder, Multiplexer, Demultiplexer, Magnitude Comparator, Decoder, Encoder, PriorityEncoder.

UNIT III SYNCHRONOUSSEQUENTIALCIRCUITS 9
Flip flops – SR, JK, T, D, Master/Slave FF – operation and excitation tables, Triggering of FF, Analysisand design of clocked sequential circuits – Design - Moore/Mealy models, state minimization, stateassignment, circuit implementation – Design of Counters- Ripple Counters, Ring Counters, Shiftregisters, Universal Shift Register.

UNIT IV ASYNCHRONOUSSEQUENTIALCIRCUITS 9
Stableand Unstablestates, output specifications, cycles andraces, statereduction, racefreeassignments,Hazards, Essential Hazards, Pulse mode sequential circuits, Design of Hazard free circuits.

UNITVMEMORY DEVICESANDDIGITALINTEGRATEDCIRCUITS 9
Basic memorystructure– ROM -PROM – EPROM–EEPROM –EAPROM, RAM – StaticanddynamicRAM - Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic(PAL) – Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuitsusing PLA, PAL.

Digital integrated circuits: Logic levels, propagation delay, power dissipation, fan-out and fan-in, noisemargin, logic families and their characteristics-RTL, TTL, ECL, CMOS

TOTAL:45 PERIODS

OUTCOMES:
Attheendofthecourse:

- Usedigitalelectronicsinthepresentcontemporaryworld
- Designvariouscombinationaldigitalcircuitsusinglogicgates
- Dotheanalysisanddesignproceduresfor synchronousandasynchronoussequentialcircuits
- Usethesemiconductormemoriesandrelatedtechnology
- Useelectroniccircuitsinvolvedinthedesignoflogicgates

TEXTBOOK:

1.M.MorrisManoandMichaelD.Ciletti,―DigitalDesign‖, 5thEdition,Pearson, 2014.

SKILL DEVELOPMENT **EMPLOYABILITY** **ENTREPRENEURSHIP**

REFERENCES:

1. CharlesH.Roth.―FundamentalsofLogicDesign‖,6thEdition,ThomsonLearning,2013.
2. ThomasL.Floyd,―DigitalFundamentals‖,10thEdition,PearsonEducationInc,2011
3. S.Salivahanan and S.Arivazhagan―Digital Electronics‖, Ist Edition, VikasPublishing House pvt Ltd, 2012.
4. AnilK.Maini―DigitalElectronics‖,Wiley,2014.
5. A.AnandKumar―FundamentalsofDigitalCircuits‖,4thEdition,PHILearningPrivate Limited, 2016.
6. SoumitraKumarMandal―DigitalElectronics‖,McGrawHillEducationPrivateLimited, 2016.

SEMESTERIII

20152C35 SIGNALSANDSYSTEMS **L T PC**
4 00 4

OBJECTIVES:

- Tounderstandthebasicpropertiesofsignal&systems
- ToknowthemethodsofcharacterizationofLTIsystemsintimedomain
- ToanalyzecontinuoustimesignalsandsystemintheFourierandLaplacedomain
- Toanalyzediscretetimesignals andsystemintheFourierandZtransformdomain

UNIT I CLASSIFICATIONOFSIGNALSANDSYSTEMS 12

Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids_Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodicsignals, Deterministic & Random signals, Energy & Power signals - Classification of systems-CTsystems and DT systems- – Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal,Stable & Unstable.

UNIT III LINEARTIMEINVARIANTCONTINUOUSTIMESYSTEMS 12

Impulseresponse-convolutionintegrals-DifferentialEquation-FourierandLaplacetransformsinAnalysis of CT systems - Systems connected in series / parallel.

UNIT IV ANALYSISOFDISCRETETIMESIGNALS 12

Baseband signal Sampling –FourierTransform of discrete time signals(DTFT)– Propertiesof DTFT-Z Transform & Properties

UNIT V LINEARTIMEINVARIANT-DISCRETETIMESYSTEMS 12

Impulseresponse– Difference equations-Convolution sum- DiscreteFourier TransformandZ TransformAnalysis of Recursive & Non-Recursive systems-DT systems connected in series and parallel.

TOTAL:60PERIODS

OUTCOMES:

Attheendofthecourse, thestudentshouldbeableto:

- Tobeableto determineifagivensystemislinear/causal/stable
- Capableofdeterminingthefrequencycomponentspresentina deterministicsignal
- CapableofcharacterizingLTIsystemsinthetime domainandfrequency domain
- TobeabletocomputetheoutputofanLTIsysteminthetimeandfrequencydomains

TEXTBOOK:

1. AllanV.Oppenheim,S.WilskyandS.H.Nawab,―SignalsandSystems‖,Pearson,2015. (Unit 1-V)

REFERENCES

1. B.P.Lathi,―PrinciplesofLinearSystemsandSignals‖,SecondEdition,Oxford,2009.
2. R.E.Zeimer, W.H.Tranter and R.D.Fannin, ―Signals & Systems - Continuous and Discrete‖, Pearson, 2007.
3. JohnAlanStuller,―AnIntroductiontoSignalsandSystems‖,Thomson,2007.

SEMESTERIII

20152C36 **ELECTRONICCIRCUITS-I** **LTPC**
3003

OBJECTIVES:

- Tounderstandthemethodsofbiasingtransistors
- Todesignandanalyzesinglestageand multistageamplifiercircuits
- Toanalyzethefrequencyresponseofsmallsignalamplifiers
- TodesignandanalyzetheregulatedDC powersupplies.
- Totroubleshootandfaultanalysisofpower supplies.

UNIT IBIASINGOFDISCRETEBJT,JFETAND MOSFET 9

BJT– Need for biasing - DC Load Line and Bias Point – DC analysis of Transistor circuits - Various biasing methods of BJT – Bias Circuit Design - Thermal stability - Stability factors - Bias compensation techniquesusingDiode, thermistor andsensistor –BiasingBJT SwitchingCircuits-JFET -DCLoadLine and Bias Point - Various biasing methods of JFET - JFET Bias Circuit Design - MOSFET Biasing - Biasing FET Switching Circuits.

UNIT II BJTAMPLIFIERS 9

Small Signal Hybrid π equivalent circuit of BJT– Early effect - Analysis of CE, CC and CB amplifiers usingHybridπequivalentcircuits-ACLoadLineAnalysis-DarlingtonAmplifier-Bootstraptechnique -Cascade,Cascodeconfigurations-Differentialamplifier,BasicBJTdifferentialpair–Smallsignal analysis and CMRR.

UNIT III SINGLESTAGEFET,MOSFETAMPLIFIERS 9

Small Signal Hybrid π equivalent circuit of FET and MOSFET - Analysis of CS, CD and CG amplifiersusing Hybrid π equivalent circuits - Basic FET differential pair- BiCMOS circuits.

UNIT IV FREQUENCYRESPONSEOFAMPLIFIERS 9

Amplifier frequencyresponse– Frequencyresponseof transistor amplifiers withcircuit capacitors – BJTfrequency response – short circuit current gain - cut off frequency – fα, fβ and unity gain bandwidth –Miller effect - frequency response of FET - High frequency analysis of CE and MOSFET CSamplifier - Transistor Switching Times.

UNIT V POWERSUPPLIESANDELECTRONICDEVICETESTING 9

Linear mode power supply - Rectifiers - Filters - Half-Wave Rectifier Power Supply - Full-Wave Rectifier Power Supply - Voltage regulators: Voltage regulation - Linear series, shunt and switching Voltage Regulators - Over voltage protection - BJT and MOSFET – Switched mode power supply (SMPS)-PowerSupplyPerformanceandTesting-TroubleshootingandFaultAnalysis,Designof RegulatedDCPower Supply.

TOTAL: 45 PERIODS

OUTCOMES:

Afterstudyingthiscourse,thestudentshouldbeable to:

- Acquireknowledgeof
  - Workingprinciples,characteristicsandapplicationsofBJTandFET
  - FrequencyresponsecharacteristicsofBJTandFETamplifiers
- AnalyzetheperformanceofsmallsignalBJTandFETamplifiers-singlestageandmulti stage amplifiers
- ApplytheknowledgegainedinthedesignofElectroniccircuits

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

TEXTBOOKS:

1. Donald.A.Neamen,ElectronicCircuitsAnalysisandDesign,3rdEdition,McGrawHill Education (India) Private Ltd., 2010. (Unit I-IV)
2. RobertL.BoylestadandLouisNasheresky,―ElectronicDevicesandCircuitTheory‖,11th Edition,PearsonEducation,2013.(UnitV)

REFERENCES

1. Millman J,Halkias.C.and SathyabradaJit,ElectronicDevicesandCircuits,4th Edition,Mc Graw Hill Education (India) Private Ltd., 2015.
2. Salivahanan and N. Suresh Kumar, Electronic Devices and Circuits,4th Edition,, Mc GrawHill Education (India) Private Ltd., 2017.
3. Floyd,ElectronicDevices,NinthEdition,PearsonEducation,2012.
4. DavidA.Bell,ElectronicDevices&Circuits,5thEdition,OxfordUniversityPress,2008.
5. AnwarA. KhanandKanchanK.Dey, AFirstCourseonElectronics,PHI,2006.
6. RashidM,MicroelectronicsCircuits,ThomsonLearning,2007.

SEMESTERIII

20152L37 FUNDAMENTALSOFDATASTRUCTURESINCLABORATORY

LTPC
0042

OBJECTIVES:

- TounderstandandimplementbasicdatastructuresusingC
- Toapplylinear andnon-lineardatastructuresinproblemsolving.
- Tolearntoimplement functionsandrecursivefunctionsbymeansofdatastructures
- Toimplementsearchingandsortingalgorithms

LISTOFEXERCISES

1. BasicCPrograms–looping,datamanipulations, arrays
2. Programsusingstrings–stringfunction implementation
3. Programsusingstructuresandpointers
4. Programsinvolvingdynamicmemoryallocations
5. Arrayimplementationofstacksandqueues
6. Linkedlistimplementationofstacksandqueues
7. ApplicationofStacksandQueues
8. ImplementationofTrees,TreeTraversals
9. ImplementationofBinarySearchtrees
10. ImplementationofLinearsearchandbinarysearch
11. ImplementationInsertionsort,Bubblesort, QuicksortandMergeSort
12. ImplementationHashfunctions,collisionresolutiontechnique

TOTAL:60PERIODS

OUTCOMES:
Uponcompletionofthecourse,thestudentswillbeableto:

- WritebasicandadvancedprogramsinC
- ImplementfunctionsandrecursivefunctionsinC
- ImplementdatastructuresusingC
- Chooseappropriatesortingalgorithmfor anapplicationandimplementitinamodularizedway

SEMESTERIII

20152L38 ANALOGANDDIGITALCIRCUITSLABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

Thestudentshouldbe made to:

- StudytheFrequencyresponseof CE,CBandCCAmplifier
- LearnthefrequencyresponseofCSAmplifiers
- StudytheTransfercharacteristicsofdifferentialamplifier
- Performexperimenttoobtainthebandwidthofsinglestageandmultistageamplifiers
- PerformSPICEsimulationofElectronicCircuits
- DesignandimplementtheCombinationalandsequentiallogiccircuits

LISTOFANALOGEXPERIMENTS:

1. DesignofRegulatedPowersupplies
2. FrequencyResponseofCE,CB,CCandCSamplifiers
3. DarlingtonAmplifier
4. DifferentialAmplifiers-Transfercharacteristics,CMRRMeasurement
5. CascodeandCascadeamplifiers
6. Determinationofbandwidthofsinglestageandmultistageamplifiers
7. AnalysisofBJTwithFixedbiasandVoltagedivider biasusingSpice
8. AnalysisofFET,MOSFETwithfixedbias,self-biasandvoltagedividerbiasusingsimulation software like Spice
9. AnalysisofCascodeandCascadeamplifiersusing Spice
10. AnalysisofFrequencyResponseofBJTandFETusingSpice

LISTOFDIGITALEXPERIMENTS

1. Design and implementation of code converters using logic gates(i) BCD to excess-3 code and vice versa (ii) Binary to gray and vice-versa
2. Design and implementation of 4 bit binary Adder/ Subtractor and BCD adder usingIC 7483
3. DesignandimplementationofMultiplexerandDe-multiplexerusinglogicgates
4. Designandimplementationofencoderanddecoderusinglogicgates
5. Constructionandverificationof4bit ripple counter andMod-10/ Mod-12Ripple counters
6. Designandimplementationof3-bitsynchronousup/downcounter

TOTAL:60 PERIODS

OUTCOMES:

Oncompletionofthislaboratorycourse,thestudentshouldbeableto:

- DesignandTestrectifiers,filtersandregulatedpower supplies.
- DesignandTestBJT/JFETamplifiers.
- Differentiatecascodeandcascadeamplifiers.
- Analyzethelimitationinbandwidthofsinglestageand multistageamplifier
- MeasureCMRRindifferentialamplifier
- Simulateandanalyzeamplifier circuitsusingPSpice.
- DesignandTest thedigitallogiccircuits.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

SEMESTERIII

20152L39 INTERPERSONALSKILLS/LISTENING&SPEAKING

L	T	P	C
0	0	2	1

OBJECTIVES:

TheCoursewillenablelearnersto:

- EquipstudentswiththeEnglishlanguageskillsrequiredforthesuccessfulundertakingof academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage inspecific academic speaking activities.
- improvegeneralandacademiclisteningskills
- Makeeffectivepresentations.

UNIT I

Listeningasakeyskill-itsimportance-speaking-givepersonalinformation-askforpersonalinformation - express ability - enquire about ability - ask for clarification Improving pronunciation pronunciationbasics taking lecturenotes -preparingtolistentoa lecture-articulatea completeideaas opposed to producing fragmented utterances.

UNIT II

Listen to a process information- give information, as part of a simple explanation - conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrastinformationandideasfrommultiplesources-conversewithreasonableaccuracyoverawide rangeofeverydaytopics.

UNIT III

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk- greet- respondtogreetings-describe healthandsymptoms-inviteandoffer-accept-decline-takeleave-listenforandfollowthegist-listenfordetail

UNIT IV

Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizingacademicreadingsandlecturesconversationalspeechlisteningtoandparticipatingin conversations-persuade.

UNIT V

Formalandinformaltalk-listentofollowandrespondtoexplanations,directionsandinstructionsin academicandbusinesscontexts-strategiesforpresentationsandinteractivecommunication -group/pair presentations-negotiatedisagreementingroupwork.

TOTAL :30PERIODS

OUTCOMES:

AttheendofthecourseLearnerswillbeableto:

- Listenandrespondappropriately.
- Participateingroupdiscussions
- Makeeffectivepresentations
- Participateconfidentlyandappropriatelyinconversationsbothformalandinformal

TEXTBOOKS:

1. Brooks,Margret.SkillsforSuccess.ListeningandSpeaking.Level4OxfordUniversityPress, Oxford: 2011.
2. Richards,C.Jack.&DavidBholke.SpeakNowLevel3.OxfordUniversityPress,Oxford:2010

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUERSHIP

REFERENCES

1. Bhatnagar,NitinandMamtaBhatnagar.CommunicativeEnglishforEngineersandProfessionals. Pearson: New Delhi, 2010.
2. Hughes, Glyn and Josephine Moate. Practical English Classroom. Oxford University Press: Oxford, 2014.
3. Vargo,Mari.SpeakNowLevel4.OxfordUniversityPress:Oxford, 2013.
4. RichardsC.Jack.PersontoPerson(Starter).OxfordUniversityPress:Oxford, 2006.
5. Ladousse,GillianPorter.RolePlay.OxfordUniversityPress:Oxford,2014

SEMESTER III

201AGGS INTRODUCTIONTOGENDERSTUDIES

L	T	P	C
0	0	0	2

UNIT I CONCEPTS

Sex vs. Gender, masculinity, femininity, socialization, patriarchy, public/ private, essentialism,binaryism, power, hegemony, hierarchy, stereotype, gender roles, gender relation, deconstruction,resistance, sexual division of labour.

UNIT II FEMINISTTHEORY

Liberal,Marxist,Socialist,Radical,Psychoanalytic,postmodernist,eco-feminist.

UNIT III WOMEN'SMOVEMENTS:GLOBAL,NATIONALANDLOCAL

RiseofFeminisminEuropeandAmerica.Women's

Movement in India.

UNIT IV GENDERANDLANGUAGE

LinguisticFormsandGender.

Gender andnarratives.

UNIT V GENDERANDREPRESENTATION

Advertisingandpopularvisualmedia.

GenderandRepresentationinAlternativeMedia.

Gender andsocialmedia.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

SEMESTER IV

20148S41B PROBABILITYANDRANDOMPROCESSES

L	T	P	C
4	0	0	4

OBJECTIVES:

- To provide necessary basic concepts in probability and random processes for applications suchas random signals, linear systems in communication engineering.
- To understand the basic concepts of probability, one and two dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.
- Tounderstandthebasicconcepts ofrandomprocesseswhicharewidelyusedinITfields.
- Tounderstandtheconceptofcorrelationandspectraldensities.
- Tounderstandthesignificanceof linear systemswithrandominputs.

UNIT I PROBABILITYANDRANDOMVARIABLES 12

Probability – Axioms of probability – Conditional probability – Baye‘s theorem - Discrete andcontinuous random variables – Moments – Moment generating functions – Binomial, Poisson,Geometric, Uniform, Exponential and Normal distributions.

UNIT II TWO-DIMENSIONALRANDOMVARIABLES 12

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linearregression–Transformationofrandomvariables–Centrallimittheorem(for independentandidenticallydistributed random variables).

UNIT III RANDOMPROCESSES 12

Classification–Stationaryprocess–Markovprocess-Markovchain-Poissonprocess–Randomtelegraph process.

UNITIV CORRELATIONANDSPECTRALDENSITIES 12

Auto correlation functions– Crosscorrelation functions– Properties– Powerspectral density –Crossspectral density – Properties.

UNIT V LINEARSYSTEMS WITHRANDOMINPUTS 12

Lineartimeinvariantsystem–Systemtransferfunction–Linearsystemswithrandominputs–Autocorrelation and cross correlation functions of input and output.

TOTAL : 60 PERIODS

OUTCOMES:

Uponsuccessfulcompletionofthecourse,studentsshouldbe ableto:

- Understandthefundamentalknowledgeoftheconceptsofprobabilityandhaveknowledgeof standard distributions which can describe real life phenomenon.
- Understandthebasicconceptsofoneandtwodimensionalrandomvariablesandapplyin engineering applications.
- Applytheconceptrandomprocessesinengineering disciplines.
- Understandandapplytheconceptofcorrelationandspectraldensities.
- The students will have an exposure of various distribution functions and help in acquiring skills in handling situations involving more than one variable. Able to analyze the response of random inputs to linear time invariant systems.

TEXTBOOKS:

1. Ibe,O.C.,"FundamentalsofAppliedProbabilityandRandom Processes",1st IndianReprint, Elsevier, 2007.

SKILL DEVELOPMENT **EMPLOYABILITY** **ENTREPRENEURSHIP**

2. Peebles,P.Z., "Probability,Random Variablesand Random Signal Principles",Tata McGraw Hill, 4th Edition, New Delhi, 2002.

REFERENCES:

1. Cooper. G.R., McGillem. C.D., "Probabilistic Methods of Signal and System Analysis", Oxford University Press, New Delhi, 3rd Indian Edition, 2012.
2. Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes ", Tata McGraw Hill Edition, New Delhi, 2004.
3. Miller.S.L.andChilders.D.G.,―ProbabilityandRandomProcesseswithApplicationsto Signal Processing and Communications ", Academic Press, 2004.
4. Stark.H.and Woods.J.W., ― Probability and Random Processeswith Applications to Signal Processing ", Pearson Education, Asia, 3rd Edition, 2002.
5. Yates. R.D. and Goodman. D.J., ―Probability and Stochastic Processes", Wiley India Pvt. Ltd., Bangalore, 2nd Edition, 2012.

SEMESTER IV

20152C42 ELECTRONICCIRCUITSII

L	T	P	C
3	0	0	3

OBJECTIVES:

- To give a comprehensive exposure to all types of amplifiers and oscillators constructed with discrete components. This helps to develop a strong basis for building linear and digital integrated circuits
- Tostudyaboutfeedbackamplifiersandoscillators principles
- Todesignoscillators.
- Tostudyabout turnedamplifier.
- TounderstandtheanalysisanddesignofLCandRCoscillators,amplifiers,multivibrators, power amplifiers and DC convertors.

UNIT I FEEDBACKAMPLIFIERSANDSTABILITY 9

Feedback Concepts – gain with feedback – effect of feedback on gain stability, distortion,bandwidth, input and output impedances; topologies of feedback amplifiers – analysis of series -series, shunt-shunt and shunt-series feedback amplifiers-stability problem- Gain and Phase-margins-Frequency compensation.

UNIT II OSCILLATORS 9

Barkhausen criterion for oscillation – phase shift, Wien bridge - Hartley & Colpitt‘s oscillators – Clapposcillator-Ring oscillators and crystal oscillators – oscillator amplitude stabilization.

UNIT III TUNEDAMPLIFIERS 9

Coil losses, unloaded and loaded Q of tank circuits, small signal tuned amplifiers– Analysis ofcapacitor coupled singletuned amplifier —doubletuned amplifier - effect of cascading singletuned anddouble tuned amplifiers on bandwidth – Stagger tuned amplifiers - Stability of tuned amplifiers –Neutralization - Hazeltine neutralization method.

UNIT IV WAVESHAPINGANDMULTIVIBRATORCIRCUITS 9

Pulse circuits – attenuators – RC integrator and differentiator circuits– diode clampers and clippers – Multivibrators - Schmitt Trigger- UJT Oscillator.

UNIT V POWERAMPLIFIERSANDDCCONVERTERS 9

Power amplifiers- class A-Class B-Class AB-Class C-Power MOSFET-Temperature Effect- Class ABPower amplifier using MOSFET –DC/DC convertors – Buck, Boost, Buck-Boost analysis and design

TOTAL: 45 PERIODS

OUTCOMES:

Uponcompletionofthecourse, thestudentshouldbeableto:

- Analyzedifferenttypesofamplifier,oscillatorandmultivibratorcircuits
- DesignBJTamplifierandoscillator circuits
- Analyzetransistorizedamplifierandoscillator circuits
- Designandanalyzefeedbackamplifiers
- DesignLCandRCoscillators,tunedamplifiers,waveshapingcircuits,multivibrators,power amplifier and DC convertors.

TEXTBOOKS:

1. SedraandSmith,―MicroElectronicCircuits‖;SixthEdition,OxfordUniversityPress,2011. (UNIT I, III,IV,V)
2. JacobMillman,‗Microelectronics‘,McGrawHill,2ndEdition,Reprinted,2009.(UNIT I,II,IV,V)

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

REFERENCES:

1. RobertL.BoylestadandLouisNasheresky,―ElectronicDevicesandCircuitTheory‖,10th Edition, Pearson Education / PHI, 2008
2. DavidA.Bell,―ElectronicDevicesandCircuits‖,FifthEdition,OxfordUniversityPress, 2008.
3. MillmanJ.andTaubH.,―PulseDigitalandSwitchingWaveforms‖, TMH,2000.
4. MillmanandHalkias.C.,IntegratedElectronics,TMH,2007.

SEMESTER IV

20152C43 COMMUNICATIONTHEORY LTPC
3003

OBJECTIVES:

- Tointroducetheconceptsof variousanalogmodulationsandtheirspectralcharacteristics
- Tounderstandthepropertiesofrandomprocess
- Toknowtheeffect ofnoiseoncommunicationsystems
- Tostudythelimitsset byInformationTheory

UNIT I AMPLITUDEMODULATION 9

Amplitude Modulation- DSBSC, DSBFC, SSB, VSB - Modulation index, Spectra, Power relations andBandwidth– AM Generation– SquarelawandSwitching modulator, DSBSC Generation – BalancedandRing Modulator, SSB Generation – Filter, Phase Shift and Third Methods, VSB Generation – FilterMethod, Hilbert Transform, Pre-envelope& complex envelope–comparison ofdifferent AM techniques,Superheterodyne Receiver

UNIT II ANGLEMODULATION 9

Phase and frequency modulation, Narrow Band and Wide band FM – Modulation index, Spectra, Powerrelations and Transmission Bandwidth - FM modulation –Direct and Indirect methods, FMDemodulation – FM to AM conversion, FM Discriminator - PLL as FM Demodulator.

UNIT III RANDOMPROCESS 9

Random variables, Random Process, Stationary Processes, Mean, Correlation & Covariance functions,Power Spectral Density, Ergodic Processes, Gaussian Process, Transmission of a Random ProcessThrough a LTI filter.

TOTAL: 45 PERIODS

OUTCOMES:

Attheendofthecourse,thestudentshouldbeableto:

- DesignAMcommunicationsystems
- DesignAnglemodulatedcommunicationsystems
- ApplytheconceptsofRandomProcesstothedesignofCommunicationsystems
- AnalyzethenoiseperformanceofAM andFM systems
- Gainknowledgeinsamplingandquantization

TEXTBOOKS:

1. J.G.Proakis,M.Salehi,―FundamentalsofCommunicationSystems‖,PearsonEducation2014. (UNIT I-IV)
2. SimonHaykin,―CommunicationSystems‖,4thEdition,Wiley,2014.(UNITI-V)

REFERENCES:

1. B.P.Lathi,―ModernDigitalandAnalogCommunicationSystems‖,3rdEdition,Oxford University Press, 2007.

2. D.Roody,J.Coolen,―ElectronicCommunications,4theditionPHI2006
3. A.Papoulis,―Probability,RandomvariablesandStochasticProcesses‖,McGrawHill,3rd edition,1991.
4. B.Sklar,―DigitalCommunicationsFundamentalsandApplications‖,2ndEditionPearsonEducation 2007
5. HPHsu,SchaumOutlineSeries-―AnalogandDigitalCommunications‖ TMH2006
6. Couch.L.,"ModernCommunicationSystems",Pearson,2001.

SEMESTER IV

20152C44 ELECTROMAGNETICFIELDS LTPC
4004

OBJECTIVES:

- To gain conceptual and basic mathematical understanding of electric and magnetic fields in free space and in materials
- Tounderstandthecouplingbetweenelectricandmagneticfieldsthroughfaraday'slaw, displacement current and Maxwell's equations
- Tounderstandwavepropagationinlossless andinlossy media
- Tobeabletosolveproblemsbasedontheaboveconcepts

UNIT I INTRODUCTION 12
Electromagnetic model, Units and constants, Review of vector algebra, Rectangular, cylindrical andspherical coordinate systems, Line, surface and volume integrals, Gradient of a scalar field, Divergenceofa vector field, Divergencetheorem,Curlofa vector field,Stoke'stheorem,Nullidentities, Helmholtz'stheorem

UNIT III MAGNETOSTATICS 12
Lorentz force equation, Law of no magnetic monopoles, Ampere's law, Vector magnetic potential, Biot-Savart lawand applications, Magnetic field intensity and idea of relativepermeability, Magnetic circuits,Behaviour of magnetic materials, Boundary conditions, Inductance and inductors, Magnetic energy,Magnetic forces and torques

UNIT IV TIME-VARYINGFIELDSANDMAXWELL'sEQUATIONS 12
Faraday'slaw,DisplacementcurrentandMaxwell-Amperelaw,Maxwell's equations,Potentialfunctions,Electromagnetic boundary conditions, Wave equations and solutions, Time-harmonic fields

UNIT V PLANEELECTROMAGNETICWAVES 12
Plane waves in lossless media, Plane waves in lossy media (low-loss dielectrics and good conductors),Group velocity, Electromagnetic power flow and Poynting vector, Normal incidence at a planeconducting boundary, Normal incidence at a plane dielectric boundary

TOTAL:60PERIODS

OUTCOMES:
Bytheendofthiscourse,thestudentshouldbe ableto:

- Displayanunderstandingoffundamentalelectromagneticlawsandconcepts
- WriteMaxwell'sequationsinintegral,differentialandphasorformsandexplaintheirphysical meaning
- Explainelectromagneticwavepropagationinlossyandinlosslessmedia
- Solve simple problems requiring estimation of electric and magnetic field quantities based on these concepts and laws

TEXTBOOKS:

1. D.K.Cheng,Fieldandwaveelectromagnetics,2nded.,Pearson(India),1989(UNITI,II,III IV,V)

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

2. W.H.HaytandJ.A.Buck,Engineeringelectrmagnetics,7thed.,McGraw-Hill(India),2006 (UNIT I-V)

REFERENCES

1. D.J.Griffiths, Introductiontoelectrodynamics,4thed.,Pearson(India), 2013
2. B.M.Notaros,Electromagnetics,Pearson:NewJersey, 2011
3. M.N.O.SadikuandS.V.Kulkarni,Principlesofelectromagnetics,6thed.,Oxford(AsianEdition), 2015

SEMESTER IV

20152C45 LINEARINTEGRATEDCIRCUITS **LT PC**
30 03

OBJECTIVES:

- Tointroducethebasicbuildingblocksof linear integratedcircuits
- Tolearnthelinear andnon-linearapplicationsofoperationalamplifiers
- Tointroducethetheoryandapplicationsofanalogmultipliersand PLL
- TolearnthetheoryofADC andDAC
- Tointroducetheconceptsofwaveformgenerationandintroducesomespecialfunction ICs

UNIT I BASICSOFOPERATIONAL AMPLIFIERS 9

Current mirror and current sources, Current sources as active loads, Voltage sources, VoltageReferences, BJT Differential amplifier with active loads, Basic information about op-amps – IdealOperational Amplifier - General operational amplifierstages -and internal circuit diagrams of IC 741,DC and AC performance characteristics, slew rate, Open and closed loop configurations – JFETOperational Amplifiers – LF155 and TL082.

UNIT II APPLICATIONSOFOPERATIONALAMPLIFIERS 9

Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters,adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier,Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper andclamper, Low-pass, high-pass and band-pass Butterworth filters.

UNIT III ANALOGMULTIPLIERAND PLL 9

Analog Multiplier using Emitter Coupled Transistor Pair - Gilbert Multiplier cell – Variabletransconductance technique, analog multiplier ICs and their applications, Operation of the basic PLL,Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, application of PLL for AMdetection, FM detection, FSK modulation and demodulation and Frequency synthesizing and clocksynchronisation.

UNITIVANALOGTODIGITALANDDIGITALTOANALOGCONVERTERS9

Analog and Digital Data Conversions, D/A converter – specifications - weighted resistor type, R-2RLadder type, Voltage Mode and Current-Mode *R - 2R* Ladder types - switches for D/A converters, highspeed sample-and-hold circuits, A/D Converters – specifications - Flash type - SuccessiveApproximation type - Single Slope type – Dual Slope type - A/D Converter using Voltage-to-TimeConversion - Over-sampling A/D Converters, Sigma – Delta converters.

UNIT V WAVEFORMGENERATORSANDSPECIALFUNCTIONICS 9

Sine-wave generators, Multivibrators and Triangular wave generator, Saw-tooth wave generator,ICL8038 function generator, Timer IC 555, IC Voltage regulators – Three terminal fixed and adjustablevoltage regulators - IC 723 general purpose regulator - Monolithic switching regulator, Low Drop –Out(LDO) Regulators - Switched capacitor filter IC MF10, Frequency to Voltage and Voltage toFrequency converters, Audio Power amplifier, Video Amplifier, Isolation Amplifier, Opto-couplers andfibre optic IC.

TOTAL:45PERIODS

OUTCOMES:

Uponcompletionofthecourse, thestudentshouldbeableto:

- Designlinearandnonlinear applicationsofOP–AMPS
- DesignapplicationsusinganalogmultiplierandPLL
- DesignADC andDAC usingOP–AMPS
- GeneratewaveformsusingOP–AMPCircuits
- AnalyzespecialfunctionICs

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

TEXTBOOKS:

1. D.RoyChoudhry,ShailJain,—LinearIntegratedCircuits‖,NewAgeInternationalPvt.Ltd., 2018, Fifth Edition. (Unit I – V)
2. SergioFranco,—DesignwithOperationalAmplifiersandAnalogIntegratedCircuits‖, 4th Edition, Tata Mc Graw-Hill, 2016 (Unit I – V)

REFERENCES:

1. RamakantA.Gayakwad,—OP-AMPandLinearICs‖,4thEdition,PrenticeHall/Pearson Education, 2015.
2. RobertF.Coughlin,FrederickF.Driscoll,—OperationalAmplifiersandLinearIntegrated Circuits‖, Sixth Edition, PHI, 2001.
3. B.S.Sonde,—SystemdesignusingIntegratedCircuits‖, 2ndEdition, NewAgePub, 2001.
4. Gray and Meyer, —Analysis and Design of Analog Integrated Circuits‖, Wiley International,5th Edition, 2009.
5. WilliamD.Stanley,—OperationalAmplifierswithLinearIntegratedCircuits‖,PearsonEducation,4th Edition,2001.
6. S.Salivahanan & V.S. Kanchana Bhaskaran, —Linear Integrated Circuits‖, TMH,2nd Edition, 4th Reprint, 2016.

SEMESTER IV

20149S46 ENVIRONMENTALSCIENCEANDENGINEERING LTPC
3003

OBJECTIVES:

- Tostudythenatureandfactsaboutenvironment.
- Tofindingandimplementingscientific,technological,economicandpoliticalsolutionstoenvironmental problems.
- Tostudytheinterrelationshipbetweenlivingorganismand environment.
- To appreciatethe importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- Tostudythedynamicprocessesandunderstandthefeaturesoftheearth‟sinteriorandsurface.
- To study the integrated themes and biodiversity,natural resources,pollution control and wastemanagement.

UNIT I ENVIRONMENT,ECOSYSTEMSANDBIODIVERSITY 14

Definition, scope and importance of environment– need for public awareness - concept of an ecosystem– structure and function of an ecosystem – producers, consumers and decomposers – energy flow in theecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction,types,characteristicfeatures,structureandfunctionofthe(a)forestecosystem(b)grasslandecosystem

(c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographicalclassification of India – value of biodiversity: consumptive use, productive use, social, ethical, aestheticand option values – Biodiversity at global, national and local levels – India as a mega-diversity nation –hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlifeconflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situconservation of biodiversity. Field study of common plants, insects, birds; Field study of simpleecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTALPOLLUTION 8

:) Soil

UNIT III NATURALRESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, damsand their effects on forests and tribal people – Water resources: Use and over- utilization of surface andground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources:Use and exploitation, environmental effects of extracting and using mineral resources, case studies–Food resources: World food problems, changes caused by agricultureand overgrazing, effects of modernagriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources:Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources.casestudies – Landresources: Landasa resource, land degradation, man inducedlandslides, soil erosionand desertification – role of an individual in conservation of natural resources – Equitable use ofresources for sustainable lifestyles. Field study of local area to document environmental assets – river /forest / grassland / hill / mountain.

UNIT IV SOCIALISSUES ANDTHEENVIRONMENT 7

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SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidentsand holocaust, case studies. – wasteland reclamation – consumerism and waste products – environmentproduction act – Air (Prevention and Control of Pollution) act – Water (Prevention and control ofPollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved inenvironmental legislation- central and state pollution control boards- Public awareness.

TOTAL:45PERIODS

OUTCOMES:

- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Publicawarenessofenvironmentalisatinfantstage.
- Ignoranceandincompleteknowledgehasleadto misconceptions
- Developmentandimprovementinstd.oflivinghasleadtoseriousenvironmental disasters

TEXTBOOKS:

1. BennyJoseph,‗EnvironmentalScience andEngineering',TataMcGraw-Hill,NewDelhi, 2006.
2. GilbertM.Masters,‗IntroductiontoEnvironmentalEngineeringandScience',2nd edition, Pearson Education, 2004.

REFERENCES:

1. DharmendraS.Sengar,‗Environmentallaw',PrenticehallofIndiaPVTLTD,NewDelhi,2007.
2. ErachBharucha,―TextbookofEnvironmentalStudies‖,UniversitiesPress(I)PVT,LTD,Hydrabad, 2015.
3. Rajagopalan,R,‗EnvironmentalStudies-FromCrisistoCure',OxfordUniversityPress, 2005.
4. G.TylerMillerandScottE.Spoolman,―EnvironmentalScience‖,CengageLearningIndia PVT, LTD, Delhi, 2014.

SEMESTER IV

20152L47 CIRCUITSDESIGNANDSIMULATIONLABORATORY LT P C
00 4 2

OBJECTIVES:

- Togainhandsonexperienceindesigningelectroniccircuits
- Tolearnsimulationsoftwareusedincircuitdesign
- Tolearnthefundamentalprinciplesofamplifier circuits
- Todifferentiatefeedbackamplifiersandoscillators.
- Todifferentiatetheoperationof variousmultivibrators

DESIGNANDANALYSISOFTHEFOLLOWINGCIRCUITS

1. SeriesandShuntfeedbackamplifiers-Frequencyresponse,Inputandoutputimpedance
2. RCPhaseshiftoscillatorandWienBridgeOscillator
3. HartleyOscillatorandColpittsOscillator
4. SingleTunedAmplifier
5. RCIntegratorandDifferentiatorcircuits
6. AstableandMonostable multivibrators
7. ClippersandClampers

SIMULATIONUSINGSPICE(UsingTransistor):

1. TunedCollector Oscillator
2. Twin-TOscillator/WeinBridgeOscillator
3. DoubleandStaggertunedAmplifiers
4. BistableMultivibrator
5. SchmittTriggercircuitwithPredictablehysteresis
6. Analysisofpoweramplifier

TOTAL: 60 PERIODS

OUTCOMES:

Oncompletionofthislaboratorycourse,thestudentshouldbeableto:

- Analyzevarioustypes offeedbackamplifiers
- Designoscillators,tunedamplifiers,wave-shapingcircuitsandmultivibrators
- Designandsimulatefeedbackamplifiers, oscillators, tunedamplifiers, wave-shapingcircuits and multivibrators using SPICE Tool.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

SEMESTER IV

20152L48	**LINEARINTEGRATEDCIRCUITSLABORATORY**	**L**	**T**	**P**	**C**
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OBJECTIVES:

- Tounderstandthebasicsoflinear integratedcircuitsandavailableICs
- Tounderstandthecharacteristicsoftheoperationalamplifier.
- Toapplyoperationalamplifiersinlinearandnonlinearapplications.
- ToacquirethebasicknowledgeofspecialfunctionIC.
- TouseSPICEsoftwareforcircuitdesign

DESIGNANDTESTINGOFTHEFOLLOWINGCIRCUITS

1. Inverting,Noninvertinganddifferentialamplifiers.
2. IntegratorandDifferentiator.
3. Instrumentationamplifier
4. Activelow-pass,High-passandband-pass filters.
5. Astable&MonostablemultivibratorsusingOp-amp
6. SchmittTriggerusingop-amp.
7. PhaseshiftandWienbridgeoscillatorsusingOp-amp.
8. AstableandMonostablemultivibratorsusingNE555Timer.
9. PLLcharacteristicsanditsuseasFrequencyMultiplier,Clocksynchronization
10. R-2RLadderTypeD-AConverter usingOp-amp.
11. DCpowersupplyusingLM317andLM723.
12. Studyof SMPS

SIMULATIONUSINGSPICE:

1. Activelow-pass,High-passandband-passfiltersusingOp-amp
2. AstableandMonostablemultivibratorsusingNE555Timer.
3. A/Dconverter
4. Analogmultiplier

TOTAL: 60 PERIODS

OUTCOMES:

Oncompletionofthislaboratorycourse,thestudentshouldbeableto:

- Designamplifiers,oscillators,D-Aconvertersusingoperationalamplifiers.
- Designfiltersusingop-ampandperformsanexperimentonfrequencyresponse.
- AnalyzetheworkingofPLLanddescribeitsapplicationasafrequencymultiplier.
- DesignDCpower supplyusingICs.
- Analyzetheperformanceoffilters,multivibrators,A/DconverterandanalogmultiplierusingSPICE.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

SEMESTER IV

201AGCE **COMMUNITYENGAGEMENT**

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OBJECTIVES:

- Todevelopanappreciationofruralculture,life-styleandwisdomamongst students
- Tolearnaboutthestatusofvariousagriculturalandruraldevelopmentprogrammes
- Tounderstandcausesforruraldistressandpovertyandexploresolutionsforthesame
- To applyclassroomknowledgeofcoursestofieldrealitiesandtherebyimprovequalityof learning

LEARNINGOUTCOMES:
Aftercompletingthiscourse,studentwillbeable to:

- Gainanunderstandingofrurallife,cultureandsocialrealities
- Developasenseofempathyandbondsofmutualitywithlocalcommunity
- AppreciatesignificantcontributionsoflocalcommunitiestoIndiansocietyand economy
- Learntovaluethelocalknowledgeandwisdomofthecommunity
- Identifyopportunities for contributing to community's socio-economic improvements

Credit

2 credit,30hours,atleast50%infield,compulsoryfor allstudents

Contents

DividedintoofourModules, fieldimmersionispartofeachUnit
CourseStructure:2CreditsCourse(1CreditforClassroomandTutorialsand1CreditforField Engagement)

S.No.	ModuleTitle	ModuleContent	Assignment	ching/Learning Methodology	No.of Classes
1	**Appreciationof Rural Society**	Rural lifestyle,rural society,casteandgender relations, rural values with respect tocommunity, nature and resources, elaboration of"soul of India lies in villages' (Gandhi), rural infrastructure	Prepare a map (physical, visual or digital) of the villageyouvisited andwriteanessay aboutinter-family relations in that village.	- Classroom discussions - Fieldvisit** - Assignment Map	2 4 2

2	***Understanding ruraleconomy&livelihood***	Agriculture, farming, landownership, water management, animal husbandry, non-farm livelihoods and artisans, ruralentrepreneurs,rural markets	Describe your analysisofruralhousehol d economy,its llengesandpossible pathwaysto address them	- Fieldvisit** -Group discussionsin class - Assignment	3 4 1
3	***RuralInstitutions***	Traditional rural organisations,Self-help Groups, Panchayatiraj institutions (Gram Sabha, Gram Panchayat,Standing Committees), localcivil society, local administration	Howeffectively are Panchayati raj institutions functioninginthe village?What wouldyousuggest toimprovetheiref fectiveness? Present a case study(writtenor audio-visual)	-Classroom -Fieldvisit** -Group presentationof assignment	2 4 2
4	***RuralDevelopment Programmes***	Hi story of rural development India,currentnational programmes:Sarva Shiksha Abhiyan, ti Bachao, Beti Padhao, ıshmanBharat, Swatchh Bharat, PM AwaasYojana,Skill India, Gram Panchayat DecentralisedPlanning, NRLM,MNREGA, etc.	scribethebenefits received and challenges ≥dinthedeliveryof one of these programmes inthe rural c o m m u n i t y ; give suggestions about improving implementationof the programmefor therural poor.	-Classroom - Eachstudent selects one program for field visit** - Written assignment	2 4 2

SEMESTERV

20152C51 DIGITALCOMMUNICATION LTPC
3003

OBJECTIVES:

- Toknowtheprinciples ofsampling&quantization
- Tostudythevarious waveformcodingschemes
- Tolearnthevariousbasebandtransmissionschemes
- Tounderstandthevarious bandpasssignalingschemes
- Toknowthefundamentalsofchannelcoding

UNIT I INFORMATIONTHEORY 9
Discrete Memoryless source, Information, Entropy, Mutual Information - Discrete Memoryless channels– Binary Symmetric Channel, Channel Capacity - Hartley - Shannon law - Source coding theorem -Shannon - Fano & Huffman codes.

UNIT II WAVEFORMCODING&REPRESENTATION 9
PredictionfilteringandDPCM-DeltaModulation-ADPCM&ADMprinciples-LinearPredictiveCoding-Propertiesof Linecodes- PowerSpectralDensityofUnipolar /Polar RZ&NRZ–BipolarNRZ -Manchester

UNIT III BASEBANDTRANSMISSION&RECEPTION 9
ISI – Nyquist criterionfor distortionless transmission – Pulseshaping – Correlative coding - Eyepattern–Receiving Filters- Matched Filter, Correlation receiver, Adaptive Equalization

UNIT V ERRORCONTROLCODING 9
Channel coding theorem - Linear Block codes - Hamming codes - Cyclic codes - Convolutional codes - Viterbi Decoder.

TOTAL:45PERIODS

OUTCOMES:
Uponcompletionofthecourse, thestudentshouldbeableto

- DesignPCMsystems
- Designandimplementbasebandtransmissionschemes
- Designandimplementbandpasssignalingschemes
- Analyzethespectralcharacteristicsofbandpasssignalingschemesandtheirnoiseperformance
- Designerrorcontrolcodingschemes

TEXTBOOK:

1. S.Haykin,―DigitalCommunications‖,JohnWiley,2005(UnitI–V)

REFERENCES

1. B.Sklar,―DigitalCommunicationFundamentalsandApplications‖,2ndEdition,Pearson Education, 2009
2. B.P.Lathi, ―ModernDigital and AnalogCommunicationSystems‖ 3rdEdition, Oxford University Press 2007.
3. HPHsu,SchaumOutlineSeries-―AnalogandDigitalCommunications‖,TMH2006
4. J.GProakis,―DigitalCommunication‖,4thEdition,TataMcGrawHillCompany,2001.

SEMESTERV

20152C52 DISCRETE-TIMESIGNALPROCESSING LTPC
4004

OBJECTIVES:

- Tolearndiscretefourier transform,propertiesofDFTanditsapplicationtolinearfiltering
- To understand the characteristics of digital filters, design digital IIR and FIR filters and applythese filters to filter undesirable signals in various frequency bands
- Tounderstandtheeffects offiniteprecisionrepresentationondigitalfilters
- Tounderstandthefundamentalconceptsofmultiratesignalprocessinganditsapplications
- Tointroducetheconceptsofadaptivefiltersanditsapplicationtocommunication engineering

UNIT I DISCRETEFOURIERTRANSFORM 12

Review of signals and systems, concept of frequency in discrete-time signals, summary of analysis & synthesis equations for FT & DTFT, frequency domain sampling, Discrete Fourier transform (DFT) - deriving DFT from DTFT, properties of DFT - periodicity, symmetry, circular convolution. Linear filtering using DFT. Filtering long data sequences - overlap save and overlap add method. Fast computationof DFT -Radix-2 Decimation-in-time(DIT)FastFourier transform(FFT), Decimation-in-frequency (DIF) Fast Fourier transform (FFT). Linear filtering using FFT.

UNIT II INFINITEIMPULSERESPONSEFILTERS 12

Characteristics of practical frequencyselective filters. characteristics of commonlyusedanalogfilters - Butterworthfilters, Chebyshevfilters. Designof IIR filters from analogfilters (LPF,HPF,BPF,BRF) - Approximation of derivatives, Impulse invariance method, Bilinear transformation. Frequencytransformation in the analog domain. Structure of IIR filter - direct form I, direct form II, Cascade,parallel realizations.

UNIT III FINITEIMPULSERESPONSEFILTERS 12

Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filtersusing Fourier series method - FIR filter design using windows (Rectangular, Hamming and Hanningwindow), Frequency sampling method. FIR filter structures - linear phase structure, direct formrealizations

UNIT IV FINITEWORDLENGTHEFFECTS 12

Fixed point and floating point number representation - ADC - quantization - truncation and rounding - quantization noise - input / output quantization - coefficient quantization error - product quantizationerror - overflow error - limit cycle oscillations due to product quantization and summation - scaling toprevent overflow.

UNIT V INTRODUCTIONTODIGITALSIGNALPROCESSORS 12

DSP functionalities - circular buffering – DSP architecture – Fixed and Floating point architectureprinciples – Programming – Application examples.

TOTAL:60PERIODS

OUTCOMES:

Attheendofthecourse, thestudentshouldbeableto

- ApplyDFTfortheanalysisofdigitalsignalsandsystems
- DesignIIR andFIR filters
- Characterizetheeffectsoffiniteprecisionrepresentationondigitalfilters
- Designmultiratefilters
- Applyadaptivefiltersappropriatelyincommunicationsystems

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

TEXTBOOK:

1. John G. Proakis & Dimitris G.Manolakis, ―Digital Signal Processing – Principles, Algorithms & Applications‖, Fourth Edition, Pearson Education / Prentice Hall, 2007. (UNIT I – V)

REFERENCES:

1. EmmanuelC.Ifeachor&Barrie.W.Jervis,―DigitalSignalProcessing‖,SecondEdition, Pearson Education / Prentice Hall, 2002.
2. A. V. Oppenheim, R.W. Schafer and J.R. Buck, ―Discrete-Time Signal Processing‖, 8th Indian Reprint, Pearson, 2004.
3. SanjitK.Mitra,―DigitalSignalProcessing–AComputerBasedApproach‖,TataMcGraw Hill, 2007.
4. AndreasAntoniou,―DigitalSignalProcessing‖,TataMcGrawHill, 2006.

SEMESTERV

20152S53 COMPUTERARCHITECTUREANDORGANIZATION

LTPC
3003

OBJECTIVES:

- Tomakestudentsunderstandthebasicstructureandoperationofdigitalcomputer
- Tofamiliarizewithimplementationoffixedpointandfloating-pointarithmeticoperations
- Tostudythedesign ofdatapathunit andcontrolunit forprocessor
- Tounderstandtheconceptof variousmemoriesandinterfacing
- Tointroducetheparallelprocessingtechnique

UNIT I COMPUTERORGANIZATION&INSTRUCTIONS 9

Basics of a computer system: Evolution, Ideas, Technology, Performance, Power wall, Uniprocessors to Multiprocessors. Addressingandaddressingmodes. Instructions:OperationsandOperands, Representing instructions, Logical operations, control operations.

UNIT II ARITHMETIC 9

FixedpointAddition,Subtraction,MultiplicationandDivision.FloatingPointarithmetic,Highperformance arithmetic, Subword parallelism

UNITIIITHEPROCESSOR 9

Introduction, Logic Design Conventions, Building a Datapath - A Simple Implementation scheme - An Overview of Pipelining - Pipelined Datapath and Control. Data Hazards: Forwarding versus Stalling, Control Hazards, Exceptions, Parallelism via Instructions.

UNIT IV MEMORYANDI/OORGANIZATION 9

Memory hierarchy, Memory Chip Organization, Cache memory, Virtual memory. Parallel BusArchitectures, InternalCommunicationMethodologies, SerialBusArchitectures, Massstorage,InputandOutput Devices.

UNIT V ADVANCEDCOMPUTERARCHITECTURE 9

Parallelprocessingarchitecturesandchallenges, Hardwaremultithreading, Multicoreandsharedmemorymultiprocessors, Introduction to Graphics Processing Units, Clusters and Warehouse scale computers -Introduction to Multiprocessor network topologies.

TOTAL:45PERIODS

OUTCOMES:

Attheendofthecourse,thestudentshouldbeableto

- Describedatarepresentation,instructionformatsandtheoperationofadigitalcomputer
- Illustratethefixedpointandfloating-pointarithmeticforALUoperation
- Discussaboutimplementationschemesofcontrolunitandpipelineperformance
- Explaintheconceptofvarious memories,interfacingandorganizationofmultipleprocessors
- Discussparallelprocessingtechniqueandunconventionalarchitectures

TEXTBOOKS:

1. DavidA.Patterson and John L.Hennessey,―ComputerOrganization and Design‖,Fifth Edition, Morgan Kauffman / Elsevier, 2014. (UNIT I-V)
2. MilesJ.MurdoccaandVincentP.Heuring,―ComputerArchitectureandOrganization:An Integrated approach‖, Second edition, Wiley India Pvt Ltd, 2015 (UNIT IV,V)

REFERENCES

1. V.CarlHamacher,ZvonkoG.VaranesicandSafatG.Zaky,―ComputerOrganization―,Fifth edition, Mc Graw-Hill Education India Pvt Ltd, 2014.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

2. WilliamStallings―ComputerOrganizationandArchitecture‖,SeventhEdition,Pearson Education, 2006.
3. Govindarajalu,―ComputerArchitectureandOrganization,DesignPrinciplesandApplications", Second edition, McGraw-Hill Education India Pvt Ltd, 2014.

LISTOFOPENELECTIVES

OPENELECTIVE– I(SEMESTERV)

OPENELECTIVE–I
SEMESTERV

20150OE54A **DATABASEMANAGEMENTSYSTEMS** **LTPC**
3003

OBJECTIVES:

- Tolearnthefundamentalsofdatamodels
- Tolearnconceptual modelingusingER diagrams.
- TostudySQLqueriesanddatabaseprogramming
- Tolearnproperdesigningofrelationaldatabase.
- Tounderstanddatabasesecurityconcepts
- TounderstandInformationretrievaltechniques

UNIT I DBMSANDCONCEPTUALDATAMODELING 9
Purpose of Database System – Data independence - Data Models – Database System Architecture – Conceptual Data modeling: ER models - Enhanced-ER Model. Introduction to relational databases – Relational Model – Keys – ER-to-Relational Mapping. Modeling of a library management system.

UNIT II DATABASEQUERYING 11
Relational Algebra – SQL: fundamentals – DDL – Specifying integrity constraints - DML – Basicretrieval queries in SQL - Complex SQL retrieval queries – nested queries – correlated queries – joins -aggregate functions. Creating a table, populating data, adding integrity constraints, querying tables withsimple and complex queries.

UNIT III DATABASEPROGRAMMING 7
Databaseprogramming withfunctioncalls, storedprocedures - views – triggers. EmbeddedSQL. ODBCconnectivity with front end tools. Implementation using ODBC/JDBC and SQL/PSM, implementingfunctions, views, and triggers in MySQL / Oracle.

UNIT IV DATABASEDESIGN 9
FunctionalDependencies –Designguidelines –NormalForms:first, second, third–Boyce/CoddNormalForm – Normalization algorithms. Design of a banking database system / university database system.

UNIT V ADVANCEDTOPICS 9
Database security issues – Discretionary access control – role based access – Encryption and public keyinfrastructures – challenges. Information Retrieval: IR Concepts, Retrieval Models, Queries in IRsystems.

TOTAL:45PERIODS

OUTCOMES:

Uponcompletionofthecourse, thestudentswillbeableto:

- Understand relational data model, evolve conceptual model of a given problem, its mapping torelational model and Normalization
- Querytherelationaldatabaseandwriteprogramswithdatabaseconnectivity
- Understandtheconceptsofdatabasesecurityandinformationretrievalsystems

TEXTBOOKS:

1. RamezElmasri,ShamkantB.Navathe,“FundamentalsofDatabaseSystems”,SixthEdition, Pearson, 2011.
2. AbrahamSilberschatz,HenryF.Korth,S.Sudharshan,“DatabaseSystemConcepts”,Sixth Edition, Tata McGraw Hill, 2011.

REFERENCES:

1. C.J.Date,A.Kannan,S.Swamynathan,“An Introduction to Database Systems”,Eighth Edition, Pearson Education, 2006.
2. Raghu Ramakrishnan, ―DatabaseManagement Systems‖, Fourth Edition, McGraw-Hill College Publications, 2015.

OPENELECTIVE–I
SEMESTERV

20150OE54B **CLOUD COMPUTING** **LTPC**
3003

OBJECTIVES:

- Tolearnabout theconceptofcloudandutilitycomputing.
- Tohaveknowledgeonthevarious issues incloudcomputing.
- Tobefamiliarwiththeleadplayersincloud.
- Toappreciatetheemergenceofcloudasthenext generationcomputingparadigm.

UNIT I INTRODUCTIONTOCLOUDCOMPUTING 9
IntroductiontoCloudComputing – Roots ofCloudComputing– DesiredFeatures ofCloudComputing – Challenges and Risks – Benefits and Disadvantages of Cloud Computing.

UNIT II VIRTUALIZATION 9
Introduction to Virtualization Technology – Load Balancing and Virtualization – UnderstandingHypervisor – Seven Layers of Virtualization – Types of Virtualization – Server, Desktop, ApplicationVirtualization.

UNIT III CLOUDARCHITECTURE,SERVICESANDSTORAGE 9
NISTCloudComputingReferenceArchitecture–Public,PrivateandHybridClouds-laaS–PaaS–SaaS – Architectural Design Challenges – Cloud Storage.

UNIT IV RESOURCEMANAGEMENTANDSECURITYINCLOUD 9
InterCloudResourceManagement–ResourceProvisioningMethods–SecurityOverview–CloudSecurity Challenges – Data Security –Application Security – Virtual Machine Security.

UNIT V CASESTUDIES 9
Google App Engine(GAE) – GAE Architecture – Functional Modules of GAE – Amazon WebServices(AWS) – GAE Applications – Cloud Software Environments – Eucalyptus – Open Nebula – Open Stack.

TOTAL:45PERIODS

OUTCOMES:
OnCompletionofthecourse, thestudentsshouldbe ableto:

- Articulatethemainconcepts,keytechnologies, strengthsandlimitationsofcloudcomputing.
- Learnthekeyandenablingtechnologiesthathelpinthedevelopmentofcloud.
- Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.
- Explainthecoreissuesofcloudcomputingsuchasresourcemanagementandsecurity.
- Beabletoinstallandusecurrentcloudtechnologies.
- Choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.

TEXTBOOKS:

1. Buyya R.,BrobergJ., GoscinskiA., “CloudComputing:Principles andParadigm”, First Edition, John Wiley & Sons, 2011.
2. KaiHwang,GeoffreyC.Fox,JackG.Dongarra,"DistributedandCloudComputing,From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
3. Rittinghouse,JohnW.,andJamesF.Ransome,“CloudComputing:Implementation, Management, And Security”, CRC Press, 2017.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

REFERENCES:

1. RajkumarBuyya, ChristianVecchiola,S. ThamaraiSelvi,“Mastering Cloud Computing”,Tata Mcgraw Hill, 2013.
2. TobyVelte, AnthonyVelte, RobertElsenpeter, "CloudComputing - APracticalApproach”, Tata Mcgraw Hill, 2009.
3. GeorgeReese, "Cloud Application Architectures: Building Applications andInfrastructureinthe Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)”, O'Reilly, 2009.

OPENELECTIVE–I
SEMESTERV

20153OE54A INDUSTRIALNANOTECHNOLOGY LTPC
300 3

OBJECTIVES

- Toelucidateonadvantagesofnanotechnologybasedapplicationsineachindustry
- Toprovideinstancesofcontemporaryindustrialapplicationsofnanotechnology
- Toprovideanoverviewoffuturetechnologicaladvancementsandincreasingroleofnanotechnology in each industry

UNIT I NANOELECTRONICS 9

Advantages of nano electrical and electronic devices –Electronic circuit chips – Lasers - Micro andNanoElectromechanical systems – Sensors, Actuators, Optical switches,- Data memory –Lighting andDisplays – Batteries - Fuel cells and Photo-voltaic cells – Electric double layer capacitors – Lead-freesolder – Nanoparticle coatings for electrical products.

UNIT II BIONANOTECHNOLOGY 9

Nanoparticlesin bone substitutesanddentistry–Implantsand Prosthesis–Nanoroboticsin Surgery–Nanosensors in Diagnosis– Neuro-electronic Interfaces– Therapeutic applications.

UNITIIINANOTECHNOLOGYINCHEMICALINDUSTRY 9

Nanocatalyts – Smart materials – Heterogenous nanostructures and composites – Nanostructures forMolecular recognition (Quantum dots, Nanorods, Nanotubes) – Molecular Encapsulation and itsapplications – Nanoporous zeolites – Self-assembled Nanoreactors.

UNIT IV NANOTECHNOLOGYINAGRICULTUREANDFOODTECHNOLOGY9

NanotechnologyinAgriculture-Precisionfarming,Smartdeliverysystem–Insecticidesusingnanotechnology – Potential of nano-fertilizers - Nanotechnology in Food industry.

UNIT V NANOTECHNOLOGYINTEXTILESANDCOSMETICS 9

Nanofibre production - Electrospinning – Controlling morphologies of nanofibers – Tissue engineeringapplication– Polymer nanofibers - Nylon-6 nanocomposites from polymerization - Nano-filledpolypropylene fibers - Nano finishing in textiles (UV resistant, antibacterial, hydrophilic, self-cleaning,flame retardant finishes) – Modern textiles Cosmetics – Formulation of Gels, Shampoos, Hair-conditioners.

TOTAL:45PERIODS

REFERENCES:

1. NeelinaH.Malsch(Ed.),BiomedicalNanotechnology,CRCPress(2005)
2. UdoH.Brinker,Jean-LucMieusset(Eds.),MolecularEncapsulation:OrganicReactionsin Constrained Systems,Wiley Publishers (2010).
3. JenniferKuzmaandPeterVerHage,Nanotechnologyinagricultureandfoodproduction, Woodrow Wilson International Center, (2006).
4. LynnJ.Frewer, WillehmNorde, R. H.Fischer andW. H. Kampers, NanotechnologyintheAgri- food sector, Wiley-VCH Verlag, (2011).
5. P. J. Brown and K. Stevens, Nanofibers and Nanotechnology in Textiles, Woodhead Publishing Limited, Cambridge, (2007).
6. Y-W.Mai,PolymerNanocomposites,Woodheadpublishing,(2006).
7. W.N.Chang,Nanofibres fabrication, performanceand applications, Nova SciencePublishers Inc, (2009)

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

OPENELECTIVE–I
SEMESTERV

20153OE54B ENERGYCONSERVATIONANDMANAGEMENT LTPC
3003

OBJECTIVES:
Attheendofthecourse, thestudentisexpectedto

- Understandandanalysetheenergydataofindustries
- Carryoutenergyaccountingandbalancing
- Conductenergyauditandsuggestmethodologiesforenergysavingsand
- Utilisetheavailableresourcesinoptimal ways

UNIT I INTRODUCTION 9
Energy-Power – Past &Present scenarioofWorld; NationalEnergyconsumptionData – Environmentalaspects associated with energy utilization – Energy Auditing: Need, Types, Methodology and Barriers.Role of Energy Managers. Instruments for energy auditing.

UNIT II ELECTRICALSYSTEMS 9
Components of EB billing – HT and LT supply, Transformers, Cable Sizing, Concept of Capacitors,Power Factor Improvement, Harmonics, Electric Motors - Motor Efficiency Computation, EnergyEfficient Motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED Lighting and scope ofEncon in Illumination.

UNIT III THERMALSYSTEMS 9
Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency computation and enconmeasures. Steam: Distribution &U sage: Steam Traps, Condensate Recovery, Flash Steam Utilization,Insulators & Refractories

UNIT IV ENERGYCONSERVATIONINMAJORUTILITIES 9
Pumps, Fans, Blowers, Compressed Air Systems, Refrigerationand Air ConditioningSystems – CoolingTowers – D.G. sets

UNIT V ECONOMICS 9
Energy Economics–DiscountRate,Payback Period,Internal Rate of Return,NetPresentValue,LifeCycle Costing –ESCO concept

TOTAL:45PERIODS

OUTCOMES:
Uponcompletionofthiscourse,thestudentscanabletoanalysetheenergydataofindustries.

- Cancarryoutenergyaccountingandbalancing
- Cansuggest methodologiesforenergysavings

TEXTBOOKS:

1. Energy Manager Training Manual (4 Volumes) available at www.energymanager training.com,a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India, 2004.

REFERENCES:

1. Witte.L.C.,P.S.Schmidt,D.R.Brown,"IndustrialEnergyManagementandUtilisation" Hemisphere Publ, Washington, 1988.
2. Callaghn, P.W. "Design and Management for Energy Conservation", Pergamon Press, Oxford, 1981.
3. Dryden.I.G.C.,"TheEfficientUseofEnergy"Butterworths,London,1982
4. Turner.W.C.,"EnergyManagementHandbook",Wiley,NewYork, 1982.
5. Murphy.W.R.andG.McKAY,"EnergyManagement",Butterworths,London1987.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

OPENELECTIVE–I
SEMESTERV

20154OE54A **RENEWABLEENERGYSOURCES** **LTPC 3003**

OBJECTIVES:

- Togetexposureonsolar radiationanditsenvironmentalimpacttopower.
- Toknowabout thevariouscollectorsusedforstoringsolarenergy.
- Toknowabout thevariousapplicationsinsolarenergy.
- Tolearnabout thewindenergyandbiomass anditseconomic aspects.
- Toknowaboutgeothermalenergywithotherenergysources.

UNIT II SOLARENERGY COLLECTION 8
Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermalanalysis, advanced collectors.

UNIT III SOLARENERGYSTORAGEAND APPLICATIONS 7
Differentmethods,Sensible,latentheatandstratifiedstorage,solarponds.SolarApplications-solarheating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

UNIT IV WIND ENERGY 10
Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteriaBIO-MASS: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gasyield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engine operation and economicaspects.

UNIT V GEOTHERMALENERGY: 9
Resources, types of wells, methods of harnessing the energy, potential in India. OCEAN ENERGY:OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy:Potential and conversion techniques, mini-hydel power plants, and their economics. DIRECT ENERGYCONVERSION: Need for DEC, Carnot cycle, limitations, principles of DEC.

TOTAL:45PERIODS

OUTCOMES:

- Understandingthephysicsofsolarradiation.
- Abilitytoclassifythesolar energycollectorsandmethodologiesofstoringsolarenergy.
- Knowledgeinapplyingsolarenergyinauseful way.
- Knowledgeinwindenergyandbiomasswithitseconomicaspects.
- Knowledgeincapturingandapplyingotherformsofenergysourceslikewind,biogasand geothermal energies.

TEXTBOOKS:

1. RaiG.D.,“Non-ConventionalEnergySources”,KhannaPublishers,2011
2. Twidell&Wier,“RenewableEnergyResources”,CRCPress(Taylor&Francis),2011

REFERENCES:

1. TiwariandGhosal,“Renewableenergyresources”,NarosaPublishingHouse,2007
2. RameshR &Kumar K.U,“RenewableEnergyTechnologies”,NarosaPublishingHouse, 2004

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

3. MittalKM,“Non-ConventionalEnergySystems”,WheelerPublishingCo.Ltd,NewDelhi, 2003
4. KothariD.P,Singhal.,K.C.,“Renewableenergysourcesandemergingtechnologies”,P.H.I, New Delhi, 2010.

OPENELECTIVE–I
SEMESTERV

20154OE54B AUTOMOTIVESYSTEMS

LTPC
3003

OBJECTIVES:

- Tounderstandtheconstructionandworkingprincipleofvarious partsofanautomobile.
- Tohavethepracticefor assemblinganddismantlingof enginepartsandtransmission system.

UNIT I AUTOMOTIVEENGINEAUXILIARYSYSTEMS 9

Automotiveengines-Externalcombustionengines–Internalcombustionengines-classificationof engines-SI Engines- CI Engines- two stroke engines -four stroke engines- construction andworking principles - IC engine components- functions and materials -valve timing –port timingdiagram- Injectionsystem-Unit injector system- Rotarydistributor type-Electronicallycontrolledinjection system for SI engines-CI engines-Ignition system - Electronic ignition system
-Transistorizedignitionsystem,capacitivedischargeignitionsystem.

UNIT II VEHICLEFRAMESANDSTEERINGSYSTEM 9

Vehicleconstructionanddifferent Chassislayouts –classifications ofchassis-typesofframes- frameless chassis construction –articulated vehicles- vehicle body -Vehicleaerodynamics-various resistances and its effects - steering system –conventional –sophisticated vehicle- and types of steering gear box-Power Steering-Steering
geometry-conditionfor truerollingmotion-Ackermann's-Devi'ssteeringsystem-types ofstubaxle –Types of rear axles.

UNIT III TRANSMISSIONSYSTEMS 9

Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms,Overdrive,transferbox,fluidflywheel,torqueconverter,propellershaft,slipjoints,universaljoints –- Hotchkiss Drive and Torque Tube Drive- rear axle- Differential-wheels and tyres.

UNIT IV SUSPENSIONANDBRAKESSYSTEMS 9

SuspensionSystems-conventionalSuspensionSystems -independentSuspensionSystems–leaf spring – coil spring –taper-lite - eligo,s spring Types of brakes -Pneumatic andHydraulic Braking Systems, Antilock Braking System (ABS), electronic brake force distribution(EBD)andTractionControl. DerivetheequationofForcesactingwhileapplyinga brakes on plain surface -inclined road-gradient.

UNIT V ALTERNATIVEENERGYSOURCES 9

Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol andHydrogen in Automobiles- Engine modifications required –Performance, Combustion andEmissionCharacteristics of SI andCI engines withthesealternatefuels - Electric andHybridVehicles, FuelCell.Turbochargers -Engineemissioncontrolbythreewaycatalyticconvertersystem.

TOTAL:45PERIODS

OUTCOMES:

Uponcompletionofthiscourse, thestudentswillbe ableto:

- identifythedifferentcomponentsinautomobileengineering.
- haveclearunderstandingon differentauxiliaryandtransmissionsystemsusual.

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TEXTBOOKS:

1. GanesanV.“InternalCombustionEngines”,ThirdEdition,TataMcGraw-Hill,2007.
2. JainK.K.andAsthana .R.B,“AutomobileEngineering”TataMcGrawHillPublishers, New Delhi, 2002.
3. KirpalSingh,“AutomobileEngineering”,Vol1&2,SeventhEdition,StandardPublishers, New Delhi, 1997.

REFERENCES:

1. HeinzHeisler,“AdvancedEngineTechnology,”SAEInternationalPublicationsUSA, 1998.
2. JosephHeitner,“AutomotiveMechanics,”SecondEdition,East-WestPress, 1999.
3. MartinW, StockelandMartinTStockle, “Automotive MechanicsFundamentals,”The Good heart –Will Cox Company Inc, USA ,1978.
4. Newton,SteedsandGaret,“MotorVehicles”,ButterworthPublishers,1989.

OPENELECTIVE–I
SEMESTERV

20155OE54A	**AIRPOLLUTIONANDCONTROLENGINEERING**	**LTPC 3003**

OBJECTIVE:

- To impart knowledge on the principle and design of control of Indoor/particulate/gaseousairpollutant and its emerging trends.

UNIT I INTRODUCTION 7

Structure and composition of Atmosphere – Definition, Scope and Scales of Air Pollution – Sources andclassification of air pollutants and their effect on human health, vegetation, animals, property, aestheticvalue and visibility- Ambient Air Quality and Emission standards.

UNIT II METEOROLOGY 6

Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profilesand stack plume patterns- Atmospheric Diffusion Theories – Dispersion models, Plume rise.

UNIT IV CONTROLOFGASEOUSCONTAMINANTS 11

FactorsaffectingSelectionofControlEquipment–Workingprinciple-absorption,Adsorption,condensation, Incineration, Bio filters – Process control and Monitoring.

TOTAL:45PERIODS

OUTCOMES:

Thestudentscompletingthecoursewillhave

- Anunderstandingofthenatureandcharacteristicsofairpollutants,noisepollutionandbasic concepts of air quality management
- Abilitytoidentify, formulateandsolveairandnoisepollutionproblems
- Abilitytodesignstacksandparticulateair pollutioncontroldevicestomeetapplicablestandards.
- Abilitytoselectcontrol equipments.
- Abilitytoensurequality,controlandpreventivemeasures.

TEXTBOOKS:

1. Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, “Air Pollution Control Engineering”, Tokyo, springer science + science media LLC,2004.
2. NoeldeNevers,“AirPollutionControlEngineering”,Wavelandpress,Inc2017.
3. Anjaneyulu.Y,“AirPollutionandControlTechnologies‟,AlliedPublishers(P)Ltd.,India2002.

REFERENCES:

1. DavidH.F.Liu,BelaG.Liptak,“AirPollution”,LweisPublishers, 2000.
2. ArthurC.Stern,“AirPollution(Vol.I–Vol.VIII)”,AcademicPress, 2006.
3. WayneT.Davis,“AirPollutionEngineeringManual”,JohnWiley&Sons,Inc, 2000.
4. M.NRaoandHVNRao,“AirPollution”,TataMcgrawHillPublishingCompanylimited,2007.
5. C.S.Rao,“EnvironmentalPollutionControlEngineering”,NewAgeInternational(P)Limited Publishers,2006.

SKILL DEVELOPMENT **EMPLOYABILITY** **ENTREPRENEURSHIP**

OPENELECTIVE–I
SEMESTERV

20155OE54B **GEOGRAPHICINFORMATIONSYSTEM** **LTPC 3003**

OBJECTIVES:
- TointroducethefundamentalsandcomponentsofGeographicInformationSystem
- Toprovidedetailsofspatialdatastructuresandinput,managementandoutputprocesses.

UNIT I FUNDAMENTALSOFGIS 9
Introduction to GIS - Basic spatial concepts - Coordinate Systems - GIS and Information Systems – Definitions – History of GIS - Components of a GIS – Hardware, Software, Data, People, Methods – Proprietary and open source Software - Types of data – Spatial, Attribute data- types of attributes –scales/ levels of measurements.

UNIT II SPATIALDATAMODELS 9
Database Structures – Relational, Object Oriented – ER diagram - spatial data models – Raster DataStructures – Raster Data Compression - Vector Data Structures - Raster vs Vector Models- TIN andGRID data models - OGC standards - Data Quality.

UNIT III DATAINPUTANDTOPOLOGY 9
Scanner - Raster Data Input – Raster Data File Formats – Vector Data Input –Digitiser –Topology - Adjacency, connectivity and containment – Topological Consistency rules – Attribute Data linking – ODBC – GPS - Concept GPS based mapping.

UNIT IV DATA ANALYSIS 9
VectorDataAnalysistools-DataAnalysistools-NetworkAnalysis-Digital Educationmodels-3Ddata collection and utilisation.

UNIT V APPLICATIONS 9
GIS Applicant - Natural Resource Management - Engineering - Navigation - Vehicle tracking and fleetmanagement - Marketing and Business applications - Case studies.

TOTAL:45PERIODS

OUTCOMES:
Thiscourseequipsthestudentto
- Havebasicidea aboutthefundamentalsof GIS.
- Understandthetypes ofdatamodels.
- Getknowledgeaboutdatainputandtopology.
- Gainknowledgeondataqualityandstandards.
- Understanddatamanagementfunctionsanddataoutput

TEXTBOOKS:
1. Kang-TsungChang, IntroductiontoGeographicInformationSystems, McGrawHillPublishing, 2nd Edition, 2011.
2. IanHeywood,SarahCornelius,SteveCarver,SrinivasaRaju,“AnIntroductionGeographical Information Systems, Pearson Education, 2nd Edition,2007.

REFERENCE:
1. Lo.C.P.,AlbertK.W.Yeung,ConceptsandTechniquesofGeographicInformationSystems, Prentice-Hall India Publishers, 2006

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

SEMESTERV

20152C55 COMMUNICATIONNETWORKS

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OBJECTIVES:

Thestudentshouldbe made to:

- Understandthedivisionofnetworkfunctionalitiesintolayers.
- Befamiliar withthecomponentsrequiredtobuilddifferenttypesofnetworks
- Beexposedtotherequiredfunctionalityateachlayer
- Learntheflowcontrolandcongestioncontrolalgorithms

UNIT I FUNDAMENTALS&LINKLAYER 9

Overview of Data Communications- Networks – BuildingNetworkand its types– Overview of Internet - Protocol Layering - OSI Mode – Physical Layer – Overview of Data and Signals - introduction to DataLink Layer - Link layer Addressing- Error Detection and Correction

UNIT II MEDIAACCESS &INTERNETWORKING 9

Overview of Data linkControlandMedia access control - Ethernet (802.3) - Wireless LANs – AvailableProtocols – Bluetooth – Bluetooth Low Energy – WiFi – 6LowPAN–Zigbee - Network layer services –Packet Switching – IPV4 Address – Network layer protocols (IP, ICMP, Mobile IP)

UNIT V APPLICATIONLAYER 9

Application Layer Paradigms – Client Server Programming – World Wide Web and HTTP - DNS- - Electronic Mail (SMTP, POP3, IMAP, MIME) – Introduction to Peer to Peer Networks – Need forCryptography and Network Security – Firewalls.

TOTAL:45PERIODS

OUTCOMES:

Attheendofthecourse, thestudentshouldbeableto:

- Identifythecomponentsrequiredtobuilddifferenttypesofnetworks
- Choosetherequiredfunctionalityat eachlayerforgivenapplication
- Identifysolutionfor eachfunctionalityateachlayer
- Tracetheflowofinformationfromonenodetoanothernodeinthenetwork

TEXTBOOK:

1. Behrouz A. Forouzan, ―Data communication and Networking‖, Fifth Edition, Tata McGraw –Hill, 2013 (UNIT I –V)

REFERENCES

1. James F. Kurose, Keith W. Ross, ―Computer Networking - A Top-Down Approach Featuring the Internet‖, Seventh Edition, Pearson Education, 2016.
2. Nader. F. Mir,― Computer and Communication Networks‖,Pearson Prentice Hall Publishers, 2nd Edition, 2014.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

3. Ying-DarLin,Ren-HungHwang,FredBaker,―ComputerNetworks:AnOpenSource Approach‖, Mc Graw Hill Publisher, 2011.
4. LarryL.Peterson,BruceS.Davie,―ComputerNetworks:ASystemsApproach‖,FifthEdition, Morgan Kaufmann Publishers, 2011.

LISTOF ELECTIVES

ELECTIVE–I(SEMESTERV)

ELECTIVE–I
SEMESTERV

20152E56A OBJECTORIENTEDPROGRAMMING LTPC
3003

OBJECTIVES:

- TounderstandObjectOrientedProgrammingconceptsandbasiccharacteristicsofJava
- Toknowtheprinciplesofpackages,inheritanceandinterfaces
- TodefineexceptionsanduseI/O streams
- Todevelopa javaapplicationwiththreadsandgenericsclasses
- TodesignandbuildsimpleGraphical UserInterfaces

UNIT I INTRODUCTIONTOOOPANDJAVA FUNDAMENTALS 10
ObjectOrientedProgramming-Abstraction–objectsandclasses-Encapsulation-Inheritance-Polymorphism-OOPinJava–CharacteristicsofJava–TheJavaEnvironment-JavaSourceFile-Structure–Compilation.FundamentalProgrammingStructuresinJava–DefiningclassesinJava –constructors,methods-accessspecifiers-staticmembers-Comments,DataTypes,Variables,Operators, Control Flow, Arrays , Packages - JavaDoc comments.

UNIT II INHERITANCEANDINTERFACES 9
Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Objectclass – abstract classes and methods- final methods and classes – Interfaces – defining an interface,implementing interface, differences between classes and interfaces and extending interfaces - Objectcloning -inner classes, Array Lists - Strings

UNIT III EXCEPTIONHANDLINGAND I/O 9
Exceptions - exception hierarchy - throwing and catching exceptions - built in exceptions, creating ownexception, Stack Trace Elements.
Input / Output Basics –Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files

UNIT IV MULTITHREADINGANDGENERICPROGRAMMING 8
Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizingthreads, Inter thread communication, daemon threads, thread groups.
GenericProgramming–Genericclasses–genericmethods–BoundedTypes–RestrictionsandLimitations.

UNIT V EVENTDRIVEN PROGRAMMING 9
Graphics programming - Frame – Components - working with 2D shapes - Using color, fonts, andimages - Basics of event handling - event handlers - adapter classes - actions - mouse events - AWTevent hierarchy - Introduction to Swing – layout management - Swing Components – Text Fields , TextAreas – Buttons-CheckBoxes –RadioButtons –Lists-choices-Scrollbars –Windows –Menus – DialogBoxes.

TOTAL:45PERIODS

OUTCOMES:
Uponcompletionofthecourse, studentswillbeableto:

- DevelopJavaprogramsusingOOP principles
- DevelopJava programswiththeconceptsinheritanceandinterfaces

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

- BuildJavaapplicationsusingexceptionsandI/Ostreams
- DevelopJavaapplicationswiththreadsandgenericsclasses
- DevelopinteractiveJavaprogramsusingswings

TEXTBOOKS:

1. HerbertSchildt,—JavaThecompletereference‖,8th Edition,McGrawHillEducation,2011.
2. Cay S.Horstmann,Gary cornell,—CoreJavaVolume –I Fundamentals‖,9th Edition,Prentice Hall, 2013.

REFERENCES:

1. PaulDeitel,HarveyDeitel,—JavaSE8forprogrammers‖,3rd Edition,Pearson, 2015.
2. StevenHolzner,—Java2Blackbook‖,Dreamtechpress,2011.
3. TimothyBudd,—UnderstandingObject-orientedprogrammingwithJava‖,UpdatedEdition, Pearson Education, 2000.

ELECTIVE–I
SEMESTERV

20152E56B **MEDICAL ELECTRONICS** **LTPC 3003**

OBJECTIVES:
Thestudentshouldbemade:

- To gain knowledge about the various physiological parameters both electrical and non electrical and the methods of recording and also the method of transmitting these parameters
- Tostudyabout thevariousassist devicesusedinthehospitals
- Togainknowledgeaboutequipmentusedforphysicalmedicineandthevariousrecently developed diagnostic and therapeutic techniques.

UNIT I ELECTRO-PHYSIOLOGYANDBIO-POTENTIALRECORDING 9
Sourcesofbiomedicalsignals, Bio-potentials, Biopotential electrodes, biologicalamplifiers, ECG,EEG,EMG, PCG, typical waveforms and signal characteristics

UNIT II BIO-CHEMICALANDNONELECTRICALPARAMETERMEASUREMENT 9
pH,PO2,PCO2,Colorimeter,Bloodflowmeter,Cardiacoutput,respiratory,bloodpressure,temperatureand pulse measurement, Blood Cell Counters.

UNIT III ASSISTDEVICES 9
Cardiacpacemakers,DCDefibrillator,Dialyser,Ventilators,MagneticResonanceImagingSystems,Ultrasonic Imaging Systems.

UNIT IV PHYSICALMEDICINEANDBIOTELEMETRY 9
Diathermies-Shortwave,ultrasonicandmicrowavetypeandtheirapplications,SurgicalDiathermy,Biotelemetry.

9
Telemedicine,InsulinPumps,Radiopill,Endomicroscopy,Brainmachineinterface,Lab on a chip.

TOTAL:45PERIODS

OUTCOMES:
Onsuccessfulcompletionofthiscourse,thestudentshouldbeableto:

- Knowthehumanbodyelectro-physiologicalparametersandrecordingofbio-potentials
- Comprehendthenon-electricalphysiologicalparametersandtheirmeasurement–bodytemperature, blood pressure, pulse, blood cell count, blood flow meter etc.
- Interpretthevariousassistdevicesusedinthehospitalsviz.pacemakers,defibrillators, dialyzers and ventilators
- Comprehendphysicalmedicinemethodseg.ultrasonic,shortwave,microwavesurgical diathermies , and bio-telemetry principles and methods
- Knowaboutrecenttrendsinmedicalinstrumentation

TEXTBOOK:

1. Leslie Cromwell, ―Biomedical Instrumentation and Measurement‖, Prentice Hall of India, New Delhi, 2007. (UNIT I – V)

REFERENCES:

1. Khandpur, R.S.,―Handbookof BiomedicalInstrumentation‖, TATAMc Graw-Hill, NewDelhi, 2003.
2. John G.Webster, ―Medical Instrumentation Application and Design‖, 3rd Edition, Wiley India Edition, 2007
3. Joseph J.Carr and John M.Brown, ―Introduction to Biomedical Equipment Technology‖, John Wiley and Sons, New York, 2004.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

ELECTIVE–I
SEMESTERV

20152E56C **OPERATINGSYSTEMS** **LTPC**
3003

OBJECTIVES:

- Tounderstandthebasicconceptsandfunctionsofoperatingsystems.
- TounderstandProcessesandThreads
- ToanalyzeSchedulingalgorithms.
- Tounderstandtheconcept ofDeadlocks.
- Toanalyzevariousmemorymanagementschemes.
- TounderstandI/OmanagementandFilesystems.
- TobefamiliarwiththebasicsofLinux systemandMobileOSlikeiOSand Android.

UNIT I OPERATINGSYSTEMOVERVIEW 7

Computer System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy,Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating systemoverview-objectives and functions, Evolution of Operating System.- Computer System OrganizationOperating SystemStructureand Operations- SystemCalls, SystemPrograms, OS Generation and SystemBoot.

UNIT II PROCESSMANAGEMENT 11

Processes-ProcessConcept,ProcessScheduling,OperationsonProcesses, InterprocessCommunication;CPU Scheduling - Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real timescheduling;Threads-Overview, Multithreadingmodels,Threadingissues;ProcessSynchronization - Thecritical-section problem, Synchronization hardware, Mutex locks, Semaphores, Classic problems ofsynchronization, Critical regions, Monitors; Deadlock – System model, Deadlock characterization,Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection,Recovery from deadlock.

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UNIT IV FILESYSTEMS ANDI/OSYSTEMS 9

Mass Storage system – Overview of Mass Storage Structure, Disk Structure, Disk Scheduling andManagement, swap space management; File-System Interface - File concept, Access methods, DirectoryStructure, Directory organization, File system mounting, File Sharing and Protection; File SystemImplementation- File System Structure, Directory implementation, Allocation Methods, Free SpaceManagement, Efficiency and Performance, Recovery; I/O Systems – I/O Hardware, Application I/Ointerface, Kernel I/O subsystem, Streams, Performance.

UNIT V CASESTUDY 9

Linux System - Design Principles, Kernel Modules, Process Management, Scheduling, MemoryManagement, Input-Output Management, File System, Interprocess Communication; Mobile OS - iOSand Android - Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, FileSystem.

TOTAL:45PERIODS

OUTCOMES:

Attheendofthecourse,thestudentsshouldbeableto:

- Analyzevariousschedulingalgorithms.
- Understanddeadlock,preventionandavoidancealgorithms.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENEURSHIP**

- Compareandcontrastvarious memorymanagementschemes.
- Understandthefunctionalityoffilesystems.
- PerformadministrativetasksonLinuxServersandcompareiOSandAndroidOperating Systems.

TEXTBOOK:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, ―Operating System Concepts‖, 9th Edition, John Wiley and Sons Inc., 2012.

REFERENCES:

1. RamazElmasri,A.GilCarrick,DavidLevine,―OperatingSystems –ASpiralApproach‖, Tata McGraw Hill Edition, 2010.
2. AchyutS.Godbole,AtulKahate,―OperatingSystems‖,McGrawHillEducation,2016.
3. AndrewS.Tanenbaum,―ModernOperatingSystems‖,SecondEdition,Pearson Education, 2004.
4. GaryNutt,―OperatingSystems‖,ThirdEdition,PearsonEducation, 2004.
5. HarveyM.Deital,―OperatingSystems‖,ThirdEdition,PearsonEducation,2004.
6. DanielP BovetandMarcoCesati,―Understandingthe Linuxkernel‖,3rdedition,O'Reilly, 2005.
7. Neil Smyth, ―iPhone iOS 4 Development Essentials – Xcode‖, Fourth Edition, Payload media, 2011.

ELECTIVE–I
SEMESTERV

20152E56D ROBOTICSANDAUTOMATION LTPC
3003

OBJECTIVES:
Thestudentshouldbemade:

- Tounderstandthe basic concepts associated withthe design, functioning, applications andsocial aspects of robots
- Tostudyabout theelectricaldrivesystemsandsensorsusedinrobotics forvarious applications
- To learn about analyzing robot kinematics, dynamics through different methodologies and study various design aspects of robot arm manipulator and end-effector
- Tolearnaboutvariousmotionplanningtechniquesandtheassociatedcontrolarchitecture
- TounderstandtheimplicationsofAIandothertrendingconceptsofrobotics

UNIT I FOUNDATIONFORBEGINNERS 9
Introduction -- brief history, definition, anatomy, types, classification, specification and need basedapplications; role and need of robots for the immediate problems of the society, future of mankind andautomation-ethical issues; industrial scenario local and global, case studies on mobile robot researchplatform and industrial serial arm manipulator

UNITII BUILDINGBLOCKSOFAROBOT 9
Types of electric motors - DC, Servo, Stepper; specification, drives for motors - speed & directioncontrolandcircuitry, Selectioncriterionfor actuators,direct drives, non-traditionalactuators;Sensors forlocalization, navigation, obstacle avoidance and path planning in known and unknown environments –optical, inertial, thermal, chemical, biosensor, other common sensors; Case study on choice of sensorsand actuators for maze solving robot and self driving cars

UNITIII KINEMATICS,DYNAMICSANDDESIGNOFROBOTS&END-EFFECTORS 9
Robot kinematics -Geometricapproachfor 2R,3R manipulators, homogenous transformationusingD-Hrepresentation, kinematics of WMR, Lagrangian formulation for 2R robot dynamics; Mechanical designaspects of a 2R manipulator, WMR; End-effector - common types and design case study.

UNITIVNAVIGATION,PATHPLANNINGANDCONTROL ARCHITECTURE 9
Mapping & Navigation – SLAM, Path planning for serial manipulators; types of control architectures - Cartesian control, Force control and hybrid position/force control, Behaviour based control, applicationof Neural network, fuzzy logic, optimization algorithms for navigation problems, programmingmethodologies of a robot

UNIT V AIANDOTHERRESEARCHTRENDSIN ROBOTICS 9
ApplicationofMachinelearning-AI,Expertsystems;Tele-roboticsandVirtualReality,Micro&Nanorobots, Unmanned vehicles, Cognitive robotics, Evolutionary robotics, Humanoids

TOTAL:45PERIODS

OUTCOMES:
Thestudentshouldbeableto:

- Explain the concepts of industrial robots in terms of classification, specifications and coordinate systems, along with the need and application of robots & automation
- Examinedifferentsensorsandactuatorsfor applicationslikemazesolvingandselfdrivingcars.
- Designa2Rrobot&anend-effectorandsolvethekinematicsanddynamicsofmotionfor robots.
- Explainnavigationandpathplanningtechniques along withthe control architectures adoptedfor robot motion planning.
- Describetheimpactandprogress inAIandotherresearchtrendsinthefieldof robotics.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

TEXTBOOKS:

1. Saeed.B.Niku,IntroductiontoRobotics,Analysis,system,Applications,PearsonEducations, 2002
2. Roland Siegwart, Illah Reza Nourbakhsh, Introduction to Autonomous Mobile Robots, MIT Press, 2011

REFERENCES:

1. Richard David Klafter, Thomas A. Chmielewski, Michael Negin, Robotic engineering: an integrated approach, Prentice Hall, 1989
2. Craig,J.J.,IntroductiontoRobotics:MechanicsandControl,2ndEdition,Addison-Wesley,1989.
3. K.S. Fu, R.C. Gonzalez and C.S.G. Lee, Robotics: Control, Sensing, Vision and Intelligence, McGraw-Hill, 1987.
4. Wesley E Snyder R, Industrial Robots, Computer Interfacing and Control, Prentice Hall International Edition, 1988.
5. RobinMurphy,IntroductiontoAIRobotics, MITPress,2000
6. RonaldC.Arkin,Behavior-basedRobotics,MITPress,1998
7. N.P.Padhy,ArtificialIntelligenceandIntelligentSystems,OxfordUniversityPress,2005
8. Stefano Nolfi, Dario Floreano, Evolutionary Robotics – The Biology, Intelligence and Technology of Self–Organizing Machines (Intelligent Robotics and Autonomous Agents series), MIT Press, 2004.

ELECTIVE–I
SEMESTERV

20152E56E **NANOTECHNOLOGYANDAPPLICATIONS** **LTPC**
3003

OBJECTIVES:
- Toprovideabroadviewofthenascentfieldofnanoscienceandnanotechnologyto undergraduates
- Toexplorethebasicsofnanomaterialsynthesisandcharacterization.
- Tointroducetheapplicationsofnanotechnology

UNIT I INTRODUCTIONTO NANOTECHNOLOGY 9
BasicStructureofNanoparticles-Kinetics inNanostructuredMaterials-Zerodimensional, sizeandshapeof nanoparticles; one-dimensional and two dimensional nanostructures- clusters of metals andsemiconductors, bio nano-particles.

UNIT II FABRICATIONANDCHARACTERIZATIONOFNANOMATERIALS 9
Types of Nanomaterials (Quantum dots, Nanoparticles, Nanocrystals, Dendrimers, Buckyballs,Nanotubes); Gas, liquid, and solid –phase synthesis of nanomaterials; Lithography techniques(Photolithography, Dip-pen and Electron beam lithography); Thin film deposition; Electrospinning. Bio-synthesis of nanomaterials.

ls;
Microscopy measurements: SEM, TEM, AFM and STM. Confocal and TIRF imaging.

UNIT IV NANOSTRUCTURES 9
Carbon Nanotubes, Fullerenes, Nanowires, Quantum Dots. Applications of nanostructures.Reinforcement in Ceramics, Drug delivery, Giant magnetoresistance, etc. Cells response toNanostructures.

UNIT V APPLICATIONSOFNANOTECHNOLOGY 9
Nanoelectronics,Nanosensors,NanotechnologyinDiagnosticsapplications,EnvironmentalandAgricultural Applications of nanotechnology, Nano technology for energy systems

TOTAL:45PERIODS

OUTCOMES:
Attheendofthecourse, thestudentshouldbeableto:
- Describethebasicsciencebehindtheproperties ofmaterials.
- Interpretthecreation,characterization,andmanipulationofnanoscalematerials.
- Comprehendtheexcitingapplicationsofnanotechnologyattheleadingedgeofscientificresearch
- Applytheirknowledgeofnanotechnologytoidentifyhowtheycanbeexploitedfornew applications.

TEXTBOOKS:
1. SpringerHandbookofNanotechnologybyBharatBhushan2004.(UnitI–V)
2. Encyclopedia ofNanotechnology-HariSinghNalwa2004. (UnitI –V)

REFERENCES:

1. Nanomaterials,Nanotechnologiesand Design: an Introduction to EngineersandArchitects,D. Michael Ashby, Paulo Ferreira, Daniel L. Schodek, Butterworth-Heinemann, 2009.

SKILL DEVELOPMENT **EMPLOYABILITY** **ENTREPRENEURSHIP**

2. Handbook of Nanophase and Nanostructured Materials (in four volumes), Eds: Z.L. Wang, Y.Liu, Z. Zhang, Kluwer Academic/Plenum Publishers, 2003.
3. Handbook ofNanoceramics andtheir BasedNanodevices (Vol. 2)EditedbyTseung-YuenTseng and Hari Singh Nalwa, American Scientific Publishers.

ELECTIVE–I
SEMESTERV

20152E56F **HUMANRIGHTS** **LTPC**
3003

OBJECTIVE:

- TosensitizetheEngineeringstudentstovariousaspectsofHumanRights.

UNIT I **9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, MoralandLegalRights. CivilandPoliticalRights, Economic, Socialand CulturalRights; collective/ SolidarityRights.

UNIT II **9**

EvolutionoftheconceptofHumanRightsMaganacarta–Genevaconventionof1864.UniversalDeclaration of Human Rights, 1948. Theories of Human Rights.

UNIT III **9**

TheoriesandperspectivesofUNLaws –UNAgenciestomonitorandcompliance.

TOTAL:45PERIODS

OUTCOME:

- Engineeringstudentswillacquirethebasicknowledgeofhumanrights.

REFERENCES:

1. KapoorS.K.,―HumanRightsunderInternationallawandIndianLaws‖,CentralLawAgency, Allahabad, 2014.
2. ChandraU.,―HumanRights‖,AllahabadLawAgency,Allahabad, 2014.
3. UpendraBaxi,TheFutureofHumanRights, OxfordUniversityPress, NewDelhi.

ELECTIVE–I
SEMESTERV

20152E56G **TOTALQUALITYMANAGEMENT** **LTPC**
3003

OBJECTIVE:

- TofacilitatetheunderstandingofQualityManagementprinciplesandprocess.

UNIT I INTRODUCTION 9
Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of productand service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran andCrosby - Barriers to TQM - Customer focus - Customer orientation, Customer satisfaction, Customercomplaints, Customer retention.

UNIT II TQMPRINCIPLES 9
Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCAcycle, 5S,Kaizen - Supplier partnership - Partnering, Supplierselection, Supplier Rating.

UNIT III TQMTOOLSANDTECHNIQUESI 9
The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology,applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark,Bench marking process - FMEA - Stages, Types.

UNIT IV TQMTOOLSANDTECHNIQUESII 9
Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V QUALITYMANAGEMENTSYSTEM 9
Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-SpecificStandards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation—Documentation—Internal Audits—Registration-
ENVIRONMENTAL MANAGEMENT SYSTEM: Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001—Benefits of EMS.

TOTAL:45PERIODS

OUTCOME:

- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

TEXTBOOK:

1. DaleH.Besterfiled, CarolB.Michna,GlenH.Besterfield,MaryB.Sacre,Hemant Urdhwaresheand Rashmi Urdhwareshe, ―Total Quality Management‖, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.

REFERENCES:

1. James R. Evans andWilliamM. Lindsay, "TheManagement andControlofQuality", 8thEdition, First Indian Edition, Cengage Learning, 2012.
2. Janakiraman. B and Gopal .R.K., "Total Quality Management- Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
3. Suganthi.LandAnandSamuel,"TotalQualityManagement",PrenticeHall(India)Pvt.Ltd., 2006.
4. ISO9001-2015standards

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

SEMESTERV

20152L57 DIGITALSIGNALPROCESSINGLABORATORY

L	T	P	C
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OBJECTIVES:

Thestudentshouldbemade:

- ToperformbasicsignalprocessingoperationssuchasLinearConvolution,Circular Convolution, Auto Correlation, Cross Correlation and Frequency analysis in MATLAB
- ToimplementFIRandIIRfiltersinMATLABandDSPProcessor
- TostudythearchitectureofDSPprocessor
- TodesignaDSPsystemtodemonstratetheMulti-rateand Adaptivesignalprocessingconcepts.

LISTOFEXPERIMENTS:

MATLAB/EQUIVALENTSOFTWAREPACKAGE

1. GenerationofelementaryDiscrete-Timesequences
2. LinearandCircularconvolutions
3. AutocorrelationandCrossCorrelation
4. FrequencyAnalysisusingDFT
5. DesignofFIRfilters(LPF/HPF/BPF/BSF)anddemonstratesthefilteringoperation
6. DesignofButterworthandChebyshevIIRfilters(LPF/HPF/BPF/BSF)anddemonstrate the filtering operations

DSPPROCESSORBASED IMPLEMENTATION

1. StudyofarchitectureofDigitalSignalProcessor
2. PerformMACoperationusingvariousaddressingmodes
3. Generationof varioussignalsandrandomnoise
4. DesignanddemonstrationofFIRFilterforLowpass,Highpass,BandpassandBandstopfiltering
5. Design and demonstration of Butter worth and Chebyshev IIR Filters for Low pass, High pass,Band pass and Band stop filtering
6. ImplementanUp-samplingandDown-samplingoperationinDSPProcessor

TOTAL: 60 PERIODS

OUTCOMES:

Attheendofthe course, thestudentshouldbeableto:

- Carryoutbasicsignalprocessingoperations
- DemonstratetheirabilitiestowardsMATLABbasedimplementationofvariousDSPsystems
- AnalyzethearchitectureofaDSP Processor
- Design and Implement the FIR and IIR Filters in DSP Processor for performing filtering operation over real-time signals
- DesignaDSPsystemfor variousapplicationsof DSP

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

SEMESTERV

20152L58 COMMUNICATIONSYSTEMSLABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

Thestudentshouldbemade:

- Tovisualizetheeffectsofsamplingand TDM
- ToImplementAM&FMmodulationanddemodulation
- Toimplement PCM& DM
- TosimulateDigitalModulationschemes
- TosimulateErrorcontrolcodingschemes

LISTOFEXPERIMENTS:

1. SignalSamplingandreconstruction
2. TimeDivisionMultiplexing
3. AMModulatorandDemodulator
4. FMModulatorandDemodulator
5. PulseCodeModulationandDemodulation
6. DeltaModulationandDemodulation
7. Linecodingschemes
8. SimulationofASK,FSK,andBPSKgenerationschemes
9. SimulationofDPSK,QPSKandQAMgenerationschemes
10. Simulationofsignalconstellations ofBPSK,QPSKandQAM
11. SimulationofASK,FSKandBPSKdetectionschemes
12. SimulationofLinearBlockandCyclicerrorcontrolcodingschemes
13. SimulationofConvolutionalcodingscheme
14. Communicationlinksimulation

TOTAL: 60 PERIODS

OUTCOMES:

Attheendofthecourse, thestudentshouldbeableto:

- Simulate&validatethevariousfunctionalmodulesofacommunicationsystem
- Demonstrate their knowledge in base band signaling schemes through implementation of digital modulation schemes
- Applyvariouschannelcodingschemes&demonstratetheircapabilitiestowardsthe improvement of the noise performance of communication system
- Simulateend-to-endcommunicationLink

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENEURSHIP**

SEMESTERV

20152L59 COMMUNICATIONNETWORKSLABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

Thestudentshouldbe made to:

- Learntocommunicatebetweentwodesktopcomputers
- Learntoimplementthedifferent protocols
- Befamiliar withIP Configuration
- Befamiliar withthevariousroutingalgorithms
- Befamiliarwithsimulationtools

LISTOFEXPERIMENTS:

1. ImplementationofErrorDetection/ErrorCorrectionTechniques
2. ImplementationofStopandWaitProtocolandslidingwindow
3. ImplementationandstudyofGoback-Nandselectiverepeatprotocols
4. ImplementationofHighLevelDataLinkControl
5. ImplementationofIPCommandssuchasping,Traceroute, nslookup.
6. ImplementationofIPaddressconfiguration.
7. Tocreate scenarioandstudythe performanceofnetworkwithCSMA/CAprotocolandcompare with CSMA/CD protocols.
8. NetworkTopology-Star, Bus,Ring
9. Implementationofdistancevectorroutingalgorithm
10. ImplementationofLinkstateroutingalgorithm
11. StudyofNetworksimulator(NS) andsimulationofCongestionControlAlgorithmsusing NS
12. ImplementationofEncryptionandDecryptionAlgorithmsusinganyprogramminglanguage

TOTAL: 60 PERIODS

OUTCOMES:

Attheendofthecourse, thestudentshouldbeableto:

- Communicatebetweentwodesktopcomputers
- Implementthedifferentprotocols
- Programusingsockets.
- Implementandcomparethevariousroutingalgorithms
- Usethesimulation tool.

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

SEMESTERV

20152CRM **RESEARCHMETHODOLOGY** **LTPC**
3003

AIM:

Tocreateabasicappreciationtowardsresearchprocessandawarenessofvariousresearch publication.

OBJECTIVES:

- Tounderstandthesteps inresearchprocessandthesuitablemethods.
- Toidentifyvariousresearchcommunicationsandtheirsalient features
- Tocarryoutbasicliteraturesurveyusingthecommon data-bases
- Togiveexposuretostandardlaboratoryprecautionsandbestpracticesfor experimentalwork
- Toprovideorientationfor basicmathematicalcomputationusefulinbasicresearch

OUTCOME:

Ability to carry out independent literature survey corresponding to the specific publication type and assess basic experimental as well as conceptual set up.

PREREQUISITES:

Basicmathematicalandexperimentalskillsandexposuretowindow-basedcomputeroperation system.

UNIT I

Introductionto Research– Definition, Objectives, Motivationandpurpose – types of research – Pureandapplied, survey, case study experimental, exploratory – Research Design – Steps in selection andformulation of research problem - Steps in research – Criteria of Good Research,Problems Encounteredby Researchers in India.

UNIT II

Research Problem:Definition of research problem, selecting the problem - Necessity of defining theproblem - Techniques involved in defining the problem - Research design - Needs and features of gooddesign - Different research design - Basic principles of experimental designs. Development of a researchplan, Formulation of Hypothesis – Sampling techniques –Sampling error and sample size. Literaturetypes- compendia and tables of information, Reviews, General treatises, Monographs.

UNIT III

Methods of data collection – Primary and secondary data – observation – interview –Questionnaire – Tools for questionnaire;surveying & literature survey, spreadsheets, Technical writing, Construction oftools for data collection – testing validity – pilot study and pre-testing, Survey vs Experiment, PracticalExercises. Collectionofliterature, manualcollectionfromlibrary, usageoflibrary, collectionofliteraturefrom Scopus, Science Direct etc., compiling literature, software utilization in literature collection.

UNIT IV

Processing and analysis of data – editing – coding – transcription – tabulation –outline of statisticalanalysis- Uncertainty, accuracy and precision- Mean value; standard deviation; error on the mean-Usinga spreadsheet for data analysis- Graphs and graph plotting-Least squares methods – descriptive statistics– elements of processing through computer- packages for analysis (Excel).

UNIT V

Reviewof literature, Report writing – target audience– types of reports –contents of reports –styles andConventionsinreporting–stepsindraftingareport.Basicconceptofresearchpaperwritingfor Journals

SKILL DEVELOPMENT **EMPLOYABILITY** **ENTREPRENEURSHIP**

andformatsofpublicationsinJournals, ReportStructure- writingresearchabstract -introduction, reviewof literature, result, conclusions, Concepts of Bibliography and references, Technical Presentation.

References:

1. C.R.Kothari,ResearchMethodology, NewAgeInternationalPublishers.NewDelhi, 2004.
2. Rajammal.P.Devadas,1976,Ahandbookofmethodologyofresearch,RMMVidyalayaPress.
3. R.ADayandA.L.Underwood,Quantitativeanalysis,PrenticeHall,1999.
4. R.Gopalan,Thesiswriting,VijayNicoleImprintsPrivateLtd., 2005.
5. W.J. DeCoursey,StatisticsandProbabilityfor EngineeringApplicationsWithMicrosoft®Excel, Newnes, 2003.
6. ArchibaldFripp, JonFripp, Michael Fripp; Just-in-TimeMathfor Engineers, Elsevier Science& Technology Books, 2003.

SEMESTERV

201AGIE **INNOVATIONANDENTREPRENEURSHIP** **LTPC**
0002

Module–I

IntroductiontoEntrepreneurship: Entrepreneurs;entrepreneurialpersonalityandintentions-characteristics, traits and behavioral; entrepreneurial challenges.

Module-II

Module Entrepreneurial Opportunities: Opportunities. discovery/ creation, Pattern identification andrecognition for venture creation: prototype and exemplar model, reverse engineering.

Module–III

Entrepreneurial Process and Decision Making: Entrepreneurial ecosystem, Ideation, developmentand exploitation of opportunities; Negotiation, decision making process and approaches**,** Effectuationand Causation.

Module-IV

Crafting business models and Lean Start-ups: Introduction to business models; Creating valuepropositions-conventional industrylogic, value innovationlogic; customer focused innovation; buildingandanalyzingbusiness models; Business modelcanvas, Introductiontoleanstartups,Business Pitching.

Module–V

Organizing Business and Entrepreneurial Finance: Forms of business organizations; organizationalstructures; Evolution of Organisation, sources and selection of venture finance options and itsmanagerial implications. PolicyInitiatives andfocus; roleof institutions inpromoting entrepreneurship.

COURSEOUTCOMES:

Afterthecompletionofthecourse, thestudentswillbeableto:

- Comprehendtheroleofboundedrationality,framing,causationandeffectuationinentrepreneurial decision making.
- Demonstrateanabilitytodesignabusiness modelcanvas.
- Evaluatethevarioussourcesofraisingfinancefor startupventures.
- Understandthefundamentalsofdevelopingandpresentingbusinesspitchingtopotential investors.

REFERENCES:

- Ries,Eric(2011),The leanStart-up:Howconstantinnovationcreatesradicallysuccessfulbusinesses, Penguin Books Limited.
- Blank,Steve(2013),TheStartupOwner’sManual:TheStepbyStepGuideforBuilding a Great Company, K&S Ranch.
- S. Carter and D. Jones-Evans, Enterprise and small business- Principal Practice and Policy,Pearson Education (2006)
- T.H.Byers,R.C.Dorf,A.Nelson,TechnologyVentures:FromIdeatoEnterprise,McGraw Hill (2013)
- Osterwalder,AlexandPigneur,Yves(2010)BusinessModelGeneration.
- Kachru,Upendra,IndiaLandofaBillionEntrepreneurs,Pearson
- Bagchi,Subroto,(2008),GoKisstheWorld:LifeLessonsfortheYoungProfessional,Portfolio Penguin
- Bagchi,Subroto,(2012).MBAAt16:aTeenager’sGuidetoBusiness,PenguinBooks
- Bansal,Rashmi,StayHungryStayFoolish,CIIE,IIMAhmedabad
- Bansal,Rashmi,(2013).FollowEveryRainbow,Westland.

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- Mitra,Sramana(2008),EntrepreneurJourneys(Volume1),BooksurgePublishing
- Abrams,R.(2006).Six-weekStart-up,Prentice-Hallof India.
- Verstraete,T.andLaffitte,E.J.(2011).aBusinessModelofEntrepreneurship,Edward Elgar Publishing.
- Johnson,Steven(2011).WhereGoodIdeascomesfrom,PenguinBooksLimited.
- Gabor,MichaelE.(2013),AwakeningtheEntrepreneurWithin,Primento.
- Guillebeau, Chris (2012), The $100 startup: Fire your Boss, Do what you love andworkbetter to live more, Pan Macmillan
- Kelley,Tom(2011),Thetenfacesofinnovation, CurrencyDoubleday
- Prasad,Rohit(2013),Start-upsutra:whatthe angelswon'ttellyouaboutbusinessandlife,Hachette India.

SEMESTER VI

20152C61 MICROPROCESSORSANDMICROCONTROLLERS

	L	TP	C
	3	00	3

OBJECTIVES:

- TounderstandtheArchitectureof8086 microprocessor.
- TolearnthedesignaspectsofI/OandMemoryInterfacingcircuits.
- Tointerfacemicroprocessorswithsupportingchips.
- TostudytheArchitectureof8051 microcontroller.
- Todesignamicrocontroller basedsystem

UNIT I THE8086 MICROPROCESSOR 9

Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation -Stacks - Procedures – Macros – Interruptsand interrupt serviceroutines – Byteand String Manipulation.

UNIT II 8086SYSTEMBUSSTRUCTURE 9

8086 signals – Basic configurations – System bus timing –System design using 8086 – I/O programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Coprocessor, Closelycoupledandlooselycoupled configurations – Introductiontoadvancedprocessors.

UNIT III I/OINTERFACING 9

Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – D/A and A/D Interface - Timer – Keyboard /display controller – Interrupt controller – DMA controller–ProgrammingandapplicationsCasestudies:TrafficLightcontrol,LEDdisplay,LCD display,KeyboarddisplayinterfaceandAlarmController.

UNIT IV MICROCONTROLLER 9

Architectureof8051 –SpecialFunctionRegisters(SFRs) -I/OPins PortsandCircuits – Instructionset -Addressing modes - Assembly language programming.

UNIT V INTERFACINGMICROCONTROLLER 9

Programming8051Timers-SerialPortProgramming-InterruptsProgramming–LCD&Keyboard Interfacing-ADC,DAC&SensorInterfacing-ExternalMemoryInterface-StepperMotorand Waveformgeneration-ComparisonofMicroprocessor,Microcontroller,PICandARMprocessors

TOTAL:45PERIODS

OUTCOMES:

Attheendofthecourse,thestudentsshouldbeableto:

- Understandandexecuteprograms basedon8086 microprocessor.
- DesignMemoryInterfacingcircuits.
- DesignandinterfaceI/O circuits.
- Designandimplement8051microcontrollerbasedsystems.

TEXTBOOKS:

1. Yu-Cheng Liu, Glenn A.Gibson, ―Microcomputer Systems: The 8086 / 8088 Family -Architecture, Programming and Design‖, Second Edition, Prentice Hall of India, 2007. (UNITI-III)
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, ―The 8051 Microcontroller and Embedded Systems: Using Assembly and C‖, Second Edition, Pearson education, 2011. (UNIT IV-V)

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REFERENCES:

1. DoughlasV.Hall,―MicroprocessorsandInterfacing,ProgrammingandHardware‖,TMH,2012
2. A.K.Ray,K.M.Bhurchandi,"AdvancedMicroprocessorsandPeripherals"3rd edition,Tata McGrawHill, 2012

SEMESTER VI

20152C62 VLSI DESIGN LTPC
3003

OBJECTIVES:

- StudythefundamentalsofCMOScircuitsandits characteristics.
- Learnthedesignandrealizationofcombinational&sequentialdigitalcircuits.
- Architecturalchoicesandperformancetradeoffsinvolvedindesigningandrealizingthe circuits in CMOS technology are discussed
- LearnthedifferentFPGAarchitecturesandtestabilityofVLSIcircuits.

UNIT I INTRODUCTIONTOMOSTRANSISTOR 9

MOS Transistor, CMOS logic, Inverter, Pass Transistor, Transmission gate, Layout Design Rules, GateLayouts, Stick Diagrams, Long-Channel I-V Charters tics, C-V Charters tics, Non ideal I-V Effects, DCTransfer characteristics, RC Delay Model, Elmore Delay, Linear Delay Model, Logical effort, ParasiticDelay, Delay in Logic Gate, Scaling.

UNIT II COMBINATIONALMOSLOGICCIRCUITS 9

Circuit Families: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits,Pass Transistor Logic, Transmission Gates, Domino, Dual Rail Domino, CPL, DCVSPG, DPL, CircuitPitfalls.

Power: DynamicPower,StaticPower,LowPowerArchitecture.

UNIT III SEQUENTIALCIRCUITDESIGN 9

StaticlatchesandRegisters,DynamiclatchesandRegisters,PulseRegisters,SenseAmplifierBasedRegister, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits.

TimingIssues: TimingClassificationOfDigitalSystem,SynchronousDesign.

UNIT IV DESIGNOFARITHMETICBUILDINGBLOCKSANDSUBSYSTEM 9

ArithmeticBuildingBlocks:DataPaths,Adders,Multipliers,Shifters,ALUs,powerandspeedtradeoffs, Case Study: Design as a tradeoff.

Designing Memory and Array structures: Memory Architectures and Building Blocks, Memory Core,Memory Peripheral Circuitry.

UNIT V IMPLEMENTATIONSTRATEGIESANDTESTING 9

FPGA Building Block Architectures, FPGA Interconnect Routing Procedures. Design for Testability: *AdHoc* Testing, Scan Design, BIST, IDDQ Testing, Design for Manufacturability, Boundary Scan.

TOTAL:45PERIODS

OUTCOMES:

UPONCOMPLETIONOFTHECOURSE,STUDENTSSHOULDbeABLETO

- RealizetheconceptsofdigitalbuildingblocksusingMOStransistor.
- DesigncombinationalMOScircuitsandpowerstrategies.
- DesignandconstructSequentialCircuitsandTimingsystems.
- Designarithmeticbuildingblocksandmemorysubsystems.
- Applyandimplement FPGAdesignflowand testing.

TEXTBOOKS:

1. Neil H.E. Weste, David Money Harris ―CMOS VLSI Design: A Circuits and Systems Perspective‖, 4th Edition, Pearson , 2017 (UNIT I,II,V)
2. JanM.Rabaey,AnanthaChandrakasan,Borivoje.Nikolic,‖DigitalIntegratedCircuits:A Design perspective‖, Second Edition , Pearson , 2016.(UNIT III,IV)

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

REFERENCES

1. M.J.Smith,―ApplicationSpecificIntegratedCircuits‖,AddissonWesley,1997
2. Sung-Mo kang, Yusuf leblebici, Chulwoo Kim ―CMOS Digital Integrated Circuits:Analysis & Design‖,4th edition McGraw Hill Education,2013
3. WayneWolf,―ModernVLSIDesign:SystemOnChip‖,PearsonEducation, 2007
4. R.Jacob Baker, Harry W.LI., David E.Boyee, ―CMOS Circuit Design, Layout andSimulation‖, Prentice Hall of India 2005.

SEMESTER VI

20152C63 WIRELESS COMMUNICATION

	L	T	P	C
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OBJECTIVES:

- Tostudythecharacteristicof wirelesschannel
- Tounderstandthedesignofacellularsystem
- Tostudythevariousdigitalsignalingtechniquesandmultipathmitigationtechniques
- Tounderstandtheconceptsof multipleantennatechniques

UNIT II CELLULARARCHITECTURE 9

Multiple Access techniques - FDMA, TDMA, CDMA – Capacity calculations–Cellular concept-Frequency reuse - channel assignment- hand off- interference & system capacity-trunking & grade ofservice – Coverage and capacity improvement.

UNITIIIDIGITALSIGNALING FORFADING CHANNELS 9

Structure of a wireless communication link, Principles of Offset-QPSK, p/4-DQPSK, Minimum ShiftKeying, Gaussian Minimum Shift Keying, Error performance in fading channels, OFDM principle – Cyclic prefix, Windowing, PAPR.

UNIT IV MULTIPATHMITIGATIONTECHNIQUES 9

Equalisation – Adaptive equalization, Linear and Non-Linear equalization, Zero forcing and LMSAlgorithms. Diversity – MicroandMacrodiversity, Diversitycombiningtechniques, Error probabilityinfading channels with diversity reception, Rake receiver.

UNIT V MULTIPLEANTENNATECHNIQUES 9

MIMOsystems – spatialmultiplexing-System model-Pre-coding-Beamforming-transmitter diversity,receiver diversity- Channel state information-capacity in fading and non-fading channels.

TOTAL: 45 PERIODS

OUTCOMES:

Thestudentshouldbeableto:

- Characterizeawireless channelandevolvethesystemdesignspecifications
- Designacellularsystembasedonresourceavailabilityandtrafficdemands
- Identifysuitablesignalingandmultipathmitigationtechniquesforthewirelesschanneland system under consideration.

TEXTBOOKS:

1. Rappaport,T.S., ―Wireless communications‖, PearsonEducation, SecondEdition,2010.(UNIT I, II, IV)
2. Andreas.F.Molisch,―WirelessCommunications‖,JohnWiley–India,2006.(UNITIII,V)

REFERENCES:

1. WirelessCommunication–AndreaGoldsmith,CambridgeUniversityPress, 2011
2. VanNee,R.andRamjiPrasad,―OFDMforwirelessmultimediacommunications, Artech House, 2000
3. David Tse and Pramod Viswanath,― Fundamentalsof Wireless Communication, Cambridge University Press, 2005.
4. UpenaDalal,―WirelessCommunication‖,OxfordUniversityPress,2009.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

SEMESTER VI

20152S64 PRINCIPLESOFMANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVE:

- ToenablethestudentstostudytheevolutionofManagement,tostudythefunctionsandprinciples of management and to learn the application of the principles in an organization.

UNIT I INTRODUCTIONTOMANAGEMENTANDORGANIZATIONS 9

DefinitionofManagement –Scienceor Art –Manager VsEntrepreneur -typesof managers - managerialroles and skills – Evolution of Management – Scientific, human relations, system and contingencyapproaches – Types of Business organization - Sole proprietorship, partnership, company-public andprivate sector enterprises - Organization culture and Environment – Current trends and issues inManagement.

UNIT II PLANNING 9

Natureandpurposeofplanning – planningprocess – types ofplanning– objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decisionmaking steps and process.

ment, selection, Training and Development, Performance Management, Career planning and management

UNIT IV DIRECTING 9

Foundations of individual and group behaviour – motivation – motivation theories – motivationaltechniques – job satisfaction – job enrichment – leadership – types and theories of leadership –communication – process of communication – barrier in communication – effective communication – communication and IT.

UNIT V CONTROLLING 9

Systemand process of controlling – budgetary and non-budgetary control techniques – use of computersand IT in Management control – Productivity problems and management – control and performance –direct and preventive control – reporting.

TOTAL:45PERIODS

OUTCOME:

- Uponcompletionofthecourse,studentswillbeabletohaveclearunderstanding
- Managerial functionslike planning,organizing,staffing,leading &controlling and havesame basic knowledge on international aspect of management

TEXTBOOKS:

1. Stephen P. Robbins & Mary Coulter, ―Management‖, Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009.
2. JAFStoner,FreemanR.EandDanielRGilbert―Management‖,PearsonEducation,6thEdition, 2004.

REFERENCES:

1. StephenA.Robbins&DavidA.Decenzo&MaryCoulter,―FundamentalsofManagement", Pearson Education, 7th Edition, 2011.
2. RobertKreitner&MamataMohapatra,―Management‖,Biztantra,2008.
3. HaroldKoontz&HeinzWeihrich―Essentialsofmanagement‖TataMcGrawHill,1998.
4. TripathyPC&ReddyPN,―PrinciplesofManagement‖,TataMcGrawHill, 1999.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

SEMESTER VI

20152C65 TRANSMISSIONLINESANDRFSYSTEMS **L T PC 3 0 0 3**

OBJECTIVES:

- Tointroducethevarioustypesoftransmissionlinesandits characteristics
- Togivethoroughunderstandingabouthighfrequencyline, power andimpedancemeasurements
- Toimparttechnicalknowledgeinimpedancematchingusingsmithchart
- Tointroducepassivefiltersandbasicknowledgeofactive RFcomponents
- TogetacquaintancewithRFsystemtransceiver design

UNIT I TRANSMISSIONLINETHEORY 9

General theory of Transmission lines - the transmission line - general solution - The infinite line - Wavelength, velocity of propagation - Waveform distortion - the distortion-less line - Loading anddifferent methods of loading - Line not terminated in Z0 - Reflection coefficient - calculation of current,voltage, power delivered and efficiency of transmission - Input and transfer impedance - Open and shortcircuited lines - reflection factor and reflection loss.

UNIT II HIGHFREQUENCYTRANSMISSIONLINES 9

Transmission line equations at radio frequencies - Line of Zero dissipation - Voltage and current on thedissipation-less line, StandingWaves, Nodes, Standing WaveRatio - Input impedance of thedissipation-less line - Open and short circuited lines - Power and impedance measurement on lines - Reflectionlosses - Measurement of VSWR and wavelength.

UNIT III IMPEDANCEMATCHINGINHIGHFREQUENCYLINES 9

Impedance matching: Quarter wavetransformer - Impedance matching by stubs - Singlestub and doublestub matching - Smithchart -Solutions of problems usingSmithchart -Singleanddoublestub matchingusing Smith chart.

UNIT IV WAVEGUIDES 9

General Wave behavior along uniform guiding structures – Transverse Electromagnetic Waves,Transverse Magnetic Waves, Transverse Electric Waves – TM and TE Waves between parallel plates.Field Equations in rectangular waveguides, TM and TE waves in rectangular waveguides, BesselFunctions, TM and TE waves in Circular waveguides.

UNIT V RFSYSTEMDESIGN CONCEPTS 9

Active RF components: Semiconductor basics in RF, bipolar junction transistors, RF field effecttransistors, High electron mobility transistors Basic concepts of RF design, Mixers, Low noiseamplifiers, voltage control oscillators, Power amplifiers, transducer power gain and stabilityconsiderations.

TOTAL:45PERIODS

OUTCOMES:

Uponcompletionofthecourse, thestudentshouldbeableto:

- Explainthecharacteristicsoftransmissionlinesandits losses
- Writeabout thestandingwaveratioandinput impedanceinhighfrequencytransmission lines
- Analyzeimpedancematchingbystubsusingsmithcharts
- Analyzethecharacteristics ofTEandTM waves
- DesignaRFtransceiversystemforwireless communication

TEXTBOOKS:

1. JohnDRyder,―Networks, linesandfields‖,2ndEdition,PrenticeHallIndia,2015. (UNIT I-IV)
2. MathewM. Radmanesh, ―RadioFrequency&MicrowaveElectronics‖, PearsonEducation Asia, Second Edition, 2002. (UNIT V)

SKILL DEVELOPMENT **EMPLOYABILITY** **ENTREPRENEURSHIP**

REFERENCES:

1. ReinholdLudwigandPowelBretchko,‖RFCircuitDesign–TheoryandApplications‖, Pearson Education Asia, First Edition,2001.
2. D.K.Misra,―RadioFrequencyandMicrowaveCommunicationCircuits-AnalysisandDesign‖, John Wiley & Sons, 2004.
3. E.C.JordanandK.G. Balmain, ―ElectromagneticWavesandRadiatingSystemsPrenticeHall of India, 2006.
4. G.S.N Raju, "Electromagnetic Field Theory and Transmission Lines Pearson Education, Firstedition 2005.

LISTOF ELECTIVES

ELECTIVE–II(SEMESTERVI)

ELECTIVE–II
SEMESTER VI

20152E66A CRYPTOGRAPHYANDNETWORKSECURITY **LTPC**
3003

OBJECTIVES:

- TounderstandCryptographyTheories,AlgorithmsandSystems.
- TounderstandnecessaryApproachesandTechniquestobuildprotection mechanisms in order to secure computer networks.

UNIT I INTRODUCTION 9
Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiplelevels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSIsecurity architecture – Classical encryption techniques: substitution techniques, transposition techniques,steganography).- Foundations of modern cryptography: perfect security – information theory – productcryptosystem – cryptanalysis.

[illegible]

UNIT III PUBLICKEYCRYPTOGRAPHY 9
MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes – Primality Testing – Factorization – Euler‘s totient function, Fermat‘s and Euler‘s Theorem - Chinese Remainder Theorem – Exponentiation and logarithm - ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution– Key management – Diffie Hellman key exchange - ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.

[illegible]

UNIT V SECURITYPRACTICEANDSYSTEMSECURITY 9
ElectronicMailsecurity–PGP,S/MIME–IPsecurity–WebSecurity-SYSTEMSECURITY:Intruders – Malicious software – viruses – Firewalls.

TOTAL: 45 PERIODS

OUTCOMES:
Attheendofthecourse, thestudentshouldbeableto:

- Understandthefundamentalsofnetworkssecurity,securityarchitecture,threatsand vulnerabilities
- Applythedifferentcryptographicoperationsofsymmetriccryptographicalgorithms
- Applythedifferentcryptographicoperationsofpublic keycryptography
- ApplythevariousAuthenticationschemestosimulatedifferentapplications.
- UnderstandvariousSecuritypracticesandSystemsecuritystandards

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

TEXTBOOK:

1. WilliamStallings, CryptographyandNetworkSecurity:PrinciplesandPractice, PHI3rdEdition, 2006.

REFERENCES:

1. C KShyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd
2. BehrouzA.Foruzan,CryptographyandNetworkSecurity,TataMcGrawHill2007.
3. CharlieKaufman,RadiaPerlman,andMikeSpeciner,NetworkSecurity:PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN 0-13-046019-2

ELECTIVE–II
SEMESTER VI

20152E66B ADVANCEDDIGITALSIGNALPROCESSING LTPC
3003

OBJECTIVES:

- Tolearnandunderstandtheconceptsofstationaryandnon-stationaryrandomsignalsand analysis & characterization of discrete-time random processes
- Toenunciatethesignificanceofestimationofpowerspectraldensityofrandomprocesses
- TointroducetheprinciplesofoptimumfilterssuchasWienerandKalmanfilters
- Tointroducetheprinciplesofadaptivefiltersandtheirapplicationstocommunication engineering
- Tointroducetheconceptsof multi-resolutionanalysis

UNIT I DISCRETE-TIMERANDOMPROCESSES 9
Random variables - ensemble averages a review, randomprocesses - ensemble averages, autocorrelationand autocovariance matrices, ergodic random process, white noise, filtering random processes, spectralfactorization, special types of random processes - AR, MA, ARMA

UNIT II SPECTRUMESTIMATION 10
Bias and consistency, Non-parametric methods - Periodogram, modified-Periodogram - performanceanalysis. Bartlett's method, Welch's method, Blackman-Tukey method. Performance comparison.Parametric methods -autoregressive(AR)spectrumestimation-autocorrelationmethod,Prony's method,solution using Levinson Durbin recursion.

Wiener filter - causalandnon-causalfilters. Recursiveestimators - discreteKalmanfilter.

UNIT IV ADAPTIVEFILTERS 9
Principles and properties of adaptive filters - FIR adaptive filters. Adaptive algorithms - steepest descentalgorithm, the LMS algorithm - convergence. Applications of adaptive filtering - noise cancellation,channel equalization.

UNIT V MULTIRESOLUTIONANALYSIS 8
Short-time Fourier transform - Heisenberg uncertainty principle. Principles of multi-resolution analysis - sub-band coding, the continuous and discrete wavelet transform - properties. Applications of wavelettransform - noise reduction, image compression.

TOTAL:45PERIODS

OUTCOMES:
Attheendofthecourse, thestudentshouldbeableto:

- Articulateandapplytheconceptsofspecialrandomprocessesinpracticalapplications
- Chooseappropriatespectrumestimationtechniquesfor a givenrandomprocess
- Applyoptimumfiltersappropriatelyfor a givencommunicationapplication
- Applyappropriateadaptivealgorithmfor processingnon-stationarysignals
- Applyandanalysewavelettransformsfor signalandimageprocessingbasedapplications

TEXTBOOKS

1. MonsonH. Hayes, "Statistical digitalsignalprocessingandmodeling", JohnWileyandSonsInc. New York, Indian reprint 2008. (UNIT I-IV)
2. P.P.Vaidyanathan,"Multiratesystemsandfilterbanks",PrenticeHallInc.1993(UNIT V)

SKILL DEVELOPMENT **EMPLOYABILITY** **ENTREPRENEURSHIP**

REFERENCES:

1. JohnG.Proakis&DimitrisG.Manolakis, ―DigitalSignalProcessing –Principles, Algorithms& Applications‖, Fourth Edition, Pearson Education / Prentice Hall, 2007.
2. SophonclesJ.Orfanidis,"Optimumsignalprocessing",McGrawHill,2000

ELECTIVE–II
SEMESTER VI

20152E66C **MEMS ANDNEMS** **LT PC**
30 03

OBJECTIVES:

- Tointroducetheconceptsofmicroandnanoelectromechanicaldevices
- Toknowthefabricationprocess of Microsystems
- Toknowthedesignconceptsofmicrosensorsandmicroactuators
- Tointroducetheconceptsofquantummechanicsandnanosystems

UNIT I INTRODUCTIONTOMEMSAND NEMS 9
Introduction to Design of MEMS and NEMS, Overview of Nano and Microelectromechanical Systems,Applications of Micro and Nanoelectromechanical systems, Materials for MEMS and NEMS: Silicon,silicon compounds, polymers, metals.

UNIT II MEMSFABRICATIONTECHNOLOGIES 9
Photolithography,IonImplantation,Diffusion,Oxidation,CVD,SputteringEtchingtechniques,Micromachining: Bulk Micromachining, Surface Micromachining, LIGA.

UNIT III MICROSENSORS 9
MEMSSensors:DesignofAcousticwave sensors,Vibratorygyroscope,Capacitive Pressure sensors,Case study: Piezoelectric energy harvester

UNIT IV MICROACTUATORS 9
Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuationusing piezoelectric crystals, Actuation using Electrostatic forces, Case Study:RF Switch.

UNIT V NANODEVICES 9
Atomic Structures and Quantum Mechanics, Shrodinger Equation, ZnO nanorods based NEMS device:Gas sensor.

TOTAL:45PERIODS

OUTCOMES:
Onsuccessfulcompletionofthiscourse, thestudentshouldbeableto:

- Interpretthebasicsofmicro/nanoelectromechanicalsystemsincludingtheirapplicationsand advantages
- Recognizetheuseofmaterialsinmicrofabricationanddescribethefabricationprocesses including surface micromachining, bulk micromachining and LIGA.
- Analyzethekeyperformanceaspectsofelectromechanicaltransducersincludingsensorsand actuators
- Comprehendthetheoreticalfoundationsof quantummechanicsandNanosystems

REFERENCES:

1. MarcMadou,―FundamentalsofMicrofabrication‖,CRCpress1997.
2. StephenD. Senturia,‖MicrosystemDesign‖,KluwerAcademicPublishers,2001
3. TaiRanHsu,‖MEMSandMicrosystemsDesignandManufacture‖,TataMcrawHill, 2002.
4. ChangLiu,―FoundationsofMEMS‖,PearsoneducationIndialimited,2006,
5. Sergey Edward Lyshevski, ―MEMS and NEMS: Systems, Devices, and Structures‖ CRC Press, 2002

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

ELECTIVE–II
SEMESTER VI

20152E66D MULTIMEDIACOMPRESSIONANDCOMMUNICATION

LTPC
3003

OBJECTIVES:
Thestudentshouldbemade:

- Tounderstandthecompressionschemesfor text, voice,imageandvideo
- TounderstandtheQoSissuesinmultimedia network
- Toknowthecommunicationprotocolsformultimedianetworking

UNIT II IMAGEANDVIDEOCOMPRESSION 9
Graphics Interchange format- Tagged image file format-Digitized documents- Digitized pictures-JPEG-Video Encoding-Motion estimation –Overview of H.263 and MPEG-2

UNIT IV GUARANTEEDSERVICEMODEL 10
BestEffortservicemodel–SchedulingandDroppingpolicies–NetworkPerformanceParameters – QualityofServiceandmetrics–WFQanditsvariants–RandomEarlyDetection– QoSawareRouting – AdmissionControl–ResourceReservation–RSVP-TrafficShapingAlgorithms–Caching –Laissez FaireApproach-PossibleArchitectures–AnOverviewofQoS Architectures

UNIT V MULTIMEDIACOMMUNICATION 10
Stream characteristics for Continuous media – Temporal Relationship – Object Stream Interactions,Media Levity, Media Synchronization – Models for Temporal Specifications – Streaming of Audio andVideo – Jitter – Fixed playout and Adaptive playout – Recovering from packet loss – RTSP –– Multimedia Communication Standards – RTP/RTCP – SIP and H.263

TOTAL:45PERIODS

OUTCOMES:
Attheendofthecourse, thestudentshouldbeableto:

- Designaudiocompressiontechniques
- ConfigureText, imageandvideocompressiontechniques
- Selectsuitableservicemodelforspecificapplication
- Configuremultimediacommunicationnetwork

TEXTBOOK:

1. Fred Halsall, ―Multimedia communication- Applications, Networks, Protocols and Standards‖, Pearson education, 2007.

REFERENCES

1. TayVaughan, ―MultimediaMakingitwork**,** McGraw-HillOsborneMedia,2006.
2. Kurose andW.Ross,―ComputerNetworking ―ATopDownApproach,Pearsoneducation, 3rd ed, 2005.
3. KR. Rao,Z S Bojkovic, D A Milovanovic, ―Multimedia Communication Systems: Techniques, Standards, and Networks‖, Pearson Education 2007

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

4. R.Steimnetz,K.Nahrstedt,―MultimediaComputing,CommunicationsandApplications‖, Pearson Education, First ed, 1995.
5. NalinKSharda,‗MultimediaInformationNetworking',PrenticeHallofIndia,1999
6. AuraGanz,ZviGanzandKittiWongthawaravat,‗MultimediaWirelessNetworks:Technologies, Standards and QoS', Prentice Hall, 2003.
7. EllenKayataWesel,‗WirelessMultimediaCommunications:NetworkingVideo,Voiceand Data', Addision Wesley, 1998

ELECTIVE–II
SEMESTER VI

20152E66E **CMOSANALOGICDESIGN** **LTPC**
3003

OBJECTIVES:

- TostudythefundamentalsofanalogcircuitsandMOSdevicemodels
- TogainknowledgeonvariousconfigurationsofMOStransistorsandfeedbackconcepts
- Tostudythecharacteristics ofnoiseandfrequencyresponseoftheamplifier
- TolearntheconceptsofOp-Ampfrequencycompensation,capacitorswitchesandPLLs

UNIT I INTRODUCTIONTOANALOGICDESIGNANDCURRENTMIRRORS 9
ConceptsofAnalogDesign-GeneralconsiderationofMOSdevices–MOSI/VCharacteristics–Second order effects – MOS device models. Basic current mirrors- Cascode current mirrors- Activecurrentmirrors-LargeandSmallsignalanalysis-Commonmodeproperties.

UNIT II AMPLIFIERSANDFEEDBACK 9
Basic Concepts – Common source stage- Source follower- Common gate stage- Cascode stage. Singleended and differential operation- Basic Differential pair- Common mode response-Differential pair withMOS loads- Gilbert Cell. Feedback- General Consideration of feedback circuits- Feedback topologies-Effect of loading- Effect of feedback on Noise.

UNITIIIFREQUENCYRESPONSEOFAMPLIFIERSAND NOISE 9
General considerations- Miller Effect and Association of Poles with Nodes, Common source stage- Sourcefollowers- Common gatestage- Cascodestage- Differential pair. Noise- Statistical characteristicsof noise- Types of noise- Representation of noise in circuits- Noise in single stage amplifiers- Noise indifferential pairs- Noise Bandwidth.

UNIT IV OPERATIONALAMPLIFIERSTABILITYANDFREQUENCY COMPENSATION 9
General Considerations- One and Two Stage Op Amps- Gain Boosting- Comparison- Common modefeedback- Input range limitations- Slew rate- Power Supply Rejection- Noise in Op Amps- Generalconsideration of stability and frequency compensation- Multipole system- Phase margin- Frequencycompensation- Compensation of two stage op Amps- Other compensation techniques.

UNIT V SWITCHEDCAPACITORCIRCUITSANDPLLS 9
General Considerations- Sampling switches- Switched Capacitor Amplifiers- Switched CapacitorIntegrator- Switched Capacitor Common mode feedback. Phase Locked Loops-Simple PLL- Chargepump PLLs - Non ideal Effects in PLLs- Delay locked loops- its Applications.

TOTAL:45PERIODS

OUTCOMES:
Uponcompletionofthecourse, studentshouldbeableto:

- RealizetheconceptsofAnalogMOSdevicesandcurrentmirrorcircuits.
- DesigndifferentconfigurationofAmplifiersandfeedbackcircuits.
- Analyzethecharacteristicsoffrequencyresponseoftheamplifierandits noise.
- Analyzetheperformanceofthestabilityandfrequencycompensationtechniques ofOp-Amp Circuits.
- ConstructswitchedcapacitorcircuitsandPLLs

TEXTBOOK:

1.BehzadRazavi, ―Designof AnalogCMOSIntegratedCircuits‖,TataMcGrawHill, 2001, 33rd re-print, 2016.

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

REFERENCES:

1. Phillip AllenandDouglasHolmberg―CMOSAnalogCircuitDesign‖SecondEdition,Oxford University Press, 2004.
2. PaulR.Gray,PaulJ. Hurst,StephenH. Lewis, RobertG. Meyer, AnalysisandDesignof Analog Integrated Circuits, 5th Edition, Wiley, 2009
3. Grebene,―BipolarandMOSAnalogIntegratedcircuit design‖,JohnWiley&sons,Inc.,2003

ELECTIVE–II
SEMESTER VI

20152E66F **WIRELESS NETWORKS** **LTPC**
3003

OBJECTIVES:
Thestudentshouldbemade:

- TounderstandtheconceptaboutWirelessnetworks, protocolstackandstandards
- Tounderstandandanalysethenetworklayer solutionsforWirelessnetworks
- Tostudyaboutfundamentalsof3GServices,itsprotocolsandapplications
- TohaveindepthknowledgeoninternetworkingofWLANandWWAN
- Tolearnaboutevolutionof4GNetworks,itsarchitectureandapplications

UNITI WIRELESSLAN 9
Introduction-WLANtechnologies:-IEEE802.11:Systemarchitecture,protocolarchitecture,802.11b, 802.11a–HiperLAN:WATM,BRAN,HiperLAN2–Bluetooth:Architecture,WPAN–IEEE802.15.4, Wireless USB, Zigbee, 6LoWPAN, WirelessHART

UNIT II MOBILENETWORKLAYER 9
Introduction - Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6-Network layer in the internet- Mobile IP session initiation protocol - mobile ad-hoc network: Routing:Destination Sequence distance vector, IoT: CoAP

UNIT III 3GOVERVIEW 9
Overview of UTMSTerrestrial Radio access network-UMTS Core network Architecture: 3GPPArchitecture,Userequipment,CDMA2000overview-RadioandNetworkcomponents,Networkstructure, Radio Network, TD-CDMA, TD – SCDMA.

UNITIVINTERNETWORKINGBETWEENWLANSANDWWANS 9
Internetworking objectives and requirements, Schemes to connect WLANS and 3G Networks, SessionMobility, Internetworking Architecture for WLAN and GPRS, System Description, Local MultipointDistribution Service, Multichannel Multipoint Distribution System.

UNIT V 4G&Beyond 9
Introduction – 4G vision – 4G features and challenges - Applications of 4G – 4G Technologies:Multicarrier Modulation, Smart antenna techniques, IMS Architecture, LTE, Advanced BroadbandWireless Access and Services, MVNO.

TOTAL:45PERIODS

OUTCOMES:

Uponcompletionofthecourse, thestudentwouldbeableto:

- Conversantwiththelatest3G/4Gnetworksandits architecture
- Design andimplementwirelessnetworkenvironmentforany application usinglatestwireless protocols and standards
- Abilitytoselectthesuitablenetworkdependingontheavailabilityandrequirement
- Implementdifferenttypeofapplicationsforsmartphonesandmobiledeviceswithlatestnetwork strategies

TEXTBOOKS:

1. JochenSchiller,‖MobileCommunications‖,SecondEdition,PearsonEducation 2012.(Unit I,II,III)
2. Vijay Garg, ―WirelessCommunicationsand networking‖,First Edition,Elsevier2007.(Unit IV,V)

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENEURSHIP**

REFERENCES:

1. ErikDahlman, StefanParkvall, JohanSkoldandPer Beming, "3G EvolutionHSPAandLTE for Mobile Broadband‖, Second Edition, Academic Press, 2008.
2. AnuragKumar,D.Manjunath,Joykuri,―WirelessNetworking‖,FirstEdition,Elsevier2011.
3. Simon Haykin , Michael Moher, David Koilpillai, ―Modern Wireless Communications‖, FirstEdition, Pearson Education 2013

ELECTIVE–II
SEMESTER VI

20152E66G INTELLECTUALPROPERTYRIGHTS LTPC
3003

OBJECTIVE:

- Togiveanideaabout IPR,registrationanditsenforcement.

UNIT I INTRODUCTION 9
Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights,Geographical Indications, IPR in India and Abroad – Genesis and Development – the way fromWTO toWIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventionsand Innovations – Important examples of IPR.

UNIT II REGISTRATIONOFIPRs 10
Meaningandpracticalaspectsofregistrationof CopyRights,Trademarks,Patents,GeographicalIndications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III AGREEMENTSANDLEGISLATIONS 10
InternationalTreatiesandConventionsonIPRs,TRIPSAgreement, PCT Agreement, Patent Act ofIndia,Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV DIGITALPRODUCTSANDLAW 9
Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital ContentProtection– Unfair Competition–MeaningandRelationshipbetween Unfair CompetitionandIP Laws –Case Studies.

UNIT V ENFORCEMENTOFIPRs 7
InfringementofIPRs,EnforcementMeasures,Emergingissues–CaseStudies.

TOTAL:45PERIODS

OUTCOME:

- Abilityto manageIntellectualPropertyportfoliotoenhancethevalueofthefirm.

TEXTBOOKS:

1. V.ScopleVinod,ManagingIntellectualProperty,PrenticeHallofIndiapvtLtd,2012
2. S.V.Satakar,―IntellectualPropertyRightsandCopyRights, EssEssPublications, NewDelhi, 2002.

REFERENCES:

1. DeborahE. Bouchoux, ―IntellectualProperty:TheLawof Trademarks, Copyrights, Patents and Trade Secrets‖, Cengage Learning, Third Edition, 2012.
2. PrabuddhaGanguli,‖IntellectualPropertyRights:UnleashingtheKnowledgeEconomy‖,McGraw Hill Education, 2011.
3. EditedbyDerekBosworthandElizabethWebster,TheManagementofIntellectualProperty, Edward Elgar Publishing Ltd., 2013.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

SEMESTER VI

20152L61 MICROPROCESSORSANDMICROCONTROLLERSLABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- ToIntroduceALPconcepts, featuresandCoding methods
- WriteALPfor arithmeticandlogicaloperationsin8086and8051
- DifferentiateSerialandParallelInterface
- InterfacedifferentI/OswithMicroprocessors
- BefamiliarwithMASM

LISTOFEXPERIMENTS:

8086Programsusing kitsandMASM

1. BasicarithmeticandLogicaloperations
2. Moveadata blockwithoutoverlap
3. Codeconversion, decimalarithmeticandMatrix operations.
4. Floatingpointoperations,stringmanipulations,sortingandsearching
5. Passwordchecking, PrintRAMsizeandsystemdate
6. CountersandTimeDelay

PeripheralsandInterfacingExperiments

1. Trafficlightcontroller
2. Steppermotorcontrol
3. Digitalclock
4. KeyboardandDisplay
5. Printerstatus
6. SerialinterfaceandParallelinterface
7. A/DandD/AinterfaceandWaveformGeneration

8051ExperimentsusingkitsandMASM

1. BasicarithmeticandLogicaloperations
2. SquareandCubeprogram,Find2‘scomplementofanumber
3. UnpackedBCDtoASCII

TOTAL:60PERIODS

OUTCOMES:

Attheendofthecourse,thestudentshouldbeableto:

- WriteALPProgrammesfor fixedandFloatingPointandArithmeticoperations
- InterfacedifferentI/Oswithprocessor
- GeneratewaveformsusingMicroprocessors
- ExecuteProgramsin8051
- ExplainthedifferencebetweensimulatorandEmulator

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

20152L62 **VLSIDESIGNLABORATORY** **SEMESTER VI**

L	T	P	C
0	0	4	2

OBJECTIVES:

Thestudentshouldbemade:

- TolearnHardwareDescriptiveLanguage(Verilog/VHDL)
- TolearnthefundamentalprinciplesofVLSIcircuit designindigitalandanalogdomain
- Tofamiliarizefusingof logicalmodulesonFPGAs
- Toprovidehandsondesignexperiencewithprofessionaldesign(EDA)platforms

LISTOFEXPERIMENTS:

PartI:DigitalSystemDesignusingHDL &FPGA (24Periods)

1. DesignanAdder(Min8Bit)usingHDL.SimulateitusingXilinx/AlteraSoftwareandimplement by Xilinx/Altera FPGA
2. DesignaMultiplier(4BitMin)usingHDL.SimulateitusingXilinx/AlteraSoftwareandimplement by Xilinx/Altera FPGA
3. DesignanALUusingHDL.SimulateitusingXilinx/AlteraSoftwareandimplementbyXilinx/Altera FPGA
4. DesignaUniversalShiftRegisterusingHDL.SimulateitusingXilinx/AlteraSoftwareandimplement by Xilinx/Altera FPGA
5. DesignFiniteStateMachine(Moore/Mealy)usingHDL.SimulateitusingXilinx/AlteraSoftware and implement by Xilinx/Altera FPGA
6. DesignMemoriesusingHDL.SimulateitusingXilinx/AlteraSoftwareandimplementbyXilinx/Altera FPGA

Comparepresynthesisandpostsynthesissimulationfor experiments1to6.

Part-IIDigitalCircuitDesign (24Periods)

7. Designandsimulatea CMOSinverterusingdigitalflow
8. Designandsimulatea CMOS BasicGates&Flip-Flops
9. Designandsimulatea 4-bitsynchronouscounter usingaFlip-Flops

Manual/Automatic Layout Generation and Post Layout Extraction for experiments 7 to 9Analyze the power, area and timing for experiments 7 to 9 by performing Pre Layout and PostLayout Simulations.

Part-IIIAnalogCircuitDesign (12Periods)

10. DesignandSimulateaCMOSInvertingAmplifier.
11. DesignandSimulatebasicCommonSource, CommonGateandCommonDrainAmplifiers.

Analyze the input impedance, output impedance, gain and bandwidth for experiments 10 and 11by performing Schematic Simulations.
Designandsimulatesimple5transistordifferentialamplifier.AnalyzeGain,BandwidthandCMRR by performing Schematic Simulations.

TOTAL:60PERIODS

OUTCOMES:

Attheendofthecourse,thestudentshouldbeableto:

- WriteHDLcodefor basicaswellasadvanceddigitalintegratedcircuit
- ImportthelogicmodulesintoFPGABoards
- SynthesizePlaceandRoutethedigitalIPs
- Design,SimulateandExtractthelayoutsofDigital&AnalogICBlocksusingEDAtools

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

SEMESTER VI

20152L63 PROFESSIONALCOMMUNICATION

L	T	P	C
0	0	2	1

OBJECTIVES:

Thecourseaimsto:

- EnhancetheEmployabilityandCareerSkillsofstudents
- Orientthestudentstowardsgroomingasaprofessional
- MakethemEmployableGraduates
- Developtheir confidenceandhelpthemattendinterviewssuccessfully.

UNIT I

Introduction to Soft Skills-- Hard skills & soft skills -employability and career Skills—Grooming as aprofessional with values—Time Management—General awareness of Current Affairs

UNIT II

Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minutepresentations

UNIT III

IntroductiontoGroup Discussion— Participatingingroup discussions – understanding group dynamics - brainstorming the topic — questioning and clarifying –GD strategies- activities to improve GD skills

UNIT IV

Interview etiquette– dress code– bodylanguage– attendingjob interviews– telephone/skypeinterview -one to one interview &panel interview – FAQs related to job interviews

UNIT V

Recognizing differences between groups and teams- managing time-managing stress-networkingprofessionally- respecting social protocols-understanding career management-developing a long-termcareer plan-making career changes

TOTAL: 30 PERIODS

OUTCOMES:

AttheendofthecourseLearnerswillbeableto:

- Makeeffectivepresentations
- ParticipateconfidentlyinGroup Discussions.
- Attendjobinterviewsandbesuccessfulinthem.
- DevelopadequateSoftSkillsrequiredfor theworkplace

RecommendedSoftware

1. Globearena
2. WinEnglish

REFERENCES:

1. Butterfield,JeffSoftSkillsforEveryone.CengageLearning:NewDelhi,2015
2. E.SureshKumaretal.CommunicationforProfessionalSuccess.OrientBlackswan: Hyderabad, 2015
3. InteractEnglishLabManualforUndergraduateStudents,.OrientBalckSwan:Hyderabad,2016.
4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
5. S.Hariharanetal.SoftSkills.MJPPublishers:Chennai,2010.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

SEMESTER VII

20152C71 ANTENNASANDMICROWAVEENGINEERING

LTPC
3003

OBJECTIVES:

- Toenablethestudent tounderstandthebasicprinciplesinantennaandmicrowavesystemdesign
- Toenhancethestudentknowledgeintheareaofvariousantennadesigns.
- Toenhancethestudentknowledgeintheareaofmicrowavecomponentsandantennafor practical applications.

UNIT III ANTENNAARRAYSANDAPPLICATIONS 9

Two-element array, Array factor, Pattern multiplication, Uniformly spaced arrays with uniformand non-uniform excitation amplitudes, Smart antennas.

UNITIVPASSIVE ANDACTIVEMICROWAVEDEVICES 9

Microwave Passive components: Directional Coupler, Power Divider, Magic Tee, attenuator, resonator,Principles of Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrierdiodes, PIN diodes, Microwave tubes: Klystron, TWT, Magnetron.

UNIT V MICROWAVEDESIGNPRINCIPLES 9

Impedance transformation, Impedance Matching, Microwave Filter Design, RF and MicrowaveAmplifier Design, Microwave Power amplifier Design, Low Noise Amplifier Design, Microwave MixerDesign, Microwave Oscillator Design

TOTAL: 45 PERIODS

OUTCOMES:

Thestudentshouldbeableto:

- Applythebasicprinciplesandevaluateantenna parametersandlinkpowerbudgets
- Designandassesstheperformanceofvariousantennas
- Designamicrowavesystemgiventheapplicationspecifications

TEXTBOOKS:

1. JohnDKrauss,RonaldJMarhefkaandAhmadS.Khan,"AntennasandWavePropagation: Fourth Edition, Tata McGraw-Hill, 2006. (UNIT I, II, III)
2. DavidM.Pozar,"MicrowaveEngineering",FourthEdition,WileyIndia,2012.(UNIT I,IV,V)

REFERENCES:

1. ConstantineA.Balanis, ―Antenna TheoryAnalysisandDesign‖,Thirdedition,JohnWileyIndia Pvt Ltd., 2005.
2. R.E.Collin,"Foundationsfor MicrowaveEngineering", SecondEdition,IEEEPress,2001.

SEMESTER VII

20152C72 **OPTICALCOMMUNICATION**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study about the various optical fiber modes, configuration and transmission characteristics of optical fibers
- Tolearnaboutthevariousopticalsources, detectorsandtransmissiontechniques
- Toexplorevariousideaaboutopticalfibermeasurementsandvariouscouplingtechniques
- Toenrichtheknowledgeaboutopticalcommunicationsystemsandnetworks

UNIT I INTRODUCTIONTOOPTICALFIBERS 9

Introduction-general optical fiber communication system- basic optical laws and definitions-opticalmodes and configurations -mode analysis for optical propagation through fibers-modes in planar waveguide-modes in cylindrical optical fiber-transverse electric and transverse magnetic modes-fibermaterials-fiber fabrication techniques-fiber optic cables-classification of optical fiber-single mode fiber-graded index fiber.

UNIT II TRANSMISSIONCHARACTERISTICOFOPTICALFIBER 9

Attenuation-absorption --scattering losses-bending losses-core and cladding losses-signal dispersion –inter symbol interference and bandwidth-intra model dispersion-material dispersion-waveguidedispersion-polarization mode dispersion-intermodal dispersion-dispersion optimization of single modefiber-characteristics of single mode fiber-R-I Profile-cutoff wave length-dispersion calculation-modefield diameter.

UNIT III OPTICALSOURCESANDDETECTORS 9

Sources: Intrinsic and extrinsic material-direct and indirect band gaps-LED-LED structures-surfaceemittingLED-EdgeemittingLED-quantumefficiency andLED power-light sourcematerials-modulationof LED-LASER diodes-modes and threshold conditions-Rate equations-external quantum efficiency-resonant frequencies-structures andradiationpatterns-single mode laser-external modulation-temperatureeffort.

Detectors:PIN photodetector-Avalanchephotodiodes-Photodetector noise-noisesources-SNR-detectorresponse time-Avalanche multiplication noise-temperature effects-comparisons of photo detectors.

UNIT IV OPTICALRECEIVER,MEASUREMENTSANDCOUPLING 9

Fundamental receiver operation-preamplifiers-digital signal transmission-error sources-Front endamplifiers-digital receiver performance-probability of error-receiver sensitivity-quantum limit. Opticalpower measurement-attenuation measurement-dispersion measurement- Fiber Numerical ApertureMeasurements- Fiber cut- off Wave lengthMeasurements- Fiber diameter measurements-SourcetoFiberPower Launching-Lensing Schemes for Coupling Management-Fiber to Fiber Joints-LED Coupling toSingle Mode Fibers-Fiber Splicing-Optical Fiber connectors.

UNIT V OPTICALCOMMUNICATIONSYSTEMSANDNETWORKS 9

System design consideration Point – to –Point link design –Link power budget –rise time budget, WDM–Passive DWDM Components-Elements of optical networks-SONET/SDH-Optical Interfaces-SONET/SDH Rings and Networks-High speed light wave Links-OADM configuration-OpticalETHERNET-Soliton.

TOTAL:45PERIODS

OUTCOMES:

Attheendofthecourse, thestudentshouldbeableto:

- Realizebasicelementsinopticalfibers,differentmodesandconfigurations.
- Analyzethetransmissioncharacteristicsassociatedwithdispersionandpolarization techniques.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

- Designopticalsourcesanddetectorswiththeiruse inopticalcommunication system.
- Constructfiberopticreceiversystems,measurementsandcouplingtechniques.
- Designopticalcommunicationsystemsandits networks.

TEXTBOOKS:

1. P Chakrabarti, "Optical Fiber Communication‖, McGraw Hill Education (India) Private Limited**,** 2016 (UNIT I, II, III)
2. GerdKeiser,"OpticalFiberCommunication‖,McGrawHillEducation(India)Private Limited. Fifth Edition, Reprint 2013. (UNIT I, IV, V)

REFERENCES:

1. JohnM.Senior,**―**Opticalfibercommunication‖,PearsonEducation,SecondEdition.2007.
2. RajivRamaswami,**―**OpticalNetworks**―**,SecondEdition,Elsevier, 2004.
3. J.Gower,**―**OpticalCommunicationSystem‖,PrenticeHallofIndia, 2001.
4. Govind P. Agrawal, **―**Fiber-optic communication systems‖, third edition, John Wiley & Sons, 2004.

SEMESTER VII

20152C73 EMBEDDEDANDREALTIMESYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

Thestudentshouldbe made to:

- Understandtheconceptsofembeddedsystemdesignandanalysis
- LearnthearchitectureandprogrammingofARMprocessor
- Beexposedtothebasicconceptsofembeddedprogramming
- Learntherealtimeoperatingsystems

UNIT I INTRODUCTIONTOEMBEDDEDSYSTEMDESIGN 9

Complex systems and micro processors– Embedded system design process –Design example: Modeltrain controller- Design methodologies- Design flows - Requirement Analysis – Specifications-Systemanalysis andarchitecturedesign – Quality Assurancetechniques -Designing withcomputingplatforms –consumer electronics architecture – platform-level performance analysis.

UNIT II ARMPROCESSORANDPERIPHERALS 9

ARMArchitectureVersions–ARMArchitecture–InstructionSet–Stacksand Subroutines –Features of the LPC 214X Family – Peripherals – The Timer Unit – Pulse Width Modulation Unit –UART – Block Diagram of ARM9 and ARM Cortex M3 MCU.

UNIT III EMBEDDEDPROGRAMMING 9

Components for embeddedprograms- Models of programs- Assembly, linkingandloading – compilationtechniques- Program level performance analysis – Software performance optimization – Program levelenergy and power analysis and optimization – Analysis and optimization of program size-Programvalidation and testing.

UNIT IV REALTIMESYSTEMS 9

Structure of a Real Time System — Estimating program run times – Task Assignment and Scheduling – Fault Tolerance Techniques – Reliability, Evaluation – Clock Synchronisation.

UNIT V PROCESSESANDOPERATINGSYSTEMS 9

Introduction – Multiple tasks and multiple processes –Multirate systems- Preemptive real time operatingsystems- Priority based scheduling- Interprocess communication mechanisms – Evaluating operatingsystemperformance-power optimizationstrategiesfor processes –ExampleRealtime operatingsystems-POSIX-Windows CE. - Distributedembeddedsystems – MPSoCsandshared memory multiprocessors. –Design Example - Audio player, Engine control unit – Video accelerator.

TOTAL: 45 PERIODS

OUTCOMES:

Attheendofthecourse, thestudentshouldbeableto:

- DescribethearchitectureandprogrammingofARMprocessor
- Outlinetheconceptsof embeddedsystems
- Explainthebasicconceptsofrealtimeoperatingsystemdesign
- Modelreal-timeapplicationsusingembedded-systemconcepts

TEXTBOOKS:

1. MarilynWolf,―ComputersasComponents-PrinciplesofEmbeddedComputingSystem
2. Design‖,ThirdEdition―MorganKaufmannPublisher(AnimprintfromElsevier),2012. (UNIT I, II, III, V)
3. JaneW.S.Liu,‖RealTimeSystems‖, PearsonEducation,ThirdIndianReprint, 2003. (UNIT IV)

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

REFERENCES:

1. LylaB.Das,—EmbeddedSystems:AnIntegratedApproach‖PearsonEducation,2013.
2. Jonathan W.Valvano,—EmbeddedMicrocomputerSystemsRealTimeInterfacing‖,Third Edition Cengage Learning, 2012.
3. David.E.Simon,—AnEmbeddedSoftwarePrimer‖,1stEdition,FifthImpression,Addison Wesley Professional, 2007.
4. Raymond J.A. Buhr, Donald L.Bailey, —An Introduction to Real-Time Systems- From Designto Networking with C/C++‖, Prentice Hall, 1999.
5. C.M.Krishna,KangG.Shin,—Real-TimeSystems‖,InternationalEditions,McGrawHill1997
6. K.V.K.K.Prasad,—EmbeddedReal-TimeSystems: Concepts, Design & Programming‖, Dream Tech Press, 2005.
7. Sriram V Iyer, Pankaj Gupta, —Embedded Real Time SystemsProgramming‖, TataMc GrawHill, 2004.

LISTOFOPENELECTIVES

OPENELECTIVE–II(SEMESTERVII)

OPENELECTIVE–II
SEMESTER VII

20150OE74A INTRODUCTIONTO CPROGRAMMING LTPC
3003

OBJECTIVES:

- TodevelopCProgramsusingbasicprogrammingconstructs
- TodevelopCprogramsusingarraysandstrings
- TodevelopapplicationsinCusingfunctionsandstructures

UNIT I INTRODUCTION 9
Structure of C program –Basics: Data Types –Constants –Variables -Keywords –Operators:Precedence and Associativity -Expressions -Input/Output statements, Assignment statements –Decision-making statements -Switch statement -Looping statements –Pre-processor directives -Compilationprocess –ExercisePrograms:Checkwhether therequiredamount canbewithdrawnbasedon the available amount –Menu-driven program to find the area of different shapes –Find the sum ofeven numbers

UNIT II ARRAYS 9
Introduction to Arrays –One dimensional arrays: Declaration –Initialization -Accessing elements –Operations: Traversal, Insertion, Deletion, Searching -Two dimensional arrays: Declaration –Initialization -Accessing elements –Operations: Read –Print –Sum –Transpose –Exercise Programs:Print the number of positive and negativevalues present in the array –Sort the numbers using bubblesort -Find whether the given is matrix is diagonal or not.

UNIT III STRINGS 9
Introduction to Strings -Reading and writing a string -String operations (without using built-in stringfunctions): Length –Compare –Concatenate –Copy –Reverse –Substring –Insertion –Indexing –Deletion –Replacement –Array of strings –Introduction to Pointers –Pointer operators –Pointerarithmetic -Exercise programs: To find the frequency of a character in a string -To find the number ofvowels, consonants and white spaces in a given text –Sorting the names.

UNIT IV FUNCTIONS 9
Introduction to Functions –Types: User-defined and built-in functions -Function prototype -Functiondefinition -Function call -Parameter passing: Pass by value -Pass by reference -Built-in functions(string functions) –Recursive functions –Exercise programs: Calculate the total amount of powerconsumed by „n" devices (passing an array toa function) –Menu-driven programto count thenumberswhicharedivisibleby3, 5 andbyboth(passinganarraytoa function)–Replacethepunctuations froma given sentence by the space character (passing an array to a function)

UNIT V STRUCTURES 9
Introduction to structures –Declaration –Initialization –Accessing the members –Nested Structures –Array of Structures –Structures and functions –Passing an entire structure –Exercise programs:Computetheageofa personusingstructureandfunctions (passinga structuretoa function) –Computethe number of days an employee came late to the office by considering his arrival time for 30 days(Use array of structures and functions)

TOTAL:45PERIODS

OUTCOMES:
Uponcompletionofthiscourse, thestudentswillbe ableto:

- Developsimpleapplicationsusingbasicconstructs
- Developapplicationsusingarraysandstrings
- Developapplicationsusingfunctionsandstructures

TEXTBOOK:

1. ReemaThareja,"ProgramminginC",OxfordUniversityPress,SecondEdition,2016.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

REFERENCES:

1. Kernighan, B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2006.
2. PaulDeitelandHarveyDeitel,“CHowtoProgram”,Seventhedition,PearsonPublication.
3. Juneja,B.LandAnitaSeth,“ProgramminginC”,CENGAGELearningIndiapvt.Ltd.,2011.
4. PradipDey,ManasGhosh,“FundamentalsofComputingandProgramminginC”,First Edition, Oxford University Press, 2009.

20150OE74B DATASTRUCTURESANDALGORITHMS LTPC
3003

OBJECTIVES:

- Tounderstandthevariousalgorithmdesignandanalysis techniques.
- Tolearnlineardatastructures–lists, stacks,andqueues.
- Tolearndifferentsortingandsearchingalgorithms.
- TounderstandTreeandGraphdatastructures.

UNITIIS TACKSAND QUEUES 7
StackADT -Applications -Evaluatingarithmeticexpressions-ConversionofInfix toPostfix-Recursion.Queue ADT –Priority Queue -applications of queues. Implementation of Stack ADT and palindromechecking using C. Implementation of Queue operations using arrays in C.

UNITIIISEARCHINGANDSORTINGALGORITHMS 10
Divide and conquer methodology -Searching: Linear Search -Binary Search. Sorting: Insertion sort –Merge sort –Quick sort –Heap sort. Analysis of searching and sorting techniques. Implementation oflinear search, binary search, insertion sort, merge sort and quick sort algorithms in C.

UNIT IV TREES 9
Tree ADT –treetraversals -BinaryTree ADT –expressiontrees –binarysearchtree ADT –applicationsof trees.Heap –applications of heap. Implementation of Binary search tree and its operations, treetraversal methods, finding height of the tree using C. Implementation of heap and heap sorting usingarrays in C.

UNIT V GRAPHS 8
Definition – Representation of Graph –Breadth-first traversal -Depth-first traversal –Dynamicprogramming Technique –Warshall‟s and Floyd‟s algorithm –Greedy method -Dijkstra‟s algorithm –applications of graphs. Implementation of graph, graph traversal methods, finding shortest path usingDijkstra‟s algorithm in C.

TOTAL:45PERIODS

OUTCOMES:
Attheendofthiscourse,thestudentsshouldbeableto:

- Implementlinear datastructuresandsolveproblemsusingthem.
- Implementandapplytreesandgraphstosolveproblems.
- Implementthevarioussearchingandsortingalgorithms.

TEXTBOOKS:

1. MarkAllenWeiss,“DataStructuresandAlgorithmAnalysisinC”,2nd Edition,Pearson Education,1997.
2. BrianW.KernighanandDennisM.Ritchie,“TheCProgrammingLanguage”,2ndEdition, Pearson Education, 1988.

REFERENCES:

1. Aho,HopcroftandUllman,“DataStructuresandAlgorithms”,PearsonEducation,1983.
2. S.Sridhar,“DesignandAnalysisofAlgorithms”,FirstEdition,OxfordUniversityPress. 2014.
3. ByronGottfried,JitenderChhabra,“ProgrammingwithC”(Schaum'sOutlinesSeries), Mcgraw Hill Higher Ed., III Edition, 2010.
4. YashvantKanetkar,“DataStructuresThroughC”,BPBpublications,IIedition,2003

OPENELECTIVE–II
SEMESTER VII

20153OE74A **BASICCIRCUITTHEORY** **LTPC 3003**

OBJECTIVES:

- Tointroduceelectriccircuitsandits analysis.
- Toimpartknowledgeonsolvingcircuitequationsusingnetworktheorems.
- Tointroducethephenomenonofresonanceincoupledcircuits.
- TointroducePhasordiagramsandanalysisofthreephasecircuits.

UNIT I BASICCIRCUITSANALYSIS 9

Resistive elements -Ohm's LawResistors inseries and parallelcircuits –Kirchoffs laws –Meshcurrentand node voltage -methods of analysis.

UNIT II NETWORKREDUCTIONANDTHEOREMSFORDCCIRCUITS 9

Network reduction: voltage and current division, source transformation –star delta conversion.Thevenins and Norton Theorems –Superposition Theorem –Maximum power transfer theorem –Reciprocity Theorem –Millman's theorem.

UNIT III ACCIRCUITS 9

Introduction to AC circuits , inductance reactance, capacitive reactance, Phasor diagrams, real power,reactive power, apparent power, power factor, R-L R-C , RLC networks, Network reduction: voltageandcurrent division, sourcetransformation –meshand nodeanalysis, Thevenins andNortonTheorems–Superposition Theorem –Maximum power transfer theorem –Reciprocity Theorem –Millman'stheorem.

UNIT IV THREE PHASECIRCUITS 9

A.C. circuits –Average and RMS value -Phasor Diagram –Power, Power Factor and Energy.-Analysisofthreephase3-wireand4-wirecircuits withstaranddelta connected loads, balanced& unbalanced –phasor diagram of voltages and currents –power measurement in three phase circuits.

UNIT V RESONANCEANDCOUPLEDCIRCUITS 9

Seriesandparallelresonance–theirfrequencyresponse–QualityfactorandBandwidth-Selfandmutual inductance –Coefficient of coupling –Tuned circuits –Single tuned circuits.

TOTAL:45PERIODS

OUTCOMES:

- Abilitytointroduceelectriccircuitsandits analysis.
- Abilitytoimpartknowledgeonsolvingcircuitequationsusingnetworktheorems.
- Abilitytointroducethephenomenonofresonanceincoupledcircuits.
- AbilitytointroducePhasordiagramsandanalysisofthreephasecircuits.

TEXTBOOKS:

1. WilliamH.HaytJr,JackE.KemmerlyandStevenM.Durbin,"EngineeringCircuits Analysis", McGraw Hill publishers, edition, New Delhi, 2013.
2. CharlesK.Alexander,MathewN.O.Sadiku,"FundamentalsofElectricCircuits",Second Edition, McGraw Hill, 2013.
3. AllanH.Robbins,WilhelmC.Miller,"CircuitAnalysisTheoryandPractice",Cengage Learning India, 2013.

REFERENCES:

1. Chakrabarti A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, 1999.
2. Jegatheesan,R.,"AnalysisofElectricCircuits,"McGrawHill, 2015.
3. JosephA.Edminister,MahmoodNahri,"Electriccircuits",Schaum'sseries,McGraw-Hill, New Delhi, 2010.
4. MEVanValkenburg,"NetworkAnalysis",Prentice-HallofIndiaPvtLtd,NewDelhi, 2015.
5. Mahadevan, K., Chitra, C., "Electric Circuits Analysis," Prentice-Hall of India Pvt Ltd., New Delhi, 2015.

SKILL DEVELOPMENT **EMPLOYABILITY** **ENTREPRENEURSHIP**

6. Richard C. Dorf and James A. Svoboda, "Introduction to Electric Circuits", 7th Edition, John Wiley & Sons, Inc. 2015.
7. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", McGraw Hill, 2015.

OPENELECTIVE–II
SEMESTER VII

20153OE74A INTRODUCTIONTORENEWABLEENERGYSYSTEMS

LTPC
3003

OBJECTIVES:
ToProvide knowledge

- Aboutthestandaloneandgridconnectedrenewableenergysystems.
- Designofpowerconvertersforrenewableenergyapplications.
- Windelectricalgeneratorsandsolar energysystems.
- Powerconvertersusedforrenewableenergysystems.

UNIT II ELECTRICALMACHINESFORRENEWABLEENERGYCONVERSION 9
Referencetheoryfundamentals-principleof operationandanalysis:IGandPMSG.

UNIT III POWERCONVERTERS 9
Solar:Block diagramofsolar photo voltaicsystem-Principleof operation:line commutatedconverters(inversion-mode) -Boost and buck-boost converters-selection of inverter, battery sizing, array sizingWind: Three phase AC voltage controllers

UNIT IV ANALYSISOFWINDANDPV SYSTEMS 9
Standalone operationof fixedandvariabilityspeedwindenergyconversionsystems andsolar system-Grid connection Issues -Grid integrated PMSG, SCIG Based WECS, grid Integrated solar system.

UNIT V HYBRIDRENEWABLEENERGYSYSTEMS 9
NeedforHybridSystems-RangeandtypeofHybridsystems-CasestudiesofWind-PVMaximumPower Point Tracking (MPPT).

TOTAL:45PERIODS

OUTCOMES:

- Abilitytounderstandandanalyzepower systemoperation,stability,controlandprotection.
- Abilitytohandletheengineeringaspectsof electricalenergygenerationandutilization.
- Abilitytounderstandthestandaloneand gridconnectedrenewableenergysystems.
- Abilitytodesignofpower convertersforrenewableenergyapplications.
- Abilitytoacquireknowledgeonwindelectricalgeneratorsandsolar energysystems.
- Abilitytodesignpowerconvertersusedfor hybridrenewableenergysystems.

TEXTBOOK:

1. S.N.Bhadra,D.Kastha,S.Banerjee,“WindElectricalSystems”,OxfordUniversityPress,2005.
2. B.H.KhanNon-conventionalEnergysourcesTataMcGraw-hillPublishingCompany,New Delhi,2009.

REFERENCES:

1. Rashid.M.H“powerelectronicsHandbook”,Academicpress,2001.
2. IonBoldea,“Variabilityspeedgenerators”,Taylor&Francisgroup,2006.
3. Rai.G.D,“Nonconventionalenergysources”,Khannapublishes,1993.
4. Gray,L.Johnson,“Windenergysystem”,prenticehalllinc,1995.
5. AndrzejM.Trzynnadlowski,„IntroductiontoModernPowerElectronics‟,Secondedition, Wiley India Pvt. Ltd, 2012.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

OPENELECTIVE–II
SEMESTER VII

20154OE74A **INDUSTRIALSAFETY** **LTPC**
3003

OBJECTIVES:
Toimpartknowledgeonsafetyengineeringfundamentalsandsafetymanagementpractices.

UNIT I INTRODUCTION 9
Evolutionof modernsafetyconcepts –Fireprevention –Mechanicalhazards –Boilers, Pressurevessels,Electrical Exposure.

UNIT II CHEMICALHAZARDS 9
Chemical exposure –Toxic materials –Ionizing Radiation and Non-ionizing Radiation - IndustrialHygiene –Industrial Toxicology.

UNIT III ENVIRONMENTALCONTROL 9
IndustrialHealthHazards–EnvironmentalControl–IndustrialNoise-Noisemeasuringinstruments,Control of Noise, Vibration, -Personal Protection.

UNIT IV HAZARDANALYSIS 9
SystemSafetyAnalysis–Techniques–FaultTreeAnalysis(FTA),FailureModesandEffectsAnalysis(FMEA), HAZOP analysis and Risk Assessment.

UNIT V SAFETYREGULATIONS 9
Explosions –Disaster management –catastrophecontrol,hazardcontrol,Safetyeducationandtraining - Factories Act, Safety regulations Product safety –case studies.

TOTAL:45PERIODS

OUTCOMES:
- Students must be able to identify and prevent chemical, environmental mechanical, fire hazardthrough analysis and apply proper safety techniques on safety engineering and management.

TEXTBOOK:

1. JohnV.Grimaldi,"SafetyManagement",AITBSPublishers,2003.

REFERENCES:

1. SafetyManual,"EDELEngineeringConsultancy",2000.
2. David L.Goetsch,"Occupational Safety and Health for Technologists",5th Edition,Engineers and Managers, Pearson Education Ltd., 2005.

OPENELECTIVE–II
SEMESTER VII

20154OE74B **TESTINGOFMATERIALS** **LTPC 3003**

OBJECTIVE:
Tounderstandthevariousdestructiveandnondestructivetestingmethodsofmaterialsandits industrial applications.

UNIT I INTRODUCTIONTOMATERIALSTESTING 9
Overview of materials, Classification of material testing, Purpose of testing, Selection of material,Development of testing, Testing organizations and its committee, Testing standards, Result Analysis,Advantages of testing.

UNIT II MECHANICALTESTING 9
Introductionto mechanicaltesting, Hardness test (Vickers, Brinell, Rockwell), Tensiletest, Impact test(Izod, Charpy) -Principles, Techniques, Methods, Advantages and Limitations, Applications. Bendtest, Shear test, Creep and Fatiguetest -Principles, Techniques, Methods, Advantages and Limitations,Applications.

UNIT III NONDESTRUCTIVETESTING 9
Visual inspection, Liquid penetrant test, Magnetic particle test, Thermography test – Principles,Techniques, Advantages and Limitations, Applications. Radiographic test, Eddy current test,Ultrasonic test, Acoustic emission-Principles, Techniques, Methods, Advantages and Limitations,Applications.

UNIT IV MATERIALCHARACTERIZATIONTESTING 9
Macroscopic and Microscopic observations, Optical and Electron microscopy (SEM and TEM) - Principles, Types, Advantages and Limitations,Applications. Diffraction techniques, SpectroscopicTechniques, Electrical and Magnetic Techniques-Principles, Types, Advantages and Limitations,Applications.

UNIT V OTHERTESTING 9
Thermal Testing: Differential scanning calorimetry, Differential thermal analysis. Thermo-mechanicaland Dynamic mechanical analysis: Principles, Advantages, Applications. Chemical Testing: X-RayFluorescence, Elemental Analysis by Inductively Coupled Plasma-Optical Emission Spectroscopy andPlasma-Mass Spectrometry.

TOTAL:45PERIODS

OUTCOMES:
- Identifysuitabletestingtechniquetoinspectindustrialcomponent.
- Abilitytousethedifferent techniqueandknowitsapplicationsandlimitations.

TEXTBOOKS:

1. BaldevRaj,T.Jayakumar,M.Thavasimuthu“PracticalNon-DestructiveTesting”,NarosaPublishing House, 2009.
2. Cullity,B.D.,“Elementsof X-ray diffraction”,3rdEdition,Addison-Wesley Company Inc., New York, 2000.
3. P. Field Foster,“The Mechanical Testing of Metalsand Alloys” 7thEdition,CousensPress, 2007.

REFERENCES:

1. MetalsHandbook: Mechanical testing,(Volume 8)ASMHandbook Committee,9thEdition, American Society for Metals, 1978.
2. ASMMetalsHandbook,“Non-DestructiveEvaluationandQualityControl”,American Societyof Metals, Metals Park, Ohio, USA.
3. BrandonD.G.,“ModernTechniquesinMetallography”,VonNostrandInc.NJ,USA,1986.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

OPENELECTIVE–II
SEMESTER VII

20155OE74A **GREENBUILDINGDESIGN** **LTPC 3003**

UNIT I ENVIRONMENTALIMPLICATIONSOFBUILDINGS 9

Energy use, carbon emissions, water use, waste disposal; Building materials: sources, methods ofproduction and environmental Implications. Embodied Energy in Building Materials: TransportationEnergy for Building Materials; Maintenance Energy for Buildings.

UNIT II IMPLICATIONSOFBUILDINGTECHNOLOGIESEMBODIEDENERGY OFBUILDINGS 9

Framed Construction, Masonry Construction. Resources for Building Materials, Alternative concepts.Recycling of Industrial and Buildings Wastes. Biomass Resources for buildings.

UNIT III COMFORTSINBUILDING 9

ThermalComfort inBuildings-Issues; HeatTransfer Characteristic of BuildingMaterials and BuildingTechniques. Incidence of Solar Heat on Buildings-Implications of Geographical Locations.

UNIT IV UTILITYOFSOLARENERGYINBUILDINGS 9

Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. LowEnergy Cooling. Case studies of Solar Passive Cooled and Heated Buildings.

UNIT V GREENCOMPOSITESFORBUILDINGS 9

Concepts of Green Composites. Water Utilisation in Buildings, Low Energy Approaches to WaterManagement. Management of Solid Wastes. Management of Sullage Water and Sewage. UrbanEnvironment and Green Buildings. Green Cover and Built Environment.

TOTAL:45PERIODS

TEXTBOOKS:

1. K.S.Jagadish, B. U. VenkataramareddyandK. S. Nanjundarao. AlternativeBuildingMaterials and Technologies. New Age International, 2007.
2. LowEnergyCoolingFor SustainableBuildings. JohnWileyandSonsLtd, 2009.
3. SustainableBuildingDesignManual.Vol 1and2,Teri,NewDelhi, 2004.

REFERENCES:

1. OsmanAttmannGreenArchitectureAdvancedTechnologiesandMaterials.McGrawHill, 2010.
2. JerryYudelsonGreenbuildingThroughIntegratedDesign. McGrawHill, 2009.
3. FundamentalsofIntegratedDesignforSustainableBuildingByMarianKeeler,BillBurke.

OPENELECTIVE–II
SEMESTER VII

20155OE74B **WASTEWATERTREATMENT** **LTPC 3003**

OBJECTIVES:

- Tomakethestudentconversantwiththewatertreatmentmethodsincludingadsorptionand oxidation process.
- Toprovidebasicunder standingsabouttherequirementsofwater,itspreliminarytreatment.

UNIT I WATERQUALITYANDPRELIMINARYTREATMENT 9

Water Quality-physical-chemical and biological parameters of water-water quality requirement -potablewater standards -wastewater effluent standards -water quality indices. Water purification systems innatural systems-physical processes-chemical processes and biological processes-primary, secondary andtertiary treatment-Unit operations-unit processes. Mixing, clarification -sedimentation; Types; aerationand gas transfer –coagulation and flocculation, coagulation processes -stability of colloids -destabilization of colloids-transport of colloidal particles, clariflocculation.

UNIT II INDUSTRIALWATERTREATMENT 9

Filtration –size and shape characteristics of filtering media –sand filters hydraulics of filtration –designconsiderations –radial, upflow, highrate and multimedia filters, pressure filter. Water softening –limesoda, zeolite and demineralization processes –industrial water treatment for boilers.

UNITIIICONVENTIONALTREATMENTMETHODS 9

Tasteand odour control –adsorption –activatedcarbon treatment –removal of color –ironand manganeseremoval –aeration, oxidation, ion exchange and other methods –effects of fluorides –fluoridation anddefluoridation –desalination -corrosion prevention and control –factors influencing corrosion –Langelierindex –corrosion control measures.

UNIT IV WASTEWATERTREATMENT 9

Wastewater treatment –pre and primary treatment –equalization neutralization –screening and gridremoval –sedimentation –oil separation gas stripping of volatile organics –biological oxidation –lagoonsand stabilization basins –aerated lagoons –activated sludge process –trickling filtration –anaerobicdecomposition.

UNIT V ADSORPTIONANDOXIDATIONPROCESSES 9

Chemicalprocess–adsorption–theoryofadsorption–ionexchangeprocess–chemicaloxidation–advanced oxidation process –sludge handling and disposal –miscellaneous treatment processes.

TOTAL:45PERIODS

OUTCOMES:

- Willhaveknowledgeaboutadsorptionandoxidationprocess.
- Willgainideaaboutvariousmethodsavailableforwater treatment.
- Willappreciatethenecessityofwaterandacquireknowledgeofpreliminarytreatment.

TEXTBOOKS:

1. MetcalfandEddy,“WastewaterEngineering”,4thed.,McGrawHillHigherEdu., 2002.
2. W. Wesley Eckenfelder, Jr., “Industrial Water Pollution Control”, 2ndEdn., McGraw Hill Inc.,1989.

REFERENCES:

1. S.P. Mahajan,“Pollution control in processindustries”,27thEd.Tata McGraw Hill Publishing Company Ltd.,2012.
2. M.Lancaster,“GreenChemistry:AnIntroductoryText”,2ndedition,RSCpublishing, 2010.
3. C.S.Rao,“EnvironmentalPollutionControlEngineering”,NewAgeInternational,2007.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

SEMESTER VII

19152C75 ADHOCANDWIRELESSSENSORNETWORKS

LTPC
3003

OBJECTIVES:

- LearnAdhocnetworkandSensor Networkfundamentals
- Understandthedifferentroutingprotocols
- Haveanin-depthknowledgeonsensornetworkarchitectureand designissues
- UnderstandthetransportlayerandsecurityissuespossibleinAdhocandSensornetworks
- Haveanexposuretomoteprogrammingplatformsand tools

UNITIADHOCNETWORKS–INTRODUCTIONANDROUTINGPROTOCOLS9

Elements of Ad hoc Wireless Networks, Issues in Ad hoc wireless networks, Example commercialapplications of Ad hoc networking, Ad hoc wireless Internet, Issues in Designing a Routing Protocol forAd Hoc Wireless Networks, Classifications of Routing Protocols, Table Driven Routing Protocols -Destination Sequenced Distance Vector (DSDV), On–Demand Routing protocols –Ad hoc On–DemandDistance Vector Routing (AODV).

UNITIISENSORNETWORKS –INTRODUCTION&ARCHITECTURES 9

Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSNapplication examples, Single-Node Architecture - Hardware Components, Energy Consumption ofSensor Nodes, Network Architecture - Sensor Network Scenarios, Transceiver Design Considerations,Optimization Goals and Figures of Merit.

UNITIIIWSNNETWORKINGCONCEPTSANDPROTOCOLS 9

MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC, The Mediation Device Protocol, Contention based protocols - PAMAS, Schedule based protocols–LEACH, IEEE 802.15.4 MAC protocol, Routing Protocols-Energy Efficient Routing, Challenges andIssues in Transport layer protocol.

UNITIV SENSORNETWORKSECURITY 9

Network Security Requirements, Issues and Challenges in Security Provisioning, Network SecurityAttacks, Layer wise attacks in wireless sensor networks, possible solutions for jamming, tampering,black hole attack, flooding attack. Key Distribution and Management, Secure Routing – SPINS,reliability requirements in sensor networks.

UNIT V SENSORNETWORKPLATFORMSANDTOOLS 9

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms – TinyOS, nesC, CONTIKIOS, Node-level Simulators – NS2 and its extension to sensor networks,COOJA, TOSSIM, Programming beyond individual nodes – State centric programming.

TOTAL:45PERIODS

OUTCOMES:

Attheendofthecourse, thestudentwouldbeableto:

- KnowthebasicsofAdhocnetworksandWirelessSensorNetworks
- Apply this knowledge to identify the suitable routing algorithm based on the network and userrequirement
- ApplytheknowledgetoidentifyappropriatephysicalandMAC layerprotocols
- UnderstandthetransportlayerandsecurityissuespossibleinAdhocandsensornetworks.
- BefamiliarwiththeOS usedinWirelessSensorNetworksandbuildbasicmodules

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

TEXTBOOKS:

1. C.SivaRamMurthyandB.S.Manoj,―AdHocWirelessNetworksArchitecturesand Protocols‖, Prentice Hall, PTR, 2004. (UNIT I)
2. Holger Karl , Andreas willig, ―Protocol and Architecture for Wireless Sensor Networks‖, John wiley publication, Jan 2006.(UNIT II-V)

REFERENCES:

1. FengZhao,LeonidasGuibas,―WirelessSensorNetworks:aninformationprocessing approach‖, Elsevier publication, 2004.
2. CharlesE.Perkins,―AdHocNetworking‖,AddisonWesley,2000.
3. I.F. Akyildiz, W. Su, Sankarasubramaniam, E. Cayirci, ―Wireless sensor networks: a survey‖, computer networks, Elsevier, 2002, 394 - 422.

LISTOF ELECTIVES

ELECTIVE–III(SEMESTERVII)

ELECTIVE–III
SEMESTER VII

20152E76A ADVANCEDWIRELESSCOMMUNICATION LTPC 3003

OBJECTIVES:

- Toexpose the studentstothe importanceofimprovingcapacityofwirelesschannelusing MIMO
- To enable understanding of channel impairmentmitigation using space-time block and Trelliscodes
- ToteachadvancedMIMOsystemlikelayeredspacetimecodes,MU-MIMOSystemand MIMO-OFDM systems

UNIT I CAPACITYOFWIRELESSCHANNELS 9

The crowded spectrum, need for high data rate, MIMO systems – Array Gain, Diversity Gain, DataPipes, Spatial MUX, MIMO System Model. MIMO System Capacity – channel known at the TX,Channel unknown to the TX – capacity of deterministic channels, Random channels and frequencyselective channels.

UNIT II RADIOWAVEPROPAGATION 9

Radio wave propagation – Macroscopic fading- free space and out door, small scale fading Fadingmeasurements – Direct pulsemeasurements, spreadspectrumcorrelation channelsounding frequencydomainchannel sounding,AntennaDiversity–Diversitycombining methods.

UNIT III SPACETIMEBLOCKCODES 9

Delay Diversity scheme, Alamoti space time code – Maximum likelihood decoding maximum ratiocombining. Transmit diversity space time block codes for real signal constellation and complex signalconstellation - decoding of STBC.

UNIT IV SPACETIMETRELLISCODES 9

Space time coded systems,space time code word design criteria,design of space time T C on slowfading channels, design of STTC on Fast Fading channels, performance analysis in slow and fast fadingchannels, effect of imperfect channel estimationand Antenna correlation onperformance, comparison ofSTBC & STTC.

UNITV LAYEREDSPACETIMECODES 9

LSTtransmitter–Horizontal andVerticalLSTreceiver– MLRx,ZeroforcingRx;MMSERx,SIC Rx, ZFV-blastRx-MMSEV-blastRx,IterativeRx -capacityofMIMO–OFDMsystems–capacity of MIMO multi user systems.

TOTAL:45PERIODS

OUTCOMES:

Thestudentshouldbeableto:

- Comprehend and appreciate the significance and role of this course in the present contemporary world
- Applytheknowledgeabout theimportanceofMIMOintoday'scommunication
- Appreciatethevariousmethodsforimprovingthedatarateofwirelesscommunicationsystem

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

REFERENCES:

1. MohinderJankiraman,Space-time codesand MIMO systems,Artech House,Boston,London. www.artech house.com, ISBN 1-58053-865-7-2004
2. PaulrajRohitNabar,DhananjayGore,Introductionofspacetimewirelesscommunication systems, Cambridge University Press, 2003.
3. DavidTse andPramodViswanath,―FundamentalsofWirelessCommunication‖,Cambridge University Press, 2005.
4. SergioVerdu―MultiUserDetection‖CambridgeUniversityPress, 1998.

ELECTIVE–III
SEMESTER VII

20152E76B COGNITIVERADIO LTPC 3003

OBJECTIVES:

Thestudentshouldbemade:

- Tounderstandtheevolvingsoftwaredefinedradioandcognitiveradiotechniquesandtheir essential functionalities
- Tostudythebasicarchitectureandstandardforcognitiveradio
- Tounderstandthephysical, MACandNetworklayer designofcognitiveradio
- Toexposethestudent toevolvingapplicationsandadvancedfeaturesofcognitiveradio

[illegible]

UNIT II COGNITIVERADIOARCHITECTURE 9

Cognition cycle – orient, plan, decide and act phases, Organization, SDR as a platform for CognitiveRadio – Hardware and Software Architectures, Overview of IEEE 802.22 standard for broadbandwireless access in TV bands.

UNIT IIISPECTRUMSENSINGANDDYNAMICSPECTRUMACCESS 9

Introduction – Primary user detection techniques – energy detection, featuredetection, matched filtering,cooperative detection and other approaches, Fundamental Tradeoffs in spectrum sensing, SpectrumSharing Models of Dynamic Spectrum Access - Unlicensed and Licensed Spectrum Sharing,Fundamental Limits of Cognitive Radio.

UNIT IV MACANDNETWORKLAYERDESIGNFORCOGNITIVE RADIO 9

MACforcognitiveradios–Polling,ALOHA,slottedALOHA,CSMA,CSMA/CA,Networklayerdesign – routing in cognitive radios, flow control and error control techniques.

UNIT V ADVANCEDTOPICSINCOGNITIVERADIO 9

Overviewofsecurityissuesincognitiveradios,auctionbasedspectrummarketsincognitiveradionetworks, public safety and cognitive radio, cognitive radio for Internet of Things.

TOTAL:45PERIODS

OUTCOMES:

Attheendofthecourse,thestudentshouldbeableto:

- Gainknowledgeonthedesignprinciplesonsoftwaredefinedradioandcognitiveradio
- Develop theabilityto designand implement algorithms for cognitiveradiospectrumsensingand dynamic spectrum access
- Buildexperimentsandprojectswithrealtimewireless applications
- Applytheknowledgeofadvancedfeaturesofcognitiveradioforrealworldapplications

TEXTBOOKS:

1. AlexanderM. Wyglinski,Maziar Nekovee,ThomasHou,―Cognitive Radio Communications and Networks‖, Academic Press, Elsevier, 2010. (Unit I to IV)
2. HuseyinArslan(Ed.),―CognitiveRadio,SoftwareDefinedRadio,andAdaptiveWireless Systems, Springer, 2007. (Unit V)

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUERSHIP

REFERENCES:

1. BruceFette,―CognitiveRadioTechnology‖,Newnes,2006.
2. Kwang-ChengChen,RamjeePrasad,―CognitiveRadioNetworks‖,JohnWileyandSons,2009.
3. Ezio Biglieri, Professor Andrea J. Goldsmith, Dr Larry J. Greenstein, Narayan B. Mandayam, H. Vincent Poor, ―Principles of Cognitive Radio‖ , Cambridge University Press, 2012.

ELECTIVE–III
SEMESTER VII

20152E76C FOUNDATIONSKILLSININTEGRATEDPRODUCTDEVELOPMENT

LTPC
3003

OBJECTIVES:

- To understand the global trends and development methodologies of various types of productsand services
- To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer

UNIT I FUNDAMENTALSOFPRODUCTDEVELOPMENT 9

Global TrendsAnalysisandProductdecision-SocialTrends- TechnicalTrends-EconomicalTrends - EnvironmentalTrends-Political/PolicyTrends-**IntroductiontoProductDevelopmentMethodologies andManagement -**OverviewofProductsandServices -Types ofProduct Development - OverviewofProductDevelopmentmethodologies-ProductLifeCycle–ProductDevelopmentPlanning and Management.

UNIT II REQUIREMENTSANDSYSTEMDESIGN 9

Requirement Engineering - Types of Requirements **-** Requirement Engineering – traceability Matrixand Analysis **-** Requirement Management **- System Design & Modeling -** Introduction to SystemModeling **-** System Optimization **-** System Specification **-** Sub-System Design **-** Interface Design.

UNIT III DESIGNANDTESTING 9

Conceptualization - Industrial Design and User Interface Design - Introduction to Concept generationTechniques – **Challenges in Integration of Engineering Disciplines -** Concept Screening & Evaluation

- **Detailed Design -** Component Design and Verification – **Mechanical, Electronics and SoftwareSubsystems -** High Level Design/Low Level Design of S/W Program **-** Types of Prototypes, S/WTesting- Hardware Schematic, Component design, Layout and Hardware Testing – **Prototyping -** Introduction to Rapid Prototyping and Rapid Manufacturing **- System Integration, Testing,Certification and Documentation**

UNIT IV SUSTENANCEENGINEERINGANDEND-OF-LIFE(EOL)SUPPORT9

Introduction to Product verification processes and stages - Introduction to Product Validation processesand stages - Product Testing Standards and Certification - Product Documentation - **Sustenance -**Maintenance and Repair – Enhancements **- Product EoL -** Obsolescence Management – ConfigurationManagement - EoL Disposal

UNIT V BUSINESSDYNAMICS–ENGINEERINGSERVICESINDUSTRY 9

The Industry - Engineering Services Industry - Product Development in Industry versus Academia – **The IPD Essentials -** Introduction to Vertical Specific Product Development processes - Manufacturing/Purchase and Assembly of Systems - Integration of Mechanical, Embedded andSoftware Systems – Product Development Trade-offs - Intellectual Property Rights and Confidentiality– Security and Configuration Management.

TOTAL:45PERIODS

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

OUTCOMES:

Uponcompletionofthecourse, thestudentswillbeableto:

- Define,formulateandanalyzeaproblem
- Solvespecificproblemsindependentlyor aspartofa team
- GainknowledgeoftheInnovation&ProductDevelopmentprocessintheBusiness Context
- Workindependentlyaswellasinteams
- Manageaprojectfromstarttofinish

TEXTBOOKS:

1. BookspeciallypreparedbyNASSCOMaspertheMoU.
2. KarlTUlrichandStephenDEppinger,"ProductDesignandDevelopment",TataMcGraw Hill, Fifth Edition, 2011.
3. John W Newstorm and Keith Davis, "Organizational Behavior", Tata McGraw Hill, Eleventh Edition, 2005.

REFERENCES:

1. HiriyappaB,―CorporateStrategy–ManagingtheBusiness‖,AuthorHouse, 2013.
2. PeterFDrucker,―People andPerformance‖,Butterworth–Heinemann[Elsevier],Oxford, 2004.
3. Vinod Kumar Garg and Venkita Krishnan N K, ―Enterprise Resource Planning – Concepts‖, Second Edition, Prentice Hall, 2003.
4. MarkSSandersandErnestJMcCormick,"HumanFactorsinEngineeringandDesign", McGraw Hill Education, Seventh Edition, 2013

ELECTIVE–III
SEMESTER VII

20152E76D MACHINELEARNINGTECHNIQUES LTPC
3003

OBJECTIVES:

- Tounderstandtheneedformachinelearningforvariousproblemsolving
- Tostudythevarioussupervised,semi-supervisedandunsupervisedlearningalgorithmsin machine learning
- Tolearnthenewapproachesinmachinelearning
- Todesignappropriatemachinelearningalgorithmsforproblemsolving

UNIT I INTRODUCTION 9
Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and CandidateEliminations – Inductivebias – Decision Treelearning – Representation – Algorithm – Heuristic SpaceSearch.

UNIT II NEURALNETWORKSANDGENETICALGORITHMS 9
NeuralNetworkRepresentation–Problems–Perceptrons–MultilayerNetworksandBack Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – GeneticProgramming – Models of Evaluation and Learning.

UNIT III BAYESIANANDCOMPUTATIONALLEARNING 9
BayesTheorem–ConceptLearning–MaximumLikelihood–Minimum DescriptionLength Principle–BayesOptimalClassifier–GibbsAlgorithm–NaïveBayesClassifier–BayesianBeliefNetwork–EMAlgorithm–ProbabilityLearning–SampleComplexity–FiniteandInfiniteHypothesis Spaces – Mistake Bound Model.

UNIT IV INSTANTBASEDLEARNING 9
K-NearestNeighbourLearning–LocallyweightedRegression – Radial BasesFunctions – Case Based Learning.

UNIT V ADVANCEDLEARNING 9
Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Setsof First Order Rules – Induction on Inverted Deduction – Inverting Resolution– Analytical Learning– PerfectDomainTheories–ExplanationBaseLearning – FOCLAlgorithm – Reinforcement Learning– Task – Q-Learning – Temporal Difference Learning

TOTAL:45PERIODS

OUTCOMES:
Attheendofthecourse, thestudentswillbeableto

- Differentiatebetweensupervised,unsupervised,semi-supervisedmachinelearningapproaches
- Applyspecificsupervisedor unsupervisedmachinelearningalgorithmfor aparticularproblem
- Analyseandsuggesttheappropriatemachinelearningapproachforthevarioustypesofproblem
- Designandmakemodificationstoexistingmachinelearningalgorithmstosuitanindividual application
- Provideusefulcasestudiesontheadvancedmachinelearningalgorithms

TEXTBOOK:

1. TomM.Mitchell,―MachineLearning‖,McGraw-HillEducation(India)PrivateLimited,2013.

REFERENCES:

1. EthemAlpaydin,―IntroductiontoMachineLearning(AdaptiveComputationandMachine Learning)‖, The MIT Press 2004.
2. StephenMarsland,―MachineLearning:AnAlgorithmicPerspective‖,CRCPress, 2009.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

ELECTIVE–III
SEMESTER VII

20152E76E ELECTRONICSPACKAGINGANDTESTING LTPC
3003

OBJECTIVE:

- Tointroduceanddiscuss various issuesrelatedtothesystempackaging

UNIT I OVERVIEWOFELECTRONICSYSTEMSPACKAGING 9

Functions of an Electronic Package, Packaging Hierarchy, IC packaging: MEMS packaging, consumerelectronics packaging, medical electronics packaging, Trends, Challenges, Driving Forces on PackagingTechnology, Materials for Microelectronic packaging, Packaging Material Properties, Ceramics,Polymers, and Metals in Packaging, Material for high density interconnect substrates

UNIT II ELECTRICALISSUESINPACKAGING 9

Electrical Issues of Systems Packaging, Signal Distribution, Power Distribution, ElectromagneticInterference, Transmission Lines, Clock Distribution, Noise Sources, Digital and RF Issues.
DesignProcessElectricalDesign:InterconnectCapacitance,ResistanceandInductancefundamentals;Packagingroadmaps - Hybrid circuits - Resistive, Capacitive and Inductive parasitics

UNIT III CHIPPACKAGES 9

, Flip

UNIT IV PCB,SURFACEMOUNTTECHNOLOGYANDTHERMALCONSIDERATIONS 9

Printed Circuit Board: Anatomy, CAD tools for PCB design, Standard fabrication, Micro via Boards.Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Designchallenges. Thermal Management, Heat transfer fundamentals, Thermal conductivity and resistance,Conduction, convection and radiation – Cooling requirements

UNIT V TESTING 9

Reliability, Basic concepts, Environmental interactions. Thermal mismatch and fatigue – failures –thermo mechanically induced –electrically induced – chemically induced. Electrical Testing: Systemlevel electrical testing, Interconnection tests, Active Circuit Testing, Design for Testability

TOTAL:45PERIODS

OUTCOMES:

Attheendofthecourse, thestudentshouldbeableto:

- Givea comprehensiveintroduction tothevarious packagingtypes usedalongwiththeassociated thermal, speed, signal and integrity power issues
- Enabledesignofpackages whichcanwithstandhighertemperature,vibrationsandshock
- DesignofPCBswhichminimizetheEMIandoperateathigherfrequency
- AnalyzetheconceptsofTestingandtesting methods

TEXTBOOK:

1. Tummala,RaoR.,FundamentalsofMicrosystemsPackaging,McGrawHill,2001

REFERENCES:

1. Blackwell(Ed),Theelectronicpackaginghandbook,CRCPress, 2000.
2. Tummala,RaoR,Microelectronicspackaginghandbook,McGrawHill,2008.
3. Bosshart,PrintedCircuitBoardsDesignandTechnology,TataMcGrawHill, 1988.
4. R.G.KaduskarandV.B.Baru,ElectronicProductdesign,WileyIndia,2011

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

5. R.S.Khandpur,PrintedCircuitBoard,TataMcGrawHill,2005
6. RecentliteratureinElectronicPackaging
7. MichaelL.Bushnell&VishwaniD.Agrawal,‖EssentialsofElectronicTestingforDigital, memory & Mixed signal VLSI Circuits‖, Kluwer Academic Publishers.2000.
8. M.Abramovici,M.A.Breuer,andA.D.Friedman,―DigitalSystemTestingandTestable Design‖, Computer Science Press,1990

ELECTIVE–III
SEMESTER VII

20152E76F MIXEDSIGNALICDESIGN

LTPC
300 3

OBJECTIVES:

Thestudentshouldbe made to:

- Studythemixedsignal ofsubmicronCMOScircuits
- Understandthevariousintegratedbasedfiltersandtopologies
- Learnthedata convertersarchitecture,modelingandsignaltonoiseratio
- Studytheintegratedcircuitof oscillatorsandPLLs

UNIT I SUBMICRONCMOSCIRCUITDESIGN 9

SubmicronCMOS:OverviewandModels, CMOSprocessflow, CapacitorsandResistors. Digitalcircuitdesign:TheMOSFETSwitch,DelayElements,AnAdder.AnalogCircuit Design:Biasing,Op-AmpDesign,CircuitNoise.

UNIT II INTEGRATORBASEDCMOS FILTERS 9

Integrator Building Blocks- low pass filter, Active RC integrators, MOSFET-C Integrators, g_m-Cintegrators, Discrete time integrators. Filtering Topologies: The Bilinear transfer function, TheBiquadratic transfer function, Filters using Noise shaping.

UNITIIIDATACONVERTERARCHITECTURES 9

DAC Architectures- Resistor string, R-2R ladder Networks, Current Steering, Charge Scaling DACs,Cyclic DAC, and Pipeline DAC. ADC Architectures- Flash, Two-step flash ADC, Pipeline ADC,Integrating ADC‘s, Successive Approximation ADC.

UNITIVDATACONVERTERMODELING ANDSNR 9

Sampling and Aliasing: A modeling approach, Impulse sampling, The sample and Hold, Quantizationnoise. Data converter SNR: An overview, Clock Jitter, Improving SNR using Averaging, Decimatingfilter for ADCs, Interpolating filter for DACs, Band pass and High pass sinc filters - Using feedback toimprove SNR.

UNIT V OSCILLATORSANDPLL 9

LC oscillators,Voltage Controlled Oscillators. Simple PLL, Charge pumps PLLs, Non ideal effects inPLLs, Delay Locked Loops.

TOTAL:45PERIODS

OUTCOMES:

Uponcompletionofthecourse, studentshouldbeableto

- ApplytheconceptsformixedsignalMOS circuit.
- AnalyzethecharacteristicsofICbasedCMOS filters.
- Designofvariousdataconverterarchitecturecircuits.
- Analyzethesignaltonoiseratioand modelingofmixedsignals.
- Designof oscillatorsandphaselockloop circuit.

REFERENCES:

1. CMOSMixedSignalCircuitDesignbyR.JacobBaker, WileyIndia,IEEEPress,reprint2008.
2. CMOSCircuit Design, LayoutandSimulationbyR.Jacob Baker, WileyIndia,IEEEPress,Second Edition, reprint 2009.
3. Designof AnalogCMOSIntegratedCircuitsbyBehzadRazavi,McGrawHill,33rdRe-print,2016.

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

ELECTIVE–III
SEMESTER VII

20152E76G DISASTERMANAGEMENT LTPC
3003

OBJECTIVES:

- Toprovidestudentsanexposuretodisasters,theirsignificanceandtypes.
- Toensurethatstudentsbegintounderstandtherelationshipbetweenvulnerability,disasters, disaster prevention and risk reduction
- Togaina preliminaryunderstandingofapproachesofDisaster RiskReduction(DRR)
- Toenhanceawarenessofinstitutionalprocessesinthecountryand
- Todeveloprudimentaryabilitytorespondtotheirsurroundingswithpotential disaster response in areas where they live, with due sensitivity

UNIT II APPROACHESTODISASTERRISKREDUCTION(DRR) 9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community basedDRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati RajInstitutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- InstitutionalProcesses and Framework at State and Central Level- State Disaster Management Authority(SDMA) –Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams,embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios inthe context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTERRISKMANAGEMENTININDIA 9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation,Shelter, Health, WasteManagement, Institutional arrangements (Mitigation, Responseand Preparedness,Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Roleof GIS and Information Technology Components in Preparedness, Risk Assessment, Response andRecovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTERMANAGEMENT:APPLICATIONSANDCASESTUDIES AND

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings andInfrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm SurgeAssessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Madedisasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field worksrelated to disaster management.

TOTAL:45PERIODS

OUTCOMES:

Thestudentswillbeableto

- Differentiatethetypesofdisasters,causesandtheirimpactonenvironmentandsociety
- Assessvulnerabilityandvariousmethodsofriskreductionmeasuresaswellas mitigation.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

- Drawthehazardandvulnerabilityprofileof India,ScenariosintheIndiancontext,Disaster damage assessment and management.

TEXTBOOKS:

1. Singhal J.P. ―Disaster Management‖, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. TusharBhattacharya,―DisasterScienceandManagement‖,McGrawHillIndiaEducationPvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES:

1. Govt.ofIndia:DisasterManagementAct,GovernmentofIndia,NewDelhi,2005
2. GovernmentofIndia,NationalDisasterManagementPolicy,2009.

SEMESTER VII

20152L77 EMBEDDEDLABORATORY

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OBJECTIVES:

Thestudentshouldbe madeto:

- Learntheworkingof ARM processor
- UnderstandtheBuildingBlocksofEmbeddedSystems
- Learntheconceptof memorymapandmemoryinterface
- Writeprogramstointerfacememory,I/Oswithprocessor
- Studytheinterruptperformance

LISTOFEXPERIMENTS:

1. StudyofARMevaluationsystem
2. InterfacingADCandDAC.
3. InterfacingLEDandPWM.
4. Interfacingrealtimeclockandserialport.
5. InterfacingkeyboardandLCD.
6. InterfacingEPROMandinterrupt.
7. Mailbox.
8. InterruptperformancecharacteristicsofARMandFPGA.
9. FlashingofLEDS.
10. Interfacingsteppermotorandtemperaturesensor.
11. ImplementingzigbeeprotocolwithARM.

TOTAL: 60 PERIODS

OUTCOMES:

Attheendofthecourse, thestudentshouldbeableto:

- WriteprogramsinARMfor aspecific Application
- Interfacememory,A/DandD/AconvertorswithARM system
- Analyzetheperformanceof interrupt
- Writeprogramforinterfacingkeyboard,display,motorandsensor.
- Formulateaminiprojectusingembeddedsystem

SEMESTER VII

20152L78 ADVANCEDCOMMUNICATIONLABORATORY LTPC
0042

OBJECTIVES:
Thestudentshouldbe made to:

- Understandtheworkingprincipleofopticalsources, detector,fibers
- Developunderstandingofsimpleopticalcommunicationlink
- UnderstandthemeasurementofBER,Pulsebroadening
- Understandandcaptureanexperimentalapproachtodigitalwireless communication
- Understandactualcommunicationwaveformsthatwillbesentandreceivedacrosswireless channel

LISTOFOPTICAL EXPERIMENTS

1. Measurementofconnector,bendingandfiberattenuationlosses.
2. NumericalApertureandModeCharacteristicsofFibers.
3. DCCharacteristicsofLEDandPINPhotodiode.
4. Fiber optic AnalogandDigitalLinkCharacterization - frequencyresponse(analog), eyediagramand BER (digital)

LISTOFWIRELESSCOMMUNICATIONEXPERIMENTS

1. WirelessChannelSimulationincludingfadingandDoppler effects
2. SimulationofChannelEstimation,Synchronization&Equalizationtechniques
3. AnalysingImpact ofPulseShapingandMatchedFilteringusingSoftwareDefinedRadios
4. OFDMSignalTransmissionandReceptionusingSoftwareDefinedRadios

LISTOFMICROWAVEEXPERIMENTS

1. VSWRandImpedanceMeasurementandImpedanceMatching
2. CharacterizationofDirectionalCouplers,Isolators,Circulators
3. GunnDiodeCharacteristics
4. MicrowaveIC –FilterCharacteristics

TOTAL:60 PERIODS

OUTCOMES:
Oncompletionofthislabcourse, thestudentwould beableto

- Analyzetheperformanceofsimpleopticallinkbymeasurementoflossesand Analyzingthe mode characteristics of fiber
- AnalyzetheEyePattern,Pulsebroadeningofopticalfiberandtheimpacton BER
- EstimatetheWirelessChannelCharacteristicsandAnalyzetheperformanceofWireless Communication System
- UnderstandtheintricaciesinMicrowaveSystemdesign

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

LISTOF ELECTIVES

ELECTIVE–IV(SEMESTER VIII)

ELECTIVE–IV
SEMESTERVIII

20152E81A ELECTROMAGNETICINTERFERENCEANDCOMPATIBILITY
LTPC
3003

OBJECTIVES:

- TointroducethebasicconceptsofElectromagneticInterference
- ToteachtheimportanceofElectromagneticCompatibledesigns
- ToexplaintheexistingstandardsforElectromagneticCompatibility

UNIT I EMI/EMC CONCEPTS 9
EMI-EMCdefinitions;SourcesandVictimsofEMI;ConductedandRadiatedEMIEmissionandSusceptibility; Case Histories; Radiation Hazards to humans.

UNIT II EMICOUPLINGPRINCIPLES 9
Conducted, radiated and transient coupling; Common ground impedance coupling; Common mode andground loop coupling; Differential mode coupling; Near field cable to cable coupling; Field to cablecoupling; Power mains and Power supply coupling; Transient EMI, ESD.

UNIT III EMICONTROL 9
Shielding;EMIFilters;Grounding;Bonding;Isolationtransformer;Transientsuppressors;EMISuppression Cables.

UNIT IV EMCDESIGNFORCIRCUITSANDPCBS 9
NoisefromRelays andSwitches; Nonlinearities in Circuits; Cross talkintransmissionlineandcross talkcontrol; Component selection and mounting; PCB trace impedance; Routing; Power distributiondecoupling; Zoning; Grounding; VIAs; Terminations.

UNIT V EMIMEASUREMENTSANDSTANDARDS 9
Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic chamber;Line impedance stabilization networks; EMI Rx and spectrum analyzer; Civilian standards - CISPR,FCC, IEC, EN; Military standards-MIL461E/462.

TOTAL:45PERIODS

OUTCOMES:

Attheendofthecourse, thestudentshouldbeableto:

- IdentifythevarioustypesandmechanismsofElectromagneticInterference
- ProposeasuitableEMI mitigationtechnique
- DescribethevariousEMCStandardsandmethodstomeasurethem

TEXTBOOKS:

1. V.P.Kodali,―EngineeringEMCPrinciples,MeasurementsandTechnologies‖,IEEEPress, Newyork, 1996.(Unit I – V)
2. HenryW.Ott.,NoiseReductionTechniquesinElectronicSystems‖,AWileyInter Science
3. Publications,JohnWileyandSons, Newyork,1988.(Unit–IV)

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

REFERENCES:

1. C.R.Paul,‖IntroductiontoElectromagneticCompatibility‖,JohnWileyandSons,Inc, 1992.
2. BemhardKeiser,―PrinciplesofElectromagneticCompatibility‖,3rdEd,Artechhouse, Norwood, 1986.
3. DonR.J.WhiteConsultantIncorporate,―HandbookofEMI/EMC‖,VolI-V,1988.

ELECTIVE–IV
SEMESTERVIII

20152E81B **LOWPOWERSoCDESIGN** **LTPC**
3003

OBJECTIVES:
Thestudentshouldbe made to:

- IdentifysourcesofpowerinanIC.
- UnderstandbasicprincipleofSystemonChip design
- LearnoptimizationofpowerincombinationalandsequentiallogicmachinesforSoC Design
- Identifysuitabletechniquestoreducethepowerdissipationanddesigncircuitswithlowpower dissipation.

UNIT I POWERCONSUMPTIONINCMOS 9
Physics of power dissipation in CMOS FET devices – Hierarchy of limits of power – Sources of powerconsumption – Static Power Dissipation, Active Power Dissipation - Designing for Low Power, CircuitTechniques for Leakage Power Reduction - Basic principle of low power design, Logic level poweroptimization – Circuit level low power design.

UNIT II SYSTEM-ON-CHIPDESIGN 9
System-on-Chip Concept, Design Principles in SoC Architecture, SoC Design Flow, Platform-based andIP based SoC Designs, Basic Concepts of Bus-Based Communication Architectures. High performancealgorithms for ASICs/ SoCs as case studies – Canonic Signed Digit Arithmetic, KCM, DistributedArithmetic, High performance digital filters for sigma-delta ADC

UNITIIIPOWEROPTIMIZATIONOFCOMBINATIONALANDSEQUENTIALLOGIC MACHINESFORSOC 9
Introduction to Standard Cell-Based Layout – Simulation - Combinational Network Delay - Logic andinterconnect Design - Power Optimization - Switch Logic Networks. Introduction - Latches and Flip-Flops - Sequential Systems andClockingDisciplines - Sequential SystemDesign - Power Optimization - Design Validation - Sequential Testing.

UNITIVDESIGNOFLOW POWERCIRCUITSFORSUBSYSTEMONA SOC 9
Subsystem Design Principles - Combinational Shifters – Adders – ALUs – Multipliers – High DensityMemory – Field Programmable Gate Arrays - Programmable Logic Arrays - Computer arithmetictechniques for low power system – low voltage low power static Random access and dynamic Randomaccess memories, low power clock, Inter connect and layout design

UNIT V FLOORPLANNING 9
Floor-planningMethods–BlockPlacement&Channel Definition-GlobalRouting-switchboxRouting -PowerDistribution-ClockDistributions-Floor-planningTips-DesignValidation-Off-ChipConnections – Packages, The I/O Architecture - PAD Design

TOTAL:45PERIODS

OUTCOME:
Attheendofthecourse,thestudentshouldbeableto:

- AnalyzeanddesignIow-powerVLSIcircuitsusingdifferentcircuittechnologiesforsystemon chip design

TEXTBOOKS:

1. J.Rabaey,―LowPowerDesignEssentials(IntegratedCircuitsandSystems)‖,Springer,2009
2. Wayne Wolf, ―Modern VLSI Design – System – on – Chip Design‖, Prentice Hall, 3rd Edition,2008.

REFERENCES:

1. J.B.Kuo&J.H.Lou,―Low-voltageCMOSVLSICircuits‖,Wiley, 1999.

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

2. A.Bellaowar&M.I.Elmasry,‖LowpowerDigitalVLSIDesign,CircuitsandSystems‖,Kluwer, 1996.
3. WayneWolf,―ModernVLSIDesign–IPbasedDesign‖,PrenticeHall,4thEdition,2008.
4. M.J.S.Smith:ApplicationSpecificIntegratedCircuits,Pearson,2003
5. SudeepPasrichaandNikilDutt,On-ChipCommunicationArchitecturesSystemonChip Interconnect, Elsevier, 2008
6. RecentliteratureinLowPower VLSICircuits.
7. RecentliteratureinDesignofASICs

ELECTIVE–IV
SEMESTERVIII

20152E81C	**PHOTONICNETWORKS**	**LTPC** **3003**

OBJECTIVES:

- To enable the student to understand the importance of the backbone infrastructure for our present and future communication needs and familiarize them with the architectures and the protocol stack in use
- To enable the student to understand the differences in the design of data plane and the control plane and the routing, switching and the resource allocation methods and the network management and protection methods in vogue
- To expose the student to the advances in networking and switching domains and the future trends

UNIT I OPTICALSYSTEMCOMPONENTS 9

Light Propagation in optical fibers – Loss & bandwidth, System limitations, Nonlinear effects;Solitons; Optical Network Components – Couplers, Isolators & Circulators, Multiplexers & Filters,Optical Amplifiers, Switches, Wavelength Converters.

UNIT II OPTICALNETWORKARCHITECTURES 9

Introduction to Optical Networks; SONET / SDH, Metropolitan-Area Networks, LayeredArchitecture; Broadcast and Select Networks – Topologies for Broadcast Networks, Media-AccessControl Protocols, Wavelength Routing Architecture.

UNIT V NETWORKDESIGNANDMANAGEMENT 9

Transmission System Engineering – System model, Power penalty - transmitter, receiver, Opticalamplifiers, crosstalk, dispersion, Wavelength stabilization, Overall design considerations, Controland Management – Network management functions, Configuration management, Performancemanagement, Fault management, Optical safety, Service interface.

TOTAL:45PERIODS

OUTCOMES:

Attheendofthecourse, thestudentwouldbeableto:

- Usethebackboneinfrastructureforour presentandfuturecommunicationneeds
- Analyzethearchitecturesandtheprotocol stack
- Comparethe differences inthe design of data plane, controlplane, routing, switching, resource allocation methods, network management and protection methods in vogue

REFERENCES:

1. RajivRamaswamiandKumarN.Sivarajan,―OpticalNetworks:APracticalPerspective‖, Harcourt Asia Pte Ltd., Second Edition 2004.
2. C.Siva RamMoorthyandMohanGurusamy, ―WDMOpticalNetworks:Concept, Designand Algorithms‖, Prentice Hall of India, Ist Edition, 2002.
3. P.E.Green,Jr.,―FiberOpticNetworks‖,PrenticeHall,NJ,1993.
4. BiswanathMukherjee,―OpticalWDMNetworks‖,SpringerSeries,2006.

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

ELECTIVE–IV
SEMESTERVIII

20152E81D **COMPRESSIVESENSING** **LTPC**
3003

OBJECTIVES:
- To presentthe basic theory and ideasshowing whenitispossible to reconstructsparse ornearly sparse signals from undersampled data
- Toexposestudentstorecentideasinmodernconvexoptimizationallowingrapidsignalrecovery
- Togivestudentsasenseofrealtimeapplicationsthatmightbenefitfromcompressivesensing ideas

Conventional Data Acquisition System; Drawbacks of Transform coding; Compressed Sensing (CS).

UNIT II SPARSITYANDSIGNALRECOVERY 9
SignalRepresentation; Basis vectors; Sensing matrices; RestrictedIsometricProperty; Coherence; Stablerecovery; Number of measurements.

UNIT III RECOVERYALGORITHMS 9
Basis Pursuit algorithm: L1 minimization; Matching pursuit: Orthogonal Matching Pursuit(OMP),Stagewise OMP, Regularized OMP, Compressive Sampling Matching Pursuit (CoSaMP); IterativeThresholding algorithm: Hard thresholding, Soft thresholding; Model based : Model based CoSaMP,Model based HIT.

UNIT IV COMPRESSIVESENSINGFOR WSN 9
Basics of WSN; Wireless Sensor without Compressive Sensing; Wireless Sensor with CompressiveSensing; Compressive Wireless Sensing: Spatial compression in WSNs, Projections in WSNs,Compressed Sensing in WSNs.

UNIT V APPLICATIONSOFCOMPRESSIVESENSING 9
Compressed Sensing for Real-Time Energy-Efficient Compression on Wireless Body Sensor Nodes;Compressive sensing in video surveillance; An Application of Compressive Sensing for Image Fusion;Single-Pixel Imaging via Compressive Sampling.

TOTAL:45PERIODS

OUTCOMES:
Attheendofthecourse, thestudentshouldbeableto:
- Appreciatethemotivationandthe necessityforcompressedsensingtechnology.
- Design a new algorithm or modify an existing algorithm for different application areas in wireless sensor network.

TEXTBOOKS:

1. Radha S, Hemalatha R, Aasha Nandhini S, ―Compressive Sensing for Wireless Communication: Challenges and Opportunities‖, River publication, 2016. (UNIT I-V)
2. MarkA.Davenport,MarcoF.Duarte,YoninaC.EldarandGittaKutyniok,―Introductionto Compressed Sensing,‖ in Compressed Sensing: Theory and Applications, Y. Eldar and G.
3. Kutyniok,eds.,CambridgeUniversityPress,2011(UNIT I)

REFERENCES:

1. Duarte, M.F.; Davenport, M.A.; Takhar, D.; Laska, J.N.; Ting Sun; Kelly, K.F.; Baraniuk, R.G.; "Single-Pixel Imaging via Compressive Sampling," Signal Processing Magazine, IEEE, vol.25, no.2, pp.83-91, March 2008.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

2. TaoWan.; ZengchangQin.; , ―Anapplication ofcompressivesensingfor imagefusion‖,CIVR '10 Proceedings of the ACM International Conference on Image and Video Retrieval, Pages 3-9.
3. H. Mamaghanian , N. Khaled , D. Atienza and P. Vandergheynst "Compressed sensing for real-time energy-efficient ecgcompression onwireless bodysensor nodes", IEEE Trans. Biomed. Eng., vol. 58, no. 9, pp.2456 -2466 2011.
4. MohammadrezaBalouchestani.;KaamranRaahemifar.;andSridharKrishnan.;, ―COMPRESSEDSENSINGINWIRELESSSENSORNETWORKS:SURVEY‖,Canadian JournalonMultimedia andWirelessNetworksVol. 2,No.1,February2011.

ELECTIVE–IV
SEMESTERVIII

20152E81E DIGITALIMAGE PROCESSING LTPC
3003

OBJECTIVES:

- Tobecomefamiliar withdigitalimagefundamentals
- TogetexposedtosimpleimageenhancementtechniquesinSpatialandFrequencydomain.
- Tolearnconceptsofdegradationfunctionandrestorationtechniques.
- Tostudytheimagesegmentationandrepresentationtechniques.
- Tobecomefamiliar withimagecompressionandrecognition methods

UNIT I DIGITALIMAGE FUNDAMENTALS 9
Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing andAcquisition – Image Sampling and Quantization – Relationships between pixels - Color imagefundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT,DCT.

UNIT II IMAGEENHANCEMENT 9
Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering – Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters,Homomorphic filtering, Color image enhancement.

UNIT III IMAGERESTORATION 9
Image Restoration - degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering

UNIT V IMAGECOMPRESSIONANDRECOGNITION 9
Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEGstandard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, RegionalDescriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based onmatching.

TOTAL:45 PERIODS

OUTCOMES:
Attheendofthecourse,thestudentsshouldbeableto:

- Knowandunderstandthebasicsandfundamentalsofdigitalimageprocessing, suchasdigitization, sampling, quantization, and 2D-transforms.
- Operateonimagesusingthetechniquesofsmoothing, sharpeningandenhancement.
- Understandtherestorationconceptsandfilteringtechniques.
- Learnthebasicsofsegmentation,featuresextraction,compressionandrecognitionmethodsfor color models.

TEXTBOOKS:

1. RafaelC.Gonzalez,RichardE.Woods,‗DigitalImageProcessing',Pearson,ThirdEdition,2010.
2. AnilK.Jain,‗FundamentalsofDigitalImageProcessing',Pearson,2002.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

REFERENCES

1. KennethR.Castleman,_DigitalImageProcessing‘,Pearson,2006.
2. RafaelC.Gonzalez,RichardE.Woods, StevenEddins, _DigitalImageProcessingusing MATLAB‘, Pearson Education, Inc., 2011.
3. D,E.DudgeonandRM. Mersereau, _MultidimensionalDigitalSignalProcessing‘,PrenticeHall Professional Technical Reference, 1990.
4. WilliamK.Pratt,_DigitalImageProcessing‘,JohnWiley,NewYork,2002
5. MilanSonkaetal_Imageprocessing,analysisandmachinevision‘,Brookes/Cole, Vikas Publishing House, 2nd edition, 1999.

LISTOF ELECTIVES

ELECTIVE–V(SEMESTERVIII)

ELECTIVE–V
SEMESTERVIII

20152E82A VIDEOANALYTICS LTPC
3003

OBJECTIVES:
Thestudentshouldbemade:

- Tounderstandtheneedforvideo Analytics
- Tounderstandthebasicconfigurationofvideoanalytics
- Tounderstandthefunctionalblocksofavideoanalyticsystem
- Togetexposedtothevariousapplicationsof videoanalytics

UNIT I VIDEOANALYTICCOMPONENTS 9
NeedforVideoAnalytics-OverviewofvideoAnalytics-Foregroundextraction-Featureextraction classifier - Preprocessing- edge detection- smoothening- Feature space-PCA-FLD-SIFT features

UNIT II FOREGROUNDEXTRACTION 9
Background estimation- Averaging-GaussianMixtureModel-OpticalFlowbased-ImageSegmentation-Region growing- Region splitting-Morphological operations- erosion-Dilation-Tracking in a multiplecamera environment

UNIT III CLASSIFIERS 9
Neuralnetworks(backpropagation)-Deeplearningnetworks-FuzzyClassifier-Bayesianclassifier-HMM based classifier

UNIT IV VIDEOANALYTICSFORSECURITY 9
Abandoned object detection- human behavioral analysis -human action recognition -perimeter security - crowd analysis and prediction of crowd congestion

UNIT V VIDEO ANALYTICS FOR BUSINESS INTELLIGENCE & TRAFFICMONITIRING AND ASSISTANCE 9
Customerbehavioranalysis-peoplecounting-Trafficruleviolationdetection-trafficcongestionidentification for route planning- driver assistance- lane change warning

TOTAL:45PERIODS

OUTCOMES:
Attheendofthecourse, thestudentshouldbeableto:

- Designvideoanalyticalgorithmsforsecurityapplications
- Designvideoanalyticalgorithmsforbusinessintelligence
- Designcustommadevideoanalyticssystemforthegiventarget application

REFERENCES:

1. Graeme A. Jones (Editor), Nikos Paragios (Editor), Carlo S. Regazzoni (Editor) Video-Based Surveillance Systems: Computer Vision and Distributed Processing, Kluwer academic publisher, 2001
2. NilanjanDey(Editor), Amira Ashour (Editor)andSuvojit Acharjee(Editor),AppliedVideo Processing in Surveillance and Monitoring Systems (IGI global) 2016

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

3. ZhihaoChen(Author), YeYang(Author), JingyuXue(Author),LipingYe(Author), FengGuo (Author), TheNext Generation of Video Surveillanceand Video Analytics: The Unified Intelligent Video Analytics Suite, CreateSpace Independent Publishing Platform, 2014
4. CaifengShan (Editor), FatihPorikli(Editor),TaoXiang(Editor),ShaogangGong (Editor) Video Analytics for Business Intelligence, Springer, 2012

ELECTIVE–V
SEMESTERVIII

20152E82B DSPARCHITECTUREANDPROGRAMMING

LTPC
3003

OBJECTIVES:
Theobjectiveofthiscourseistoprovide knowledge on:

- BasicsonDigitalSignalProcessors
- ProgrammableDSP‘sArchitecture,On-chipPeripheralsandInstructionset
- Programmingforsignalprocessingapplications
- AdvancedProgrammableDSPProcessors

UNIT I FUNDAMENTALSOFPROGRAMMABLEDSPs 9
Introduction to Programmable DSPs, Architectural Features of PDSPs - Multiplier and Multiplieraccumulator – Modified Bus Structures and Memory access – Multiple access memory – Multi-portmemory – VLIW architecture- Pipelining – Special Addressing modes in P-DSPs – On chipPeripherals, Applications of Programmable DSPs.

UNIT II TMS320C5X PROCESSOR 9
Architecture of C5X Processor – Addressing modes – Assembly language Instructions - Pipelinestructure, On-chipPeripherals –BlockDiagramofDSP starter kit (DSK) –SoftwareTools, DSKon-board peripherals, Application Programs for processing real time signals.

UNIT III TMS320C6X PROCESSOR 9
Architecture of the C6x Processor - Instruction Set – Addressing modes, Assembler directives, On-chipperipherals, DSP Development System: DSP Starter Kit - Code Composer Studio - Support Files – Introduction to AIC23 codec and other on-board peripherals, Real-Time Programming Examples forSignals and Noise generation, Frequency analysis, Filter design.

UNIT IV ADSPPROCESSORS 9
ArchitectureofADSP-21XXandADSP-210XXseriesofDSPprocessors-Addressingmodesandassembly language instructions – Application programs –Filter design, FFT calculation.

UNIT V ADVANCEDPROCESSORS 9
Study of TI‘s advanced processors - TMS320C674x and TMS320C55x DSPs, ADSP‘s Blackfin andSigmaDSP Processors, NXP‘s DSP56Fxx Family of DSP Processors, Comparison of the features of TI,ADSP and NXP DSP family processors.

TOTAL: 45 PERIODS

OUTCOMES:
Attheendofthecourse, thestudentshouldbeableto:

- AnalyzetheconceptsofDigitalSignalProcessors
- Demonstratetheir abilitytoprogramtheDSP processor for signalprocessingapplications
- Discuss, compare and select the suitable Advanced DSP Processors for real-time signal processing applications

REFERENCES:

1. B. Venkataramani and M. Bhaskar, ―Digital Signal Processors – Architecture, Programming and Applications‖ – Tata McGraw – Hill Publishing Company Limited. New Delhi, 2003.
2. Avtar Singh and S. Srinivasan, Digital Signal Processing – Implementations using DSP Microprocessors with Examples from TMS320C54xx, Cengage Learning India Private Limited, Delhi 2012.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

3. RulphChassaingandDonaldReay, DigitalSignalProcessingand Applications withtheC6713 and C6416 DSK, John Wiley & Sons, Inc., Publication, 2012 (Reprint).
4. UserguidesTexasInstruments,AnalogDevicesandNXP.

ELECTIVE–V
SEMESTERVIII

20152E82C SATELLITECOMMUNICATION LTPC
3003

OBJECTIVES:
Thestudentshouldbe made to:

- Understandthebasicsofsatelliteorbits
- Understandthesatellitesegment andearthsegment
- Analyzethevariousmethodsofsatelliteaccess
- Understandtheapplicationsofsatellites
- UnderstandthebasicsofsatelliteNetworks

UNIT I SATELLITEORBITS 9
Kepler‟s Laws, Newton‟s law, orbital parameters, orbital perturbations, station keeping, geo stationary and non Geo-stationary orbits – Look Angle Determination- Limits of visibility – eclipse-Sub satellite point –Sun transit outage-Launching Procedures - launch vehicles and propulsion.

UNIT II SPACESEGMENT 9
Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command-Transponders-The Antenna Subsystem.

UNIT III SATELLITELINK DESIGN 9
Basic link analysis, Interference analysis, Rain induced attenuation and interference, Ionospheric characteristics, Link Design with and without frequency reuse.

UNIT IV SATELLITEACCESSANDCODINGMETHODS 9
Modulation and Multiplexing: Voice, Data, Video, Analog – digital transmission system, Digital video Broadcast, multiple access: FDMA, TDMA, CDMA, DAMA Assignment Methods, compression – encryption, Coding Schemes.

UNIT V SATELLITEAPPLICATIONS 9
INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO,Satellite Navigational System. GPS Position Location Principles, Differential GPS, Direct Broadcastsatellites (DBS/DTH).

TOTAL:45PERIODS

OUTCOMES:
Attheendofthecourse,thestudentwouldbeableto:

- Analyzethesatelliteorbits
- Analyzetheearthsegment andspacesegment
- AnalyzethesatelliteLinkdesign
- Designvarioussatelliteapplications

TEXTBOOKS:

1. DennisRoddy,―SatelliteCommunication‖,4thEdition,McGrawHillInternational,2006.
2. Timothy,Pratt,Charles,W.Bostain,JeremyE.Allnutt,"SatelliteCommunication‖,2ndEdition,Wiley Publications, 2002

REFERENCES:

1. Wilbur L.Pritchard, HendriG.Suyderhoud, RobertA.Nelson, ―SatelliteCommunicationSystems Engineering‖, Prentice Hall/Pearson, 2007.
2. N.Agarwal,―DesignofGeosynchronousSpaceCraft‖,PrenticeHall, 1986.

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

3. Bruce R. Elbert, ―The Satellite Communication Applications‖, Hand Book, Artech House Bostan London, 1997.
4. TriT.Ha,―DigitalSatelliteCommunication‖,II ndedition,1990.
5. EmanuelFthenakis,―ManualofSatelliteCommunications‖,McGrawHillBookCo.,1984.
6. RobertG.Winch,―TelecommunicationTransMissionSystems‖,McGraw-HillBookCo.,1983.
7. BrianAckroyd,―WorldSatelliteCommunicationandearthstationDesign‖,BSPProfessional Books, 1990.
8. G.B.Bleazard,―IntroducingSatellitecommunications―,NCCPublication,1985.
9. M.Richharia,―SatelliteCommunicationSystems-DesignPrinciples‖,Macmillan2003.

ELECTIVE–V
SEMESTERVIII

20152E82D **SOFT COMPUTING** **LTPC**
3003

OBJECTIVES:

- TolearnthebasicconceptsofSoftComputing
- To become familiar with various techniques like neural networks, genetic algorithmsand fuzzy systems.
- Toapplysoftcomputingtechniquestosolveproblems.

UNIT I INTRODUCTIONTOSOFT COMPUTING 9
Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithm and Evolutionary Programming-Swarm Intelligent Systems-Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta- Perceptron Network-Adaline Network-Madaline Network.

UNIT II ARTIFICIALNEURALNETWORKS 9
Back propagation Neural Networks - Kohonen Neural Network -Learning Vector Quantization - Hamming Neural Network - Hopfield Neural Network- Bi-directional Associative Memory -Adaptive Resonance Theory Neural Networks- Support Vector Machines - Spike Neuron Models.

UNIT III FUZZYSYSTEMS 9
Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets - Classical Relations and Fuzzy Relations - Membership Functions -Defuzzification - Fuzzy Arithmetic and Fuzzy Measures - Fuzzy Rule Base and Approximate Reasoning - Introduction to Fuzzy Decision Making.

UNIT IV GENETICALGORITHMS 9
BasicConcepts-WorkingPrinciples-Encoding-FitnessFunction -Reproduction - InheritanceOperators - Cross Over - Inversion and Deletion -Mutation Operator - Bit-wiseOperators -Convergence of GeneticAlgorithm.

UNITVHYBRID SYSTEMS 9
Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic -GA Based Weight Determination - LR-Type Fuzzy Numbers - Fuzzy Neuron - Fuzzy BP Architecture - Learning in Fuzzy BP- Inference by FuzzyBP -FuzzyArtMap: ABrief Introduction- Soft ComputingTools - GAinFuzzyLogic Controller Design - Fuzzy Logic Controller

TOTAL: 45 PERIODS

OUTCOMES:
Uponcompletionofthiscourse,thestudentsshouldbeableto

- Applysuitablesoftcomputingtechniquesforvariousapplications.
- Integratevarioussoftcomputingtechniquesforcomplexproblems.

TEXTBOOKS:

1. N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming", Oxford University Press, 2015.
2. S.N.Sivanandam,S.N.Deepa,"PrinciplesofSoftComputing",WileyIndiaPvt.Ltd.,2ndEdition, 2011.
3. S.Rajasekaran, G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications ", PHI Learning Pvt.Ltd., 2017.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

REFERENCES:

1. Jyh-ShingRogerJang,Chuen-TsaiSun,EijiMizutani,―Neuro-FuzzyandSoftComputing‖, Prentice-Hall of India, 2002.
2. KwangH.Lee,―FirstcourseonFuzzyTheoryandApplications‖,Springer, 2005.
3. GeorgeJ.KlirandBoYuan,―FuzzySetsandFuzzyLogic-TheoryandApplications‖Prentice Hall, 1996.
4. JamesA.FreemanandDavidM.Skapura,―NeuralNetworksAlgorithms,Applications,and Programming Techniques‖, Addison Wesley, 2003.

ELECTIVE–V
SEMESTERVIII

20152E82E PRINCIPLESOFSPEECHPROCESSING LTPC
3003

OBJECTIVES:
Thestudentshouldbemade:

- To understand the speech production mechanism and the various speech analysis techniques andspeech models
- Tounderstandthespeechcompression techniques
- Tounderstandthespeechrecognitiontechniques
- Toknowthespeakerrecognitionandtext tospeechsynthesis techniques

UNIT I SPEECHSIGNALCHARACTERISTICS&ANALYSIS 11
Speech production process - speech sounds and features- - Phonetic Representation of Speech -- representing= speech in time and frequency domains - Short-Time Analysis of Speech - Short-Time Energy and Zero-Crossing Rate - Short-Time Autocorrelation Function - Short-Time Fourier Transform (STFT) - Speech Spectrum - Cepstrum - Mel-Frequency Cepstrum Coefficients - Hearing and Auditory Perception - Perception of Loudness - Critical Bands - Pitch Perception

UNIT II SPEECH COMPRESSION 12
Sampling and Quantization of Speech Vector Quantization- (PCM) - Adaptive differential PCM - Delta Modulation -Linear predictive coding (LPC)- Codeexcited LinearpredictiveCoding (CELP)

UNIT III SPEECH RECOGNITION 12
LPCfor speechrecognition- HiddenMarkovModel(HMM)- trainingprocedurefor HMM-subwordunit model based on HMM- language models for large vocabulary speech recognition - Overall recognition system based on subword units - Context dependent subword units- Semantic post processor for speech recognition

UNIT IV SPEAKERRECOGNITION 5
Acoustic parameters for speaker verification- Feature space for speaker recognition-similarity measures- Text dependent speaker verification-Text independent speaker verification techniques

UNIT V SPEAKERRECOGNITIONANDTEXTTOSPEECHSYNTHESIS 5
Text to speech synthesis(TTS)-Concatenative and waveformsynthesis methods, sub-word units for TTS,intelligibility and naturalness-role of prosody

TOTAL:45PERIODS

OUTCOMES:
Attheendofthecourse, thestudentshouldbeableto:

- Designspeechcompressiontechniques
- Configurespeechrecognitiontechniques
- Designspeakerrecognitionsystems
- Designtexttospeechsynthesis systems

TEXTBOOKS:

1. L.R.RabinerandR.W.Schafer,IntroductiontoDigitalSignalProcessing,Foundationsand Trendsin Signal Processing Vol. 1, Nos. 1–2 (2007) 1–194
2. Ben Gold and Nelson Morgan ―Speech and Audio signal processing- processing and perceptionof speech and music‖, John Wiley and sons 2006

REFERENCES

1. Lawrence Rabiner,Biiingand–HwangJuangandB.Yegnanarayana―FundamentalsofSpeech Recognition‖, Pearson Education, 2009

2. ClaudioBecchettiandLucioPrina Ricotti,―SpeechRecognition‖,JohnWileyandSons, 1999
3. DonglosOshanhnessy―SpeechCommunication:HumanandMachine ―,2ndEd.University press 2001.

ELECTIVE–V
SEMESTERVIII

20152E82F FUNDAMENTALSOFNANOSCIENCE LTPC
3003

OBJECTIVE:

- Tolearnaboutbasisofnanomaterialscience,preparationmethod,typesandapplication

UNIT I INTRODUCTION 8

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thin films-multilayered materials. LengthScales involvedand effect onproperties:Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERALMETHODSOFPREPARATION 9

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phasedeposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS 12

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications-Nanometal oxides-ZnO, TiO2,MgO, ZrO2, NiO, Nano alumina, CaO, AgTiO2, Ferrites, Nano clays-functionalization and applications-Quantum wires, Quantum dots-preparation, properties andapplications.

UNIT IV CHARACTERIZATIONTECHNIQUES 9

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques-AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation.

UNIT V APPLICATIONS 7

Nano InfoTech: Information storage- Nano computer, molecular switch, super chip, nanocrystal, Nanobiotechnology: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targeted drugdelivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems(NEMS)- Nano sensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sun barrierproducts - In Photostat, printing, solar cell, battery.

TOTAL:45PERIODS

OUTCOMES:

- Willfamiliarizeaboutthescienceofnanomaterials
- Willdemonstratethepreparationofnanomaterials
- Willdevelopknowledgeincharacteristicnanomaterial

TEXTBOOKS:

1. A.S.EdelsteinandR.C.Cammearata,eds.,―Nanomaterials:Synthesis,Propertiesand Applications‖, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, ―NanoscaleCharacterization of surfaces & Interfaces‖, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

REFERENCES:

1. GTimp,―Nanotechnology‖,AIPpress/Springer, 1999.
2. AkhleshLakhtakia,―TheHandBookofNanoTechnology,NanometerStructure,Theory, Modeling and Simulations‖. Prentice-Hall of India (P) Ltd, New Delhi, 2007.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

SEMESTERVIII

201AGPE PROFESSIONALETHICSANDHUMANVALUES LTPC
0002

OBJECTIVE:

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNITI HUMANVALUES

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation– Commitment – Empathy –Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNITII ENGINEERINGETHICS

Senses of ‗Engineering Ethics' – Varietyof moralissues – Types of inquiry– Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNITIII ENGINEERINGASSOCIALEXPERIMENTATION

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A BalancedOutlook on Law.

UNITIV SAFETY,RESPONSIBILITIESANDRIGHTS

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect forAuthority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – ProfessionalRights – Employee Rights – Intellectual Property Rights (IPR)– Discrimination.

UNITV GLOBALISSUES

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.

OUTCOMES:

- Upon completion of the course, the student should be able to applyethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

TEXTBOOKS:

1 Mike W. Martin and Roland Schinzinger, ― Ethics in Engineering‖, Tata McGraw Hill, New Delhi, 2003.
2 Govindarajan M, Natarajan S, Senthil Kumar V. S, ― Engineering Ethics‖, Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1 CharlesB.Fleddermann,―EngineeringEthics‖,PearsonPrenticeHall,NewJersey,2004.
2 Charles E. Harris,Michael S. Pritchard and Michael J. Rabins, ―Engineering Ethics– Concepts andCases‖, Cengage Learning, 2009.
3 JohnRBoatright,―EthicsandtheConductofBusiness‖,PearsonEducation,NewDelhi,2003
4 EdmundGSeebauerandRobertLBarry,―FundamentalsofEthicsforScientistsandEngineers‖, Oxford University Press, Oxford, 2001.
5 Laura P. Hartman and Joe Desjardins, ―Business Ethics: Decision Making for Personal Integrity and Social Responsibility‖ Mc Graw Hill education, India Pvt. Ltd.,New Delhi, 2013.
6 WorldCommunityServiceCentre,‗ValueEducation',Vethathiripublications,Erode,2011.

Web sources:

www.onlineethics.org www.nspe.org www.globalethics.org www.ethics.org

PRISTDEEMEDTOBE UNIVERSITY

Vallam,Thanjavur

SCHOOLOFENGINEERINGANDTECHNOLOGY

DEPARTMENTOF

ELECTRONICS&COMMUNICATIONENGINEERING

PROGRAMHANDBOOK

B.TECH–PARTTIME

[REGULATION2019]

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

PROGRAMMEEDUCATIONALOBJECTIVES:

PEO1:To enable graduates to pursue research, or have a successful career in academia or industries associated with Electronics and Communication Engineering, or as entrepreneurs.

PEO2: To provide students with strong foundational concepts and also advanced techniquesand tools in order to enable them to build solutions or systems of varying complexity.

PEO3: To prepare students to critically analyze existing literature in an area of specialization and ethically develop innovative and research oriented methodologies to solve the problems identified.

PROGRAMMEOUTCOMES:

EngineeringGraduateswillbeableto:

A. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

B. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

C. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

D. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data,and synthesis of the information to provide valid conclusions.

E. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

F. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legalandculturalissuesandtheconsequent responsibilities relevant to the professional engineering practice.

G. **Environment and sustainability**: Understandtheimpact of theprofessional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

H. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

I. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

J. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

K. **Project management and finance**: Demonstrate knowledge and understanding of the engineeringand management principles andapplytheseto one‘s ownwork, asa member and leader in a team, to manage projects and in multidisciplinary environments.

L. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broadrelationbetweenthe programmeobjective andtheoutcomesisgiveninthe following table

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMMEOUTCOMES												
	A	B	C	D	E	F	G	H	I	J	K	L	M
1	3	3	2	3	2	1	1	2	1	1	3	1	3
2	3	3	3	3	3	1	1	1	1	1	1	2	2
3	3	3	3	3	3	2	2	3	1	2	2	2	2

Contribution 1:Reasonable 2:Significant 3:Strong

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

B.TECH(PARTTIME)–ECE–R-2019

SEMESTER I – VII CURRICULUM

SEMESTER-I

S.NO	SUB CODE	SUBJECTNAME	PeriodsPerWeek			C
			L	T	P	
1	19148S11P	TransformsandPartialDifferential Equations	3	1	0	4
2	19152C12P	ElectromagneticTheory	3	1	0	4
3	19152C13P	DigitalElectronics	3	1	0	4
4	19152C14P	ElectronicCircuits-I	3	0	0	3
5	19152C15P	SignalsandSystems	4	0	0	4
TOTALCREDITS						19

SEMESTER-II

S.NO	SUB CODE	SUBJECTNAME	PeriodsPerWeek			C
			L	T	P	
1	19148S21P	NumericalMethods	3	1	0	4
2	19152C22P	ElectricalEngineeringandControl Systems	3	0	0	3
3	19152C23P	LinearIntegratedCircuits	3	1	0	4
4	19152C24P	ElectronicCircuits-II	3	1	0	4
5	19152C25P	TransmissionLinesandWaveguides	4	0	0	4
TOTALCREDITS						19

SEMESTER-III

S.NO	SUBCODE	SUBJECTNAME	PeriodsPerWeek			C
			L	T	P	
1.	19148S31BP	ProbabilityandRandomProcesses	3	1	0	4
2.	19152C32P	MicroprocessorInterfacingand Applications	3	1	0	4
3.	19152C33P	DigitalSignalProcessing	3	1	0	4
4.	19152C34P	CommunicationTheory	3	1	0	4
5.	19152L35P	DigitalSignalProcessingand MicroprocessorLab	0	0	3	2
TOTALCREDITS						18

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

SEMESTER-IV

S.NO	SUBCODE	SUBJECTNAME	PeriodsPerWeek			C
			L	T	P	
1	19152C41P	DigitalCommunication	3	1	0	4
2	19152C42P	Antennaand WavePropagation	3	1	0	4
3	19152C43P	ComputerNetworks	4	0	0	4
4	19152E44_P	**Elective-I**	4	0	0	4
5	19152L45P	NetworksandCommunicationLab	0	0	3	2
			TOTALCREDITS			**18**

SEMESTER-V

S.NO	SUBCODE	SUBJECTNAME	PeriodsPerWeek			C
			L	T	P	
1	19152C51P	OpticalCommunicationand Networks	4	0	0	4
2	19152C52P	MicrowaveEngineering	4	0	0	4
3	19152C53P	VLSIDesign	3	1	0	4
4	19152E54_P	**Elective II**	4	0	0	4
5	19152L55P	OpticalCommunicationand Microwave Lab	0	0	3	2
			TOTALCREDITS			**18**

SEMESTER-VI

S.NO	SUBCODE	SUBJECTNAME	PeriodsPerWeek			C
			L	T	P	
1	19152C61P	MobileandWirelessCommunication	4	0	0	4
2	19152C62P	MedicalElectronics	3	1	0	4
3	19152C63P	MicrocontrollerandEmbedded Systems	3	1	0	4
4	19152E64_P	**Elective III**	4	0	0	4
5	19152L65P	VLSIandEmbeddedSystems Lab	0	0	3	2
			TOTALCREDITS			**18**

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

SEMESTER-VII

S.NO	SUBCODE	SUBJECTNAME	PeriodsPerWeek			C
			L	T	P	
1	19160S71P	TotalQualityManagement	3	0	0	3
2	19152C72P	WirelessNetworks	3	1	0	4
3	19152C73P	TelecommunicationSwitchingand Networks	4	0	0	4
4	19152E74_P	**Elective IV**	3	0	0	3
5	19152P75P	ProjectWork	0	0	12	6
					TOTALCREDITS	20

LISTOF ELECTIVES

ELECTIVE-I(SEMESTER-IV)

S.No	SubCode	SubName	PeriodsPerWeek			C
			L	T	P	
1	19152E44AP	HighSpeed Networks	4	0	0	4
2	19152E44BP	AdvancedDigitalSignalProcessing	4	0	0	4
3	19152E44CP	SpeechProcessing	4	0	0	4
4	19152E44DP	FuzzyLogicand NeuralNetworks	4	0	0	4
5	19152E44EP	AdvancedElectronicSystemDesign	4	0	0	4

ELECTIVE-II(SEMESTER-V)

S.No	SubCode	SubName	PeriodsPerWeek			C
			L	T	P	
1	19152E54AP	EnvironmentalScienceand Engineering	4	0	0	4
2	19152E54BP	OptoelectronicDevices	4	0	0	4
3	19152E54CP	RadarandNavigationalAids	4	0	0	4
4	19152E54DP	DigitalImageProcessing	4	0	0	4
5.	19152E54EP	EngineeringAcoustics	4	0	0	4

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE-III(SEMESTER-VI)

S.No	SubCode	SubName	PeriodsPerWeek			C
			L	T	P	
1	19152E64AP	PrinciplesOfManagement	**4**	**0**	**0**	**4**
2	19152E64BP	SatelliteCommunication	**4**	**0**	**0**	**4**
3	19152E64CP	Robotics	**4**	**0**	**0**	**4**
4	19152E64DP	Remotesensing	**4**	**0**	**0**	**4**
5.	19152E64EP	NetworkSecurity	**4**	**0**	**0**	**4**

ELECTIVE-IV(SEMESTER-VII)

S.No	SubCode	SubName	PeriodsPerWeek			C
			L	T	P	
1	19152E74AP	PowerElectronics	**3**	**0**	**0**	**3**
2	19152E74BP	AdvancedMicroprocessors	**3**	**0**	**0**	**3**
3	19152E74CP	ElectromagneticInterferenceand Compatibility	**3**	**0**	**0**	**3**
4	19152E74DP	SolidStateElectronicDrives	**3**	**0**	**0**	**3**
5	19152E74EP	ComputerHardwareand Interfacing	**3**	**0**	**0**	**3**

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

B.TECH(PARTTIME) –ECE–R-2019

COURSESTRUCTUREANDCREDITSDISTRIBUTION

Sem.	CoreCourses				Elective Courses		Total Credits
	Theory Courses		Practical Courses				
	Nos.	Credits	Nos.	Credits	Nos.	Credits	
I	05	19	-	-	-	-	19
II	05	19	-	-	-	-	19
III	04	16	01	02	-	-	18
IV	03	12	01	02	01	04	18
V	03	12	01	02	01	04	18
VI	03	12	01	02	01	04	18
VII	03	11	01	06	01	03	20
TotalCredits							130

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

19148S11P **SEMESTERI**

TRANSFORMSANDPARTIALDIFFERENTIALEQUATIONS **3104**

(CommontoCSE,IT,ECE)

AIM

Thecourseaimstodeveloptheskillsofthestudentsintheareasofboundary value problems and transform techniques. This will be necessary for their effective studies in a large number of engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory. The course will also serve as a prerequisite for post graduate and specialized studies and research.

OBJECTIVES

Atthe endofthe coursethe students would

- Be capable of mathematically formulating certain practical problems in terms of partial differential equations, solve them and physically interpret the results.
- Have gained a well founded knowledge of Fourier series, their different possible formsand the frequently needed practicalharmonic analysis that anengineer may have to make from discrete data.
- Haveobtainedcapacitytoformulateand identifycertainboundaryvalueproblems encountered in engineering practices, decide on applicabilityof the Fourier series method of solution, solve them and interpret the results.
- Have grasped the concept ofexpressionofa function, under certainconditions, as a double integral leading to identification of transform pair, and specialization on Fourier transformpair, their properties, thepossiblespecialcaseswithattentionto their applications.

UNITI FOURIERSERIES 9

Fourierseries–Oddandevenfunctions–Halfrangesineseries–Halfrangecosineseries – Complex form of Fourier Series – Parseval's identify – Harmonic Analysis.

UNITII FOURIERTRANSFORM 9

Fourierintegraltheorem(withoutproof)–SineandCosine transforms – Properties (without Proof) – Transforms of simple functions –Convolution theorem – Parseval's identity – Finite Fourier transform – Sine and Cosinetransform.

UNITIIIZ-TRANSFORMAND DIFFERENCEEQUATIONS 9

Z-transform - Elementary properties (without proof) – Inverse Z – transform – Convolution theorem -Formation of difference equations – Solution of differenceequations using Z - transform.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

UNITIV PARTIALDIFFERENTIALEQUATIONS 9

Solution of First order partial differential equation reducible to standard forms – Lagrange's linear equation – Linear partial differential equations of second order andhigher order with constant coefficients.

UNITV BOUNDARYVALUEPROBLEMS 9

Solutions of one dimensional wave equation – One dimensional heat equation– Steadystate solution of two-dimensional heat equation (Insulated edges excluded) – Fourierseries solutions in Cartesian coordinates.

TUTORIAL:15 TOTAL: 60

TEXTBOOKS

1. Andrews,L.A.,andShivamoggiB.K.,"IntegralTransformsforEngineersand Applied Mathematicians", Macmillen , New York ,1988.
2. Grewal,B.S., "Higher Engineering Mathematics", Thirty Sixth Edition,Khanna Publishers, Delhi, 2001.
3. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Engineering Mathematics Volume III", S. Chand & Company ltd., New Delhi, 1996.

REFERENCES

1. Narayanan, S., Manicavachagom Pillay, T.K. and Ramaniah, G., "Advanced Mathematics for Engineering Students", Volumes II and III, S. Viswanathan (Printers and Publishers) Pvt. Ltd. Chennai, 2002.
2. Churchill,R.V.andBrown,J.W.,"FourierSeriesandBoundaryValueProblems", Fourth Edition, McGraw-Hill Book Co., Singapore, 1987.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

19152C12P **SEMESTERI**

ELECTROMAGNETICTHEORY **3104**

AIM

To familiarize the student to the concepts, calculations and pertaining to electric, magnetic and electromagnetic fields so that an in depth understanding of antennas, electronic devices, waveguides is possible.

OBJECTIVES

- Toanalyzefieldsapotentialsduetostatic changes
- Toevaluatestaticmagnetic fields
- Tounderstandhowmaterialsaffectelectricand magnetic fields
- Tounderstandtherelationbetweenthefieldsundertimevaryingsituations
- Tounderstandprinciplesofpropagationofuniformplane waves.

UNITI STATICELECTRICFIELDS 9

Vector field. Introductionto Co-ordinate System–Rectangular – CylindricalandSphericalCo-ordinate System–calculationof lengtharea and volume. DefinitionofCurl,Divergence and Gradient – Meaning of Strokes theorem and Divergence theorem .

Coulomb's Law– Definition of Electric Field Intensity –Electric Field due todiscrete charges – charges distributed uniformly on an infinite line – Electric ScalarPotential – Relationship between potential and electric field - Potential due to infiniteuniformly charged line –Electric Flux Density – Gauss Law – Proof of Gauss Law.

UNITII STATICMAGNETICFIELD 9

The Biot-Savart Law in vector form –Magnetic field and Magnetic flux density-Magnetic Field intensity due to a infinite wire carrying a current I – Magnetic fieldintensityontheaxisofacircularandrectangular loopcarryingacurrent I – Calculationoffield using Ampere's circuital law for symmetrical distributions a) infinitely longsolenoid and b) coaxial cable. The Lorentz force equation for a moving charge andapplications –Scalar and Vector Magnetic Potential.

UNITIIIELECTRIC AND MAGNETICFIELDSIN MATERIALS9

Poisson's and Laplace's equation – Electric Polarization- Definition of Capacitance – Capacitance of various geometries using Laplace's equation – Electrostatic energy andenergy density – Boundary conditions for electric fields – Electric current – Currentdensity – point form of ohm's law –

Definition of Inductance - Inductance of loops– Definition of mutual inductance.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

Energydensity in magnetic fields – Nature of magnetic materials – magnetization andpermeability - magnetic boundary conditions.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

UNITIV TIMEVARYINGELECTRICANDMAGNETIC FIELDS 9

Faraday's law – Displacement current – Generalization of Ampere's circuital law.Maxwell's Equation in integral form from Faraday's Law – Maxwell's Equationexpressed in point form from Faraday's Law.

Poynting Vector Poynting Theorm and the flow of power – Power flow in a co-axialcable – Instantaneous Average and Complex Poynting Vector.

UNITV ELECTROMAGNETICWAVES 9

DerivationofWaveEquation –. PropertiesofUniformPlane Wave — Waveequation fora conducting medium– Plane waves Propagation in good dielectrics --- Plane wavesPropagation in good conductors – Skin effect.

Linear,Elliptical andcircularpolarization–normalincidenceandObliqueincidence–Reflection of Plane Waves by a perfect dielectric Brewster angle .Surface impedance**TUTORIAL15** **TOTAL : 60**

TEXTBOOKS

1. WilliamH.Hayt:"EngineeringElectromagnetics"TATA2003(UnitI,II,III).
2. E.C. Jordan & K.G. Balmain"Electromagnetic Waves and Radiating Systems." Prentice Hall ofIndia 2nd edition 2003. (Unit IV, V). McGraw-Hill, 9th reprint

REFERENCES

1. Ramo,WhinneryandVanDuzer:"FieldsandWavesinCommunications Electronics" John Wiley & Sons (3rd edition 2003)
2. .NarayanaRao,N:"ElementsofEngineeringElectromagnetics"4thedition, Prentice Hall of India, New Delhi, 1998.
3. M.N.O.Sadiku:"Elementsof EngineeringElectromagnetics"OxfordUniversity Press, Third edition.
4. DavidK.Cherp:"FieldandWaveElectromagnetics-SecondEdition-Pearson Edition.
5. DavidJ.Grithiths:"IntroductiontoElectrodynamics-IIIEdition-PHI.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

19152C13P **SEMESTERI**

DIGITALELECTRONICS **3104**

AIM

Tolearnthe fundamentalconceptsthoseareusefulfor designingdigitalsystems or circuits.

OBJECTIVES

- Tointroducenumbersystemsandcodes
- TointroducebasicpostulatesofBooleanalgebraandshowsthecorrelationbetween Boolean expressions
- TointroducethemethodsforsimplifyingBoolean expressions
- Tooutlinetheformalproceduresfortheanalysisanddesignofcombinational circuits and sequential circuits
- Tointroducetheconceptofmemoriesdevices.

UNITI: BOOLEANALGEBRAANDMINIMIZATION 9

Basic theorems – Boolean functions – Canonical and Standard forms – Minimizationtechniques – K-map up to five variables – NAND and NOR implementation – ExclusiveOR function - Hardware Description Language (HDL).

UNITII: DIGITALLOGIC FAMILIES 9

Switching operation of PN junction diode – bipolar and MOS devices – Bipolar logicfamilies – RTL – DTL – DCTL – HTL –TTL – ECL – MOS and CMOS – Tristate logic–Interfacing of CMOS and TTL families.

UNITIII: COMBINATIONALLOGICDESIGN 9

Design using gates – BCD arithmetic circuits – Binary adder – Subtractor – Multiplier – Divider–Designusing MSIdevices–MultiplexerandDemultiplexeraslogicelements – Encoder and decoder – Parity checker – Parity generator – Code converter – Magnitudecomparator.

UNITIV: SEQUENTIALLOGICDESIGN 9

Flip Flops and their conversions – Analysis and synthesis of synchronous sequentialcircuits – Excitation table – State table and state diagram – Design of synchronouscounters – Analysis of asynchronous sequential circuits – Reduction of state and flowtable – Race free state assignment – Designof Asynchronous counters – Timing diagram– Shift registers and their applications.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

UNITV: MEMORY DEVICES 9

Classification of memories – ROM organization – PROM – EPROM – EEPROM – EAPROM – RAM organization – Write operation – Read operation – Memory cycleTiming wave forms – Memory decoding – Memory expansion – Static RAM Cell-Bipolar RAM cell – MOSFET RAM cell – Dynamic RAM cell – Programmable LogicDevices – Programmable Logic Array(PLA) – Programmable ArrayLogic (PAL) – FieldProgrammable Gate Arrays (FPGA).

TUTORIAL15 TOTAL:60

TEXTBOOKS

1. MorrisMano M.,“DigitalDesign”,3rdEdition,PearsonEducation,2007.
2. JohnMYarbrough,“DigitalLogicApplicationsandDesign”,ThomsonLearning, 2002.

REFERENCES

1. JohnF.Wakerly,“DigitalDesign”,4thEdition,Pearson/PHI,2006
2. CharlesH.Roth, “FundamentalsofLogicDesign”, ThomsonLearning,2003.
3. Donald P.Leach and Albert Paul Malvino,“Digital Principles and Applications”, 6th Edition, TMH, 2003.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

19152C14P **SEMESTERI**

ELECTRONICCIRCUITS–I **3003**

AIM

The aim of this course is to familiarize the student with the analysis and design of basic transistor Amplifier circuits and power supplies.

OBJECTIVE

Oncompletionofthiscoursethe studentwillunderstand

- Themethodsofbiasingtransistors
- Designofsimpleamplifier circuits
- Mid– bandanalysisofamplifiercircuitsusingsmall-signalequivalent circuitsto determine gain input impedance and output impedance
- Methodofcalculatingcutofffrequenciesandtodetermine bandwidth
- Designofpower amplifiersandheatsinks
- Analysis anddesignofpowersupplies

UNIT– I TRANSISTERBIASING&STABILIZATION 9

BiasingcircuitsforBJT-DCloadline-ACloadline–Stabilityfactor-MethodsofTransistor Biasing- Bias Compensation – Thermal runaway- heatsink- FET Biasing

UNIT-II LOWFREQUENCYAMPLIFIERANALYSIS&DESIGN 9

Transistor- FETamplifiers-LowfrequencySmallsignalhybridparametermodel:C_{B},C_{E},Cc Amplifier- Analysis of Transistor Amplifier Using h-parameter.
JFETasanAmplifier-AnalysisoflowfrequencycommonSource&CommonDrainAmplifier Using h-parameter.

UNIT– III MULTISTAGEAMPLIFIERS 9

Cascading ofBJT Amplifiers- Analysis ofRC coupled Amplifiers Methods ofIncreasingInput impedance using Darlington and Boot strapping- Emitter coupled DifferentialAmplifier, Differential gain, CMRR, Transfer Characteristics – Cascode amplifier.

UNIT– IVHIGHFREQUENCYANALYSIS OFTHEAMPLIFIERS9

Frequencyresponse-Effect ofCoupling and Bypasscapacitor-Effect ofinternaltransistorcapacitance-Miller Effect – High Frequency πmodel for C_E Amplifier- C_E Short circuitCurrent gain- Cut off frequencies f_α, f_β,f_T - Gain Band Width product.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

UNIT– V POWERSUPPLIES 9

Half wave,Full Wave,Rectifiers- Capacitor Filter- Linear Regulator: ShuntRegulator,Series Regulator- Shunt Regulator using Zener Diode- Switch Mode Power Supply.

TUTORIAL15 TOTAL:60

TEXT BOOK

1. MillmanandHalkias.c.“IntegratedElectronics”TataMcGraw-Hill,1991

REFERENCEBOOKS

1. DavidA. Bell,”ElectonicDevices AndCircuits “PrenticHallofIndia,1998.
2. DonalL. Schilling,Charles,Belove“ElectronicCircuits”ThirdEdition2002.
3. Salivahanan“ElectonicDevicesAndCircuits”
4. Boylestead,RobertL.andLouisNasheresky-“ElectonicDevicesAndCircuit Theory”-Pearson Education
5. J.B.Gupta-“ElectonicDevicesAndCircuits”-S.K.Katariaandsons2004.

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

19152C15P **SEMESTERI**

SIGNALSAND SYSTEMS **4004**

(Commonto ECE& IT)

AIM

Tostudyandanalyzethecharacteristicsofcontinuous,discretesignalsandsystems.

OBJECTIVES

- Tostudythepropertiesand representationofdiscreteand continuous signals.
- Tostudythesamplingprocessandanalysisofdiscretesystemsusingz- transforms.
- Tostudythe analysisandsynthesisofdiscretetime systems.

UNITI CLASSIFICATIONOFSIGNALSAND SYSTEMS 9

Continuous time signals (CT signals), discrete time signals (DT signals) - step, Ramp,Pulse, Impulse, Exponential, Classification of CT and DT signals - periodic andaperiodic, Random signals,Classification of systems (CT systems and DT systems)Linear time invariant systems.

UNITII ANALYSISOFCTSIGNALS 9

FourierTransformandLaplaceTransforminSignalAnalysis.Fourierseries,FourierTransform and Laplace Transform properties, Parseval's relation.

UNITIII LTI-CTSYSTEMS 9

Differentialequation,Blockdiagramrepresentation,Impulseresponse,ConvolutionIntegral, Frequency response, Fourier Methods and Laplace transforms in analysis.

UNITIVSAMPLINGTHEOREMAND ANALYSIS OFDT-SIGNALS9

Sampling theorem – Reconstruction ofa Signal from its samples, aliasing – discrete timeprocessing of continuous time signals, sampling of band pass signals

Z-transform definition – region of convergence – properties of ROC – Properties of ztransform– Polesand Zeros – inverse z-transform, Relationship betweenz-transformandFourier transform.

UNITV LTI-DTSYSTEMS 9

Differenceequations,Blockdiagramrepresentation,Impulseresponse,ConvolutionSUM, Frequency response, Z-transform analysis.

TUTORIAL15 **TOTAL:60**

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

TEXT BOOK

1. AlanV.Oppenheim, AlanS.WillskywithS.Hamid Nawab, Signals &Systems, 2nd edn., Pearson Education, 1997.

REFERENCES

1. M.J.Roberts,SignalsandSystemsAnalysisusingTransformmethodandMATLAB, TMH 2003.
2. SimonHaykinandBarryVanVeen, SignalsandSystems, JohnWiley, 1999
3. K.Lindner,“SignalsandSystems”,McGrawHillInternational,1999.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

19148S21P **SEMESTERII**

NUMERICALMETHODS **3104**

(CommontoCSE,IT,ECE)

AIM

With the present development of the computer technology, it is necessary to develop efficient algorithms for solving problems in science, engineering and technology. This course gives a complete procedure for solving different kinds of problems occur in engineering numerically.

OBJECTIVES

At the end of the course, the students would be acquainted with the basic concepts in numerical methods.

- The roots of nonlinear (algebraic or transcendental) equations, solutions of large system of linear equations and eigenvalue problem of a matrix can be obtained numerically where analytical methods fail to give solution.
- When huge amounts ofexperimentaldata are involved, the methods discussed on interpolation will be useful in constructing approximate polynomial to represent the data and to find the intermediate values.
- The numerical differentiation and integration find application when the functionin the analytical form is too complicated or the huge amounts of data are given such as series of measurements, observations or some other empiricalinformation.
- Since many physical laws are couched in terms of rate of change of one/two or more independent variables, most of the engineering problems are characterizedin the form of either nonlinear ordinary differential equations or partialdifferential equations. The methods introduced in the solution of ordinary differential equations and partial differential equations will be useful inattempting any engineering problem.

UNITISOLUTIONOFEQUATIONS AND EIGENVALUEPROBLEMS9

Newton Raphson's method – Iteration method – Solution of linear system by Gaussianelimination and Gauss-Jordon methods- Iterative methods: Gauss Jacobi and Gauss-Seidel methods- Inverse of a matrix byGauss Jordon method– Eigenvalue of a matrixby power method.

UNITII INTERPOLATION 9

Newton'sforwardandbackwarddifferenceformulas–Centraldifferenceformula:Bessels and Stirling's formula - Lagrangian Polynomials – Divided difference method .

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

UNITIIINUMERICAL DIFFERENTIATION AND INTEGRATION9

Derivatives from difference tables – Divided differences and finite differences – Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg'smethod – Double integrals using trapezoidal and Simpson's rules.

UNITIV INITIALVALUEPROBLEMSFOR ORDINARYDIFFERENTIAL EQUATIONS 9

Single step methods: Taylor series method – Euler and modified Euler methods – Fourthorder Runge – Kutta method for solving first and second order equations – Multistepmethods: Milne's and Adam's predictor and corrector methods.

UNITV BOUNDARYVALUEPROBLEMSINORDINARYANDPARTIAL DIFFERENTIALEQUATIONS 9

Finite difference solution of second order ordinary differential equation – Finitedifference solution of one dimensional heat equation by explicit and implicit methods –One dimensional wave equation and two dimensional Laplace and Poisson equations.

TUTORIAL15 **TOTAL:60**

TEXTBOOKS

1. Gerald,C.F,andWheatley,P.O,"AppliedNumericalAnalysis",SixthEdition, Pearson Education Asia, New Delhi, 2002.
2. Kandasamy,P.,Thilagavathy,K.andGunavathy,K.,"NumericalMethods", S.Chand Co. Ltd., New Delhi, 2003.

REFERENCES

1. Burden, R.L and Faires, T.D., "Numerical Analysis", Seventh Edition, Thomson Asia Pvt. Ltd., Singapore, 2002.
2. Balagurusamy,E.,"NumericalMethods",TataMcGraw-HillPub.Co.Ltd,New Delhi, 1999.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

19152C22P **SEMESTERII**

ELECTRICALENGINEERINGANDCONTROL SYSTEMS

3003

AIM

Tofamiliarizethestudentswithconceptsrelatedtotheoperationanalysisandstabilization of control systems

OBJECTIVES

- TounderstandtheoperationofElectricalmachinesandtransformers
- Tounderstandtheopenloopandclosedloop(feedback) systems
- Tounderstandtimedomainandfrequencydomainanalysisofcontrolsystems required for stability analysis.
- Tounderstand thecompensation techniquethatcan beusedtostabilizecontrol systems

UNIT-I: D.CMACHINESANDTRANSFORMERS 12

Construction and operation of D.C. generators – emf equation – characteristics –principle of operation of D.C. motors. Principle of operation of transformers -parametersof transformers – regulation, losses and efficiency - introduction to three phasetransformers.

UNIT-IISPECIALMACHINES 9

Constructional details and principle of operation of single phase induction motorsandThree Phase Induction motors–servomotor, stepper motor, variable reluctance motors.-applications.

UNITIIIINTRODUCTIONTOCONTROLTHEORY 6

The control problem – differential equation of physical systems – control over systemdynamics by feedback – regenerative feedback – transfer function – block diagram -algebra – signal flow graphs.

UNITIVTIMERESPONSEANDFREQUENCYRESPONSEANALYSIS12

Time response of first and second order system – steady state errors – error constants – design specification of second order systems – state variable analysis – simple problems.Correlation between time and frequencyresponse – polar plots , Bode plots – stability infrequencydomainusingNyquiststabilitycriterion–simpleproblems.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

UNITVSTABILITY 6

Conceptofstability–stabilityconditionsandcriteria–HurwitzandRouthcriterian–relative Stability analysis.

TUTORIAL:15 **TOTAL:60**

TEXTBOOK:

1. D.P.Kothari and I.J.Nagrath “Basic Electrical Engineering”,Tata McGraw Hill Ltd, second edition, 2002.
2. I.J.NagrathandM.Gopal“ControlsystemEngineering”NewageInternational Publishing Company Ltd, third edition 2003.

REFERENCES:

1. Stephen J.Chapman “Electrical Machinery Fundamentals”, McGraw Hill PublishingCompany Ltd, third edition, 1999.
2. K.MurugeshKumar,“ElectricMachines”,VikasPublishingHouse(P)Ltd, 2002.
3. M.Gopal“ControlSystems–PrincipleandDesign”,McGrawHillPublishing companyLtd, second edition, 2003.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

19152C23P SEMESTERII

LINEARINTEGRATEDCIRCUITS 3104

AIM

Toteachthebasicconceptsinthedesignofelectroniccircuitsusinglinearintegrated circuits and their applications in the processing of analog signals.

OBJECTIVES

- Tointroducethebasicbuildingblocksoflinearintegratedcircuits.
- Toteachthelinearandnon-linearapplicationsofoperationalamplifiers.
- Tointroducethetheoryand applicationsofanalogmultipliersand PLL.
- Toteachthetheoryof ADC andDAC
- Tointroduceafewspecialfunctionintegratedcircuits.

UNITI OPAMPCHARACTERISTICSAND APPLICATIONS 9

Ideal op amp, IC op amp, DC characteristics: bias, offset and drift, AC characteristics:bandwidth, slew rate, noise and frequencycompensation, basic opamp application: scalechanger, inverter and non inverter, summer & subtractor, , differentiator & integrator,instrumentation amplifier, V to I and I to V converter, RC active filters: low pass andband pass filtersop amp circuits using diodes: precision rectifier, clipper and clamper,

UNITIICOMPARATORSAND SIGNALGENERATORS 9

Comparator and applications of comparator, regenerative comparator (Schmitt trigger),square wave generator (astable multivibrator), monostable multivibrator Triangular wavegenerator, saw tooth wave generator sine wave generators

UNITIII ANALOGMULTIPLIERANDPLL 9

Multiplier, Applications of multiplier: multiplying DC voltages, frequency doubling,phase angle detection, AM modulation/demodulation. PLL: Basic principles, analog anddigitalphase detector and comparator Voltage controlled Oscillator, Applications ofPLL

UNITIV ADCAND DAC 9

Analog switches, High speed sample and hold circuits, characteristics DAC, Types ofD/A converter, Current driven DAC, Switches for DAC, characteristics ofA/D converterTypes of A/D converter, - Single slope, Successive approximation.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

UNITV SPECIALFUNCTIONICS 9

555 timer functional diagram,Astable and Monostable Multivibrators using 555 Timer,Voltage regulators-linear and switched mode types, Switched capacitor filter, Frequencyto Voltage converters, and Isolation Amplifiers, Fiber optic ICs and Opto-couplers.

TUTORIAL15 **TOTAL:60**

TEXT BOOK

1. Sergio Franco, ‘Design with operational amplifiers and analog integrated circuits’, McGraw-Hill, 1997.
2. D.Roy Choudhry, Shail Jain,“Linear Integrated Circuits”, New Age International Pvt. Ltd., 2000.

REFERENCES

1. J.MichaelJacob,‘ApplicationsandDesignwithAnalogIntegratedCircuits’, Prentice Hall of India, 1996.
2. RamakantA.Gayakwad,‘OP-AMPandLinearIC’s’,PrenticeHall/Pearson Education, 1994.
3. K.R.Botkar,‘IntegratedCircuits’.KhannaPublishers, 1996.
4. Millman.J.andHalkias.C.C.‘IntegratedElectronics’,McGraw-Hill,1972.
5. WilliamD.Stanely,‘OperationalAmplifierswithLinearIntegratedCircuits’Pearson Education, 2004.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

19152C24P **SEMESTERII**

ELECTRONICCIRCUITS-II **3104**

AIM

The aim of this course is to familiarize the student with the analysis and design of feed back amplifiers, oscillators, tuned amplifiers, wave shaping circuits, multivibrators and blocking oscillators.

OBJECTIVES

Oncompletionofthiscoursethe studentwillunderstand

- Theadvantagesandmethodofanalysisoffeed backamplifiers
- AnalysisanddesignofRCandLCoscillators,tunedamplifiers,waveshaping circuits, multivibrators, blocking oscillators and time based generators.

UNITI:POWERAMPLIFIERS **9**

Classification, Efficiency of Class A , RC coupled, Transformer coupled, Class B push pull,Complementary symmetry power amplifier, Power Output, Efficiency and Power Dissipation,cross over distraction & Elimination, Heat sink.

UNITII:FEEDBACKAMPLIFIERS **9**

Feedback concept,Fourbasic typesoffeedback, Equivalent Circuitsofvoltage amplifier,Current Amplifier ,Trans conductance, Trans resistance amplifier, Transfer ratio fornegative feedback,Effect of feedback on noise, distortion gain input & output,impedance of the amplifier. Method of identifying feedback topology, Analysis of fourtypes of feedback amplifier.

UNITIII:OSCILLATORS **9**

Theory of Oscillator, Closed loop gain of the circuits, Barhausen Criterion. Analysis &DesignofRC Phase Shift Oscillators, WienBridge Oscillator, HartleyOscillatorColpittsOscillator, crystal Oscillator, frequency Stability.

UNITIV:TUNED AMPLIFERS **9**

Tuned Circuit, Resonance,Q factor, Classification oftuned amplifier, Analysis ofsingletuned amplifier, Capacitance coupling, Effect of cascading single tuned amplifier onBand width, Double tuned amplifier, instability of tuned amplifiers-stabilizationtechniques, Narrow band neutralization using coil, Class C tuned amplifiers and theirapplications. Efficiency of Class C tuned Amplifier.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

UNITV: WAVESHAPING,SWEEP&MULTIVIBRATORCIRCUTS 9

RL & RC Integrator and Differentiator circuits. Voltage sweep circuit , Miller sweepgenerator, UJT saw tooth generator, current time base generator, Collector coupledAstable Multivibrator, Collector coupled Monosatble Multivibrator - BistableMultivibrator - Schmitt trigger circuits.

TUTORIAL15 **TOTAL:60**

TextBooks:

1. MillmanJ. andHalkiasC.C., "IntegratedElectronics",McGrawHill1991
2. SchillingCharlesBelove,"ElectronicCircuits",ThirdEdition,2002.
3. MillmanJ. and TaubH., " Pulse Digitaland Switching waveform", McGraw Hill International.
4. RobertL.BoylestandLouisNasheresky,“ElectronicDevicesandCircuits theory” 8th edn., PHI, 2002.

References:

1. Sedra/Smith,“Micro ElectronicCircuits”OxfordUniversityPress,2004.
2. DavidA.Bell,“SolidStatePulseCircuits”,PrenticeHallofIndia, 1992.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

19152C25P **SEMESTERII**

TRANSMISSIONLINESANDWAVEGUIDES **4004**

AIM

Tolayastrongfoundationonthetheoryoftransmissionlinesandwaveguidesby highlighting their applications.

OBJECTIVES

- Tobecomefamiliarwithpropagationofsignalsthroughlines
- UnderstandsignalpropagationatRadiofrequencies
- Understandradiopropagationinguidedsystems
- Tobecomefamiliarwithresonators

UNITI TRANSMISSIONLINETHEORY 9

Different types of transmission lines – Definition of Characteristic impedance andPropagation Constant, General Solution of the transmission line –wavelength andvelocity of propagation. Waveform distortion – distortion less transmission line – Inputimpedance of lossless lines – reflection on a line not terminated by Z_o- reflection factorand reflection loss – Numerical problems.

UNITIITHELINEATRADIOFREQUENCIES 9

Standing waves and standing wave ratio on a line – One-eighth wave line – The quarterwave line and impedance matching – the halfwave line – The SmithChart – Applicationof the Smith Chart – Problems using smith chart (how to use smith chart and markimpedances, finding input impedance, SWR, reflection coefficient, finding loadimpedance) single stub matching - Numerical problems.

UNITIII GUIDEDWAVES 9

Waves betweenparallelplanes ofperfect conductors – Transverse electric and transversemagnetic waves – characteristics of TE and TM Waves – Transverse Electromagneticwaves – Velocities of propagation. – Wave impedances – Numerical problems.

UNITIV RECTANGULARWAVEGUIDES 9

Transverse Magnetic Waves in Rectangular Wave guides – Transverse Electric Waves inRectangular Waveguides – characteristic ofTE and TM Waves – cut-offwavelength andphase velocity - Dominant mode in rectangular waveguide –Wave impedance,Characteristic impedance - Numerical problems.

UNITV CIRCULARWAVEGUIDES ANDRESONATORS 9

TM and TE waves in circular guides – wave impedances and characteristic impedance –

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

Dominantmodeincircularwaveguide–excitationofmodes–Microwavecavities,

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

Rectangular cavityresonators, circular cavityresonator – Q factor of cavityresonator forTE101 mode - Numerical problems.

TUTORIAL15 **TOTAL:60**

TEXTBOOKS

1. J.D.Ryder"Networks,LinesandFields",PHI,NewDelhi,2003.(UnitI&II)
2. E.C.Jordan andK.G.Balmain"ElectroMagneticWavesandRadiatingSystem, PHI, New Delhi, 2003. (Unit III, IV & V)

REFERENCES

1. Ramo,WhineeryandVanDuzer:"FieldsandWavesinCommunicationElectronics" John Wiley, 2003.
2. DavidM.Pozar:MicrowaveEngineering–2ndEdition–John Wiley.
3. DavidK.Cheng,FieldandWavesinElectromagnetism,Pearson

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

19148S31BP **SEMESTERIII**

PROBABILITYANDRANDOMPROCESSES

(Commonto ECE& BM) **3104**

AIM

This course aims at providing the necessary basic concepts in random processes. A knowledge of fundamentals and applications of phenomena will greatly help in the understanding of topics such a estimation and detection, pattern recognition, voice and image processing networking and queuing.

OBJECTIVES

Atthe endofthe course,the students would

- Haveafundamentalknowledgeofthebasicprobabilityconcepts.
- Have a well – founded knowledge ofstandard distributions which can describe real life phenomena.
- Acquire skills in handling situations involving more than one random variable and functions of random variables.
- Understandandcharacterizephenomenawhichevolvewithrespecttotimeinprobabilistic manner.
- Beabletoanalyzetheresponseofrandominputstolinear timeinvariantsystems.

UNITI PROBABILITYANDRANDOMVARIABLE 9

Axioms of probability - Conditional probability - Baye's theorem- Random variable - Probabilitymassfunction-Probabilitydensityfunction-Properties-Moments-Momentgenerating functions and their properties.

UNITII STANDARDDISTRIBUTIONS 9

Binomial,Poisson,Geometric,Uniform,Exponential,Gamma,WeibullandNormaldistributions and their properties - Functions of a random variable (excluding theorm).

UNITIIITWODIMENSIONALRANDOMVARIABLES 9

Joint distributions - Marginal and conditional distributions – Covariance - Correlationand regression (for distributions only)- Transformation of random variables - Centrallimit theorem.

UNITIVCLASSIFICATION OFRANDOMPROCESSES 9

Definition and examples - first order, second order, strictly stationary, wide – sensestationary and Ergodic processes - Markov process - Binomial, Poisson and Normalprocesses - Sine wave process.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

UNITV CORRELATIONANDSPECTRALDENSITIES 9

Auto correlation - Cross correlation - Properties –Powerspectraldensity– Cross spectraldensity - Properties – Relationship between cross power spectrum and cross correlationfunction– Auto correlation and cross correlation functions of input and output.

TUTORIAL15 TOTAL:60

TEXTBOOKS

1. Ross, S., "AFirst CourseinProbability", Fifthedition, PearsonEducation, Delhi, 2002.
2. Peebles Jr. P.Z., "Probability Random Variables and Random Signal Principles", Tata McGraw-Hill Pubishers, Fourth Edition, New Delhi, 2002. (Chapters 6, 7and 8).

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

19152C32P **SEMESTERIII**

MICROPROCESSOR,INTERFACINGANDAPPLICATIONS

3104

AIM

Tolearnthearchitectureprogramming,interfacingandapplicationsofmicroprocessors.

OBJECTIVES

- Tointroducethearchitectureandprogramming of8085 microprocessor.
- Tointroducetheinterfacing ofperipheraldeviceswith8085microprocessor.
- Tointroducethearchitectureandprogramming of8086 microprocessor.
- Tointroducetheapplications,programmingwith8085microprocessor.

UNITI 8085 CPU 9

8085Architecture–Instructionset–Addressingmodes—Assemblylanguageprogramming – Interrupts – Memory interfacing – Interfacing, I/O devices.

UNITII PERIPHERALSINTERFACING 9

InterfacingSerialI/O(8251)-parallelI/O(8255)–KeyboardandDisplaycontroller(8279) – ADC/DAC interfacing

UNITIII 8086 CPU 9

Intel8086InternalArchitecture–8086Addressingmodes-Instructionset-8086Assembly language Programming–Interrupts.

UNITIV 8086 SYSTEMDESIGN 9

8086signals andtiming – MIN/MAX modeofoperation– Addressing memoryandI/O – Multiprocessor configurations – System design using 8086

UNITV 8085APPLICATIONS 9

Steppermotorcontrol–DCmotorcontrol–Trafficlightcontrol—DigitalClock–Square wave generation

TUTORIAL15 **TOTAL:60**

TEXTBOOKS

1. Ramesh S Gaonkar, Microprocessor Architecture, Programming and application with 8085, 4th Edition, Penram International Publishing, New Delhi, 2000. (Unit I, II)
2. JohnUffenbeck,The80x86Family,Design,ProgrammingandInterfacing,Third Edition. Pearson Education, 2002.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

3. S.P.Chowdhury,SunetraChowdhury,Microprocessor&Peripherals,FirstEdition ,ScitechPublications(INDIA)Pvt.Ltd.(UnitV)

REFERENCES

1. A.K. Ray and K.M.Burchandi, Intel Microprocessors Architecture Programming and Interfacing, McGraw Hill International Edition, 2000(Unit III,IV)
2. KennethJAyala,The8051MicrocontrollerArchitectureProgrammingand Application, 2nd Edition, Penram International Publishers (India), New Delhi, 1996.
3. M.Rafi Quazzaman,Microprocessors Theory andApplications: Intel and Motorola prentice Hall of India, Pvt. Ltd., New Delhi, 2003.

19152C33P **SEMESTERIII**

DIGITALSIGNALPROCESSING **3104**

AIM

To studythesignalprocessingmethodsandprocessors.

OBJECTIVES

- TostudyDFTandits computation
- Tostudythedesigntechniquesfordigital filters
- Tostudythefiniteword lengtheffectsinsignalprocessing
- Tostudythenon-parametricmethodsofpowerspectrumestimations
- To studythefundamentalsofdigitalsignalprocessors.

UNITI FASTFOURIER TRANSFORM 9

Discrete Time Fourier Transform (DTFT), Introduction to DFT – Efficient computationof DFT Properties of DFT – FFT algorithms – Radix-2 and Radix-4 FFT algorithms – Decimation in Time – Decimation in Frequency algorithms

UNITII IIRFILTERDESIGN 9

StructureofIIR – SystemDesign ofDiscretetime IIR filter fromcontinuous time filter –IIR filter design by Impulse Invariance. Bilinear transformation – Approximationderivatives – Design of IIR filter in the Frequency domain.

UNITIII FIRFILTERDESIGN 9

Symmetric&AntisymtericFIRfilters–Linearphasefilter–Windowingtechnique–Rectangular, Hamming– Frequency sampling techniques

UNITIV FINITEWORDLENGTH EFFECTS 9

Quantization noise – derivation for quantization noise power – Fixed point and binaryfloating point number representation – comparison – over flow error – truncation error –co-efficient quantization error- limit cycle oscillation – signal scaling

UNITV POWERSPECTRUM ESTIMATION 9

Computation of Energy density spectrum – auto correlation and power spectrum ofrandom signals. Periodogram – use of DFT in power spectrum estimation – Nonparametric methods for power spectralestimation: Bartlett methods –Application ofDSP– Model of Speech Wave Form – Vocoder.

TUTORIAL15 **TOTAL:60**

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

TEXT BOOK

1. JohnGProakisandDimtrisGManolakis,“DigitalSignalProcessingPrinciples, Algorithms and Application”, PHI/Pearson Education, 2000, 3rd Edition.

REFERENCES

1. Alan V Oppenheim, Ronald W Schafer and John R Buck, “Discrete Time Signal Processing”, PHI/Pearson Education, 2000, 2nd Edition.
2. JohnyR.Johnson,“IntroductiontoDigitalSignalProcessing”,PrenticeHallof India/Pearson Education, 2002.
3. Sanjit K.Mitra, “DigitalSignalProcessing: AComputer – Based Approach”, Tata McGraw-Hill, 2001, Second Edition.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

19152C34P **SEMESTERIII**

COMMUNICATIONTHEORY **3104**

AIM

To study the various analog communication fundamentals viz., Amplitude modulation and demodulation, angle modulation and demodulation. Noise performance of various receivers and information theory with source coding theorem are also dealt.

OBJECTIVE

- ToprovidevariousAmplitudemodulationanddemodulationsystems.
- ToprovidevariousAnglemodulationanddemodulationsystems.
- Toprovidesomedepthanalysis innoiseperformanceofvariousreceiver.
- Tostudysomebasicinformationtheorywithsomechannelcoding theorem.

UNIT1 AMPLITUDEMODULATIONSYSTEMS 10

Review of spectral characteristics of periodic and non-periodic signals – Generation anddemodulation of AM, DSBSC, SSB and VSB signals – Comparison of amplitudemodulation systems – Frequency translation – FDM – Non-linear distortion.

UNITII ANGLEMODULATION SYSTEMS 8

Phaseandfrequencymodulation–Singletone–NarrowbandandwidebandFM–Transmission bandwidth – Generation and demodulation of FM signal.

UNITIII NOISETHEORY 8

Review of probability – Random variables and random process – Gaussian process – Noise – Shot noise – Thermal noise and white noise – Narrow band noise – Noisetemperature – Noise figure.

UNITIVPERFORMANCEOFCWMODULATIONSYSTEMS 10

Superheterodyne radio receiver and its characteristic – SNR – Noise in DSBSC systemsusing coherent detection – Noise in AM system using envelope detection FM system –FM threshold effect – Pre-emphasis and de-emphasis in FM – Comparison ofperformances.

UNITV INFORMATIONTHEORY 9

Discrete messages and information content – Concept of amount of information – Average information – Entropy – Information rate – Source coding to increase averageinformation per bit – Shannon-fano coding – Huffman coding – Lempel-Ziv (LZ) coding– Shannon's theorem – Channel capacity – Bandwidth – S/N trade-off – Mutualinformation and channel capacity – Rate distortion theory – Lossy source coding.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

TUTORIAL15 **TOTAL:60**

TEXTBOOKS

1. DennisRoddyandJohnCoolen.,“ElectronicCommunication”,4thEdition,PHI,1995.
2. Herbert Taub and Donald L Schilling., “Principles of Communication Systems”, 3rd Edition, TMH, 2008.

REFERENCES

1. Simon Haykin.,“Communication Systems”,4th Edition,JohnWiley andSons, 2001.
2. BruceCarlson.,“CommunicationSystems”,3rdEdition,TMH, 1996.
3. Lathi, B. P., “Modern Digitaland Analog Communication Systems”, 3rd Edition, Oxford Press, 2007.
4. JohnG.Proakis,MasoudSalehi.,“Fundamentalsof CommunicationSystems”, 5th Edition, Pearson Education, 2006.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

19152L35P **SEMESTERIII**

DIGITALSIGNALPROCESSINGANDMICROPROCESSORLAB

0032

PART-IDSPLAB

UsingProcessor&MATLAB:

1. StudyofvariousaddressingmodesofDSPusing simpleprogrammingexamples
2. Samplingofinputsignaland display
3. ImplementationofFIRfilter
4. Calculationof FFT
5. Linear&Circular Convolution

PART–IIMICROPROCESSORLAB

1. Programsfor8/16bitArithmeticoperations(Using8085).
2. ProgramsforSortingandSearching(Using8085,8086).
3. ParallelCommunicationbetweentwoMPKitsusingMode1andMode2of8255.
4. InterfacingandProgramming8253
5. SerialCommunication betweentwoMP Kitsusing8251.
6. Interfacingand ProgrammingofStepperMotorand DCMotorSpeed control

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

19152L35P **SEMESTERIV**

DIGITALCOMMUNICATION **3104**

AIM

To introduce the basic concepts of Digital Communication modulation to baseband, passband modulation and to give an exposure to error control coding and finally to discuss about the spread spectrum modulation schemes.

OBJECTIVES

- To study pulse modulation and discuss the process of sampling, quantization and coding that are fundamental to the digital transmission of analog signals.
- To learnbaseband pulse transmission, whichdeals withthe transmissionofpulse-amplitude, modulated signals in their baseband form.
- To learnerror controlcoding whichencompasses techniques forthe encoding and decoding of digital data streams for their reliable transmission over noisy channels.

UNITI: DigitalcommunicationIntroductionandPulsemodulation 9

Block Diagramofdigitalcommunicationsystems Advantages, Disadvantages, Sampling,Aliasing, Pulse Amplitude Modulation, Pulse Duration and Pulse position Modulation,Pulse Coded Modulation, Delta Modulation, TDM

UNIT II: BasebandPulseTransmission 9

MatchedFilters,,IntersymbolInterference,NyquistPulseShaping,M-aryPAMTransmission Linear Equalizers , Adaptive Equalizers

UNITIII: DigitalBandpass Transmission 9

Representations of Bandpass Signals and Systems Correlation, Signal-spacerepresentations ,Detection of Known Signals in AWGN ,Generation ,detection, spectra,applications, signal space diagram of FSK, PSK, MSK

UNITIV: SpreadSpectrumCommunications 9

Advantages, characteristicofSpreadSpectrumCommunication. Direct Sequencespreqadspectrum systems, Frequency Hopping spread spectrum communication, Psedu Noisesequences: Types and Characteristics, code-division multiplexing (CDM). Application toCDMA wireless communication systems

UNITV: ErrorControlcoding 9

Linearblockcodes,convolutionalcodes,Hamming codes

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

TUTORIAL15 **TOTAL:60**

Textbook:

1.S. Haykin,CommunicationSystems, FourthEdition, Wiley, 2001.

Reference:

1. L.W. Couch II, *Digital and Analog Communication Systems*, Sixth Edition, Prentice-Hall,2001.
2. B.P. Lathi, *Modern Digital and Analog Communication Systems*, Oxford University Press, 1998. TK5101.L333
3. John Proakis "Digital Communications" , McGraw-HillScience/Engineering/Math; 4 edition 2000

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

19152C42P **SEMESTERIV**

ANTENNAANDWAVE PROPAGATION **3104**

AIM

Toenablethestudent tostudythevarioustypesofantennasand wave propagation.

OBJECTIVES

- To studyradiationfroma currentelement.
- To studyantenna arrays
- Tostudyapertureantennas
- Tolearnspecialantennassuchasfrequencyindependentandbroadbandantennas.
- Tostudyradiowavepropagation.

UNITI: RADIATION 9

Concept of Vector potentials- Modification for Time varying , retarded case- Fields andradiation resistance of an alternating current element--Radiation resistance – Effectivelength –Radiation intensity-Gain and Directivity-Field patterns- Beamwidth – Effectivearea-Relation between gain, effective length and radiation resistance.

UNITII: ANTENNAARRRAYS 9

Arrays of two point sources- Broadside array and End fire arrays – Binomial arrays - Pattern multiplication- Uniform linear array-

UNITIII: SPECIALPURPOSEANTENNAS 9

Radiationfromtravelingwaveonwire-Rhombicantenna–Loopantennas-Threeelement Yagi antenna- Log periodic antenna-Horn antenna -

UNITIV: PROPAGATION 9

Ground wave propagation: Attenuation characteristics – Calculation of field strength – Sky wave Propagation: Structure of Ionosphere – Effective dielectric constant of ionizedregion-Mechanism of Refraction and Refractive index- Critical Frequeny- Skip distance-Maximum usable frequency –Fading and Diversity Techniques.

SpaceWavePropagation:CalculationofFieldstrength–-Ductpropagation.

UNITV: MEASUREMENTS 9

Impedance – Field Pattern and Gain of Antennas- Radiation Pattern – Ionosphericmeasurements-Vertical incidence measurements of the ionosphere- Relation betweenoblique and vertical incidence transmission.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

TUTORIAL15 **TOTAL:60**

TextBooks:

1. EDWARDC.JORDAN-Electromagneticwavesand Radiationsystems–Asia Publication House, PHI, 1978, Reprint 2003.

ReferenceBooks:

1. Jhon.D.KrausandRonalatoryMarhefka-Antenna-TMcGrawHill– 2002
2. R.E.Collins-AntennasandRadioPropagation-McGrawhill-1987
3. Ballany–AntennaTheory-Jhonwiley&sons– 2ndedition2003.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

19152C43P **SEMESTERIV**

COMPUTERNETWORKS **4004**

AIM

Tointroducetheconcept,terminologies,andtechnologiesusedinmoderndatacommunication and computer networking.

OBJECTIVES

- Tointroducethe studentsthe functionsofdifferentlayers.
- TointroduceIEEEstandardemployedincomputer networking.
- Tomakestudentstogetfamiliarizedwithdifferentprotocolsandnetwork components.

UNITI DATA COMMUNICATIONS 8

Components – Direction of Data flow – networks – Components and Categories – typesof Connections – Topologies –Protocols and Standards – ISO / OSI model –Transmission Media – Coaxial Cable – Fiber Optics – Line Coding – Modems – RS232Interfacing sequences.

UNITII DATLINKLAYER 12

Error – detection and correction – Parity– LRC – CRC – Hamming code – Flow Controland Error control: stop and wait – go back N ARQ – selective repeat ARQ- slidingwindow techniques– HDLC.
LAN:EthernetIEEE802.3,IEEE802.4,andIEEE802.5–IEEE802.11–FDDI,SONET – Bridges.

UNITIII NETWORKLAYER 10

Internetworks-PacketSwitchingandDatagramapproach–IPaddressingmethods–Subnetting – Routing – Distance Vector Routing – Link State Routing – Routers.

UNITIV TRANSPORTLAYER 8

Duties of transport layer – Multiplexing – Demultiplexing – Sockets – User DatagramProtocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control – Qualityof services (QOS) – Integrated Services.

UNITV APPLICATIONLAYER 7

DomainNameSpace(DNS)–SMTP,FDP,HTTP,WWW– Security– Cryptography.

TOTAL:45

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

TEXTBOOKS

1. Behrouz A. Foruzan, “Data communicationand Networking”, TataMcGraw-Hill, 2004.

REFERENCES

1. James .F. Kurouse & W. Rouse, “Computer Networking: A Topdown Approach Featuring”, Pearson Education.
2. LarryL.Peterson & Peter S. Davie, “COMPUTER NETWORKS”, Harcourt Asia Pvt. Ltd., Second Edition.
3. AndrewS.Tannenbaum,“ComputerNetworks”,PHI,FourthEdition, 2003.
4. William Stallings, “Data and Computer Communication”, Sixth Edition, Pearson Education, 2000.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

19152L45P **SEMESTERIV**

NETWORKSANDCOMMUNICATIONLAB **0 0 3 2**

PartI:NETWORKS

1. PC toPC Communication
   ParallelCommunicationusing8bitparallelcableSerial communication using RS 232C
2. Ethernet LANprotocol
   TocreatescenarioandstudytheperformanceofCSMA/CDprotocolethrol simulation
3. Tokenbusandtokenringprotocols
   Tocreatescenarioandstudytheperformanceoftokenbusandtokenringprotocols through simulation
4. WirelessLANprotocols
   TocreatescenarioandstudytheperformanceofnetworkwithCSMA/CAprotocol and compare with CSMA/CD protocols.
5. Implementationand studyofstop and waitprotocol

PartII: COMMUNICATION

1. Modulation andDemodulationCharacteristicsofAM/FMTransmitterAndReciever.
2. Pulsemodulation-PAM/PWM/PPM
3. Pulsecodemodulation
4. Digitalmodulation–ASK, PSK,QPSK, FSK
5. ExperimentsonAntenna:
   Toplotandanalysetheradiationpatternsofthefollowingantennas.
   - Dipole
   - HalfWaveDipole
   - Monopole
   - YagiAntenna
6. ExperimentsonCoaxialLineSection:
   - MeasurementofVSWR
   - Stubmatching

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE -I

19152E44AP **SEMESTERIV**

HIGHSPEEDNETWORKS 4004

AIM

To highlight the features of different technologiesinvolvedin High Speed Networking and their performance.

OBJECTIVES

- StudentswillgetanintroductionaboutATMandFrame relay.
- Studentswillbeprovidedwithanup-to-datesurveyofdevelopmentsinHigh Speed Networks.
- Enable the students to know techniques involved to support real-time traffic and congestion control.

Studentswillbeprovidedwithdifferentlevelsofqualityofservice(Q.S)todifferent applications.

UNITI HIGHSPEEDNETWORKS 9

FrameRelayNetworks–Asynchronoustransfermode–ATMProtocolArchitecture,ATM Cell – ATM Service Categories – AAL.

HighSpeedLANs:FastEthernet,GigabitEthernet,WirelessLANs:applications,requirements – Architecture of 802.11

UNITII LANSWITCHINGTECHNOLOGY 9

Switching concepts, switch forwarding techniques, switch path control, LAN switching,cut through forwarding, store and forward, Virtual LANs

UNITIII TCPANDATMCONGESTIONCONTROL 9

TCP Flow control – TCP Congestion Control – Retransmission – Timer Management – Exponential RTO backoff – KARN's Algorithm –– Performance of TCP over ATM.TrafficandCongestioncontrolinATM–Requirements–Attributes–TrafficManagementFramework,TrafficControl–ABRtrafficManagement–ABRratecontrol, RM cell formats,– GFR traffic management.

UNITIV INTEGRATEDANDDIFFERENTIATEDSERVICES 9

IntegratedServicesArchitecture–Approach,Components,Services-QueuingDiscipline,FQ, PS, BRFQ, GPS, WFQ – Random Early Detection, Differentiated Services

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

UNITV IPSWITCHING 9

Addressingmodel,IPSwitchingtypes-flowdrivenandtopologydrivensolutions,IPOver ATM address and next hop resolution, multicasting,

TOTAL:45

TEXT BOOK

1.WilliamStallings,"HIGHSPEEDNETWORKSANDINTERNET",Pearson Education, Second Edition, 2002.

REFERENCES

1. Warland&PravinVaraiya,"HIGHPERFORMANCECOMMUNICATION NETWORKS", Jean Harcourt Asia Pvt. Ltd., II Edition, 2001.
2. IrvanPepelnjk,JimGuichardandJeffApcar,"MPLSandVPNarchitecture", Cisco Press, Volume 1 and 2, 2003

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE -I

19152E44BP **SEMESTERIV**

ADVANCEDDIGITALSIGNALPROCESSING **4004**

AIM

Tointroducethestudenttoadvanceddigitalsignalprocessing techniques.

OBJECTIVES

- Tostudytheparametricmethodsfor power spectrumestimation.
- TostudyadaptivefilteringtechniquesusingLMSalgorithmandtostudythe applications of adaptive filtering.
- Tostudymultiratesignalprocessingfundamentals.
- Tostudytheanalysis ofspeechsignals.
- Tointroducethestudenttowavelettransforms.

UNITI DISCRETERANDOMSIGNALPROCESSING

Discrete Random Processes-, Autocorrelation and Auto covariance matrices. Parseval'sTheorem, Wiener - Khintchine Relation- Power Spectral Density-Periodogram -Parameter estimation: Bias and consistency.

UNITIISPECTRUMESTIMATION

Non-Parametric Methods-Correlation Method, Periodogram Estimator, PerformanceAnalysis of Estimators –Unbiased Consistent Estimators-; Bartlett, Blackman –Tukeymethod.

ParametricMethods-AR, MA, andARMAmodelbasedspectralestimation.

UNITIIILINEARESTIMATIONANDPREDICTION

Linear prediction- Forward and backward predictions, - Levinson-Durbin algorithms.Least meansquared error criterion -Wiener filter for filtering and prediction, FIRWienerfilter and Wiener IIR filters, Discrete Kalman filter

UNITIVADAPTIVE FILTERS

FIRadaptive filters -adaptive filter basedonsteepest descent method-Widrow-HoffLMSadaptive algorithm Adaptive recursive filters (IIR). RLS adaptive filters-Exponentiallyweighted RLS-sliding window RLS.

UNITVMULTIRATEDIGITALSIGNALPROCESSING

Mathematicaldescriptionofchangeofsamplingrate-InterpolationandDecimation,Decimationbyanintegerfactor-Interpolationbyanintegerfactor, Filterimplementation

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

forsamplingrateconversion-ApplicationtosubbandcodingandFilterbankimplementation of wavelet expansion of signals.

REFERENCES:

1. Monson H.Hayes,Statistical Digital Signal Processing and Modeling,John Wiley and Sons, Inc., Singapore, 2002.
2. JohnG.Proakis,DimitrisG.Manolakis,DigitalSignalProcessingPearsonEducation, 2002.
3. JohnG.Proakiset.al.,'AlgorithmsforStatisticalSignalProcessing',Pearson Education, 2002.
4. DimitrisG.Manolakiset.al.,'StatisticalandadaptivesignalProcessing',McGraw Hill, Newyork,2000.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE -I

19152E44CP **SEMESTERIV**

SPEECHPROCESSING **4004**

AIM

Tointroducethecharacteristicsof Speechsignalsandtherelatedtimeandfrequency domain methods for speech analysis and speech compression

OBJECTIVE

- Tointroducethemodelsforspeechproduction
- Todeveloptimeandfrequencydomaintechniques forestimatingspeechparameters
- Tointroduceapredictivetechniqueforspeechcompression
- Tounderstandspeechrecognition, synthesisandspeakeridentification.

UNITI: NATUREOFSPEECHSIGNAL 9

Speechproduction mechanism– Classificationofspeech– Sounds– Natureofspeechsignal – Models of speech production

SpeechSignalProcessing: Purposeofspeechprocessing –Digitalmodelsforspeechsignal – Digital processing of speech signals – Significance – Short time analysis.

UNITII: TIMEDOMAINMETHODSFORSPEECHPROCESSING 9

Timedomainparametersofspeech–Methodsforextractingtheparameters –Zerocrossings – Auto correlation function – Pitch estimation.

UNITIII:FREQUENCYDOMAINMETHODSFORSPEECHPROCESSING9

Shorttimefourieranalysis–Filter bankanalysis–Spectrographicanalysis– Formatextraction – Pitch extraction – Analysis – Synthesis systems.

UNITIV: LINEARPREDICTIVECODINGOFSPEECH 9

Formulationoflinear predictionproblemintimedomain –Solutionofnormalequations– Interpretation of linear prediction in auto correlation and spectral domains.

UNITV: HOMOMORPHICSPEECHANALYSIS 9

Centralanalysisofspeech– Format andpitchestimation– Applicationsofspeechprocessing – Speech recognition – Speech synthesis and speaker verification.

Total:45

TEXTBOOK

1. RabinerL.R.andSchaferR.E,“DigitalProcessingofSpeechSignals”,Prentice Hall, 1978.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

REFERENCES

1. Flanagan J.L, “Speech Analysis Synthesis and Perception”, 2nd Edition, Springer Vertag, 1972.
2. WittenI.H.,“PrinciplesofComputerSpeech”, AcademicPress, 1983.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE -I

19152E44DP **SEMESTERIV**

FUZZYLOGICANDNEURALNETWORKS **4004**

AIM

To introduce the techniques of soft computing and adaptive neuro-fuzzy inferencing systems which differ from conventional AI and computing in terms of its tolerance to imprecision and uncertainty.

OBJECTIVES

- Tointroducetheideasof fuzzy sets,fuzzylogicanduseof heuristicsbasedon human experience
- To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems
- Toprovidethemathematicalbackgroundforcarryingouttheoptimization associated with neural network learning
- To familiarize withgenetic algorithmsand other randomsearchproceduresuseful while seeking global optimum in self-learning situations
- Tointroducecasestudiesutilizingtheaboveand illustratethe intelligent behavior of programs based on soft computing

UNITI: PrimeronFuzzySets **9**

Crisp sets, from crisp sets to fuzzy sets , Linguistic variables,Membership functionsSome terminology , Set theoretic operations for crisp sets , Set theoretic operations forfuzzy sets , membership functions

UNITII: FuzzyLogicSystems **9**

Introduction , Rules , Fuzzy Inference Engine , Fuzzification and Its Effect on InferenceFuzzifier,Fuzzyinferenceengine,Defuzzification,Centroiddefuzzifier ,Center-of-sumsdefuzzifier

UNITIII:NeuralNetsIntroduction andOverview **9**

Perceptrons,LeastMean SquareLearning Systems ,Multilayer Neural Networks Back-Propagation The Practical Application of Back-Propagation ErrorRateandComplexityFitEstimationImprovingonStandard Back-Propagation

UNITIV:RadialBasisFunctionNetworks **9**

Ill-Posed Problems and the Regularization Technique , Stabilizers and Basis Functions,GeneralizedRadialBasisFunctionNetworks,MovingCentersLearning,Regularization

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

with Nonradial Basis Functions, Orthogonal Least Squares, Optimal Subset Selection byLinear

UNIT V: ANFIS: Adaptive Neuro-Fuzzy Inference Systems

9Introduction , ANFIS Architecture , Hybrid Learning Algorithm, Learning Methods thatCross-fertilize ANFIS and RBFN , ANFIS as a Universal Approximator

TOTAL:45

Textbook:

1. Bart Kosko, Neural networks and fuzzy systems: a dynamical systems approach to machine intelligence, Prentice-Hall, Inc., Upper Saddle River, NJ, 1991

Reference:

1. Kin,S.(1999),NeuralNetworks:AComprehensiveFoundation,2nded.,Upper Saddle River, NJ: Prentice Hall, ISBN 0-13-273350-1.
2. Jyh-ShingRogerJang,Chuen-TsaiSun,EijiMizutani(1997)"Neuro-Fuzzyand Soft Computing: AComputationalApproachto LearningandMachineIntelligence, |Prentice Hall

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE -I

19152E44EP **SEMESTERIV**

ADVANCEDELECTRONICSYSTEMDESIGN 4004

AIM

To get knowledge about usage of electronic devices in Communication Engineering and Power supplies.

OBJECTIVE

- TostudyRFcomponentsuchasresonator,filter,transmissionlines,etc…
- To learndesignofRFamplifiersusingtransistors.
- TostudymodernPowerSuppliesusing SCRand SMPStechnology
- Tolearnaboutsignalshielding&groundingtechniquesandstudyofA/Dand D/A Converters.
- TolearnknowledgeaboutfabricationofPCBsusing CAD.

UNITI: INTRODUCTIONTORFDESIGN 9

RFbehaviourofpassivecomponents –Chipcomponentsandcircuit boardconsiderations–Reviewoftransmissionlines –Impedanceandadmittancetransformation–Parallelandseries connectionof networks – ABCD and scattering parameters – Analysis of amplifierusing scattering parameter – RF filter – Basic resonator and filter configurations –Butterworth and chebyshev filters – Implementation of microstrip filter design – Bandpass filter and cascading of band pass filter elements.

UNITII: RFTRANSISTORAMPLIFIERDESIGN 9

Impedance matching using discrete components – Microstrip line matching networks – Amplifier classes of operation and biasing networks – Amplifier power gain–Unilateraldesign(S_{12}=0) –Simple input andoutputmatching networks–Bilateraldesign–Stabilitycircle and conditional stability – Simultaneous conjugate matching for unconditionallystable transistors – Broadband amplifiers – High power amplifiers and multistageamplifiers.

UNITIII: DESIGNOFPOWER SUPPLIES 9

DC power supplydesignusing transistors and SCR’s – Designofcrowbar and foldbackprotectioncircuits–SwitchedModePowerSupplies(SMPS) –Forward–Flyback-buckand boost converters – Design of transformers and control circuits for SMPS.

UNITIV: DESIGNOFDATAACQUISITIONSYSTEMS 9

Amplification of lowlevel signals– Grounding– Shielding and guarding techniques–Dualslope–QuadslopeandhighspeedA/Dconverters–Microprocessorscompatible

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

A/D converters – Multiplying A/D converters and logarithmic A/D converters – Sampleand hold – Design of two and four wire transmitters.

UNITV: DESIGNOFPRINTEDCIRCUITBOARDS 9

Introduction to technology of Printed Circuit Boards (PCB) – General lay out and rulesand parameters – PCB design rules for digital – High frequency – Analog – Powerelectronics and microwave circuits – Computer Aided Design(CAD) of PCB's.

Total:45

TEXTBOOKS:

1. ReinholdLuduigandPavelBretchko,"RFCircuitDesign–Theoryand Applications", Pearson Education, 2000.
2. SydneySoclof, "ApplicationsofAnalogIntegratedCircuits",PHI,1990.
3. WalterC.Bosshart,"PrintedCircuitBoards–Design andTechnology",TMH, 1983.

REFERENCES

1. KeithH.Billings, "HandbookofSwitched ModeSupplies", TMHPublishingCo., 1989.
2. MichaelJaacob, "Applicationsand Designwith Analog Integrated Circuits", PHI, 1991.
3. Otmar Kigenstein, "Switched Mode Power Supplies in Practice", John Wileyand Sons, 1989.
4. MuhammadH.Rashid,"PowerElectronics–Circuits,DevicesandApplications",

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

19152C51P **SEMESTERV**

OPTICALCOMMUNICATIONAND NEWORKS **4004**

AIM

- To introduce the various optical fiber modes, configurations and various signal degradation factors associated with optical fiber.
- To study about various optical sources and optical detectors and their use in the optical communication system. Finally to discuss about digital transmission and its associated parameters on system performance.

OBJECTIVES

- To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures.
- To understandthe different kind oflosses, signaldistortion inopticalwave guides and other signaldegradation factors. DesignoptimizationofSM fibers, RI profile and cut-off wave length.
- Tolearnthevariousopticalsource materials, LEDstructures,quantumefficiency, Laser diodes and different fiber amplifiers.
- To learnthe fiberopticalreceivers suchasPIN APDdiodes, noiseperformance in photo detector, receiver operation and configuration.
- To learn fiber slicing and connectors, noise effects on system performance, operational principles WDM and solutions.

UNITI INTRODUCTIONTOOPTICALFIBERS 9

Evolution of fiber optic system- Element of an Optical Fiber Transmission link- RayOptics-Optical Fiber Modes and Configurations –fiber types Mode theory of CircularWave guides- Overview of Modes- Key model concepts- Linearly Polarized Modes –Single Mode Fibers-

UNITIISIGNALDEGRADATIONOPTICALFIBERS 9

Attenuation – Absorption losses, Scattering losses, Bending Losses, Core and Claddinglosses, Signal Distortion in Optical Wave guides-Information Capacity determination –GroupDelay-MaterialDispersion, Wave guide Dispersion, Signaldistortion inSM fibers

-ModeCoupling

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

UNITIII FIBEROPTICALSOURCESAND COUPLING 9

Direct and indirect Band gap materials-LED structures –Quantum efficiency Modulationofa LED, lasers Diodes-Modes and Threshold condition Fiber amplifiers-Power Fibre –to- Fibre joints, Fibre splicing.

UNITIV FIBEROPTICALRECEIVERS 9

PIN and APD diodes –Photo detector noise, SNR, Detector Response time, AvalancheMultiplication Noise –Comparison of Photo detectors –Fundamental Receiver Operation– preamplifiers, Error Sources –Receiver Configuration –Probability of Error

UNITV DIGITALTRANSMISSION SYSTEM 9

Point-to-Point links System considerations –Link Power budget –Rise - time budget –Noise Effects on System Performance-Operational Principles of WDM, Solitons-. Basicon concepts of SONET/SDH Network.

TOTAL:45

TEXT BOOK

1. GerdKeiser,"OpticalFiberCommunication"McGraw–HillInternational, Singapore, 3rd ed., 2000

REFERENCES

1. J.Senior,"OpticalCommunication,PrinciplesandPractice",PrenticeHallof India, 1994.
2. J.Gower,"OpticalCommunicationSystem",PrenticeHallofIndia,2001.

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

19152C52P **SEMESTERV**

MICROWAVEENGINEERING **4004**

Aim

Toenablethestudenttobecomefamiliarwithactive&passivemicrowavedevices& components used in Microwave communication systems.

Objectives

- TostudypassivemicrowavecomponentsandtheirS-Parameters.
- TostudyMicrowavesemiconductor devices&applications.
- To studyMicrowave sourcesandamplifiers.

Unit–I:Introduction **9**

Radio Spectrum– MicrowaveFrequencyand itscharacteristics – Transmissionmedia formicrowave signals – Waveguides – Scattering Parameters for microwave network (twoports)

Unit –II:PassiveMicrowaveDevices **9**

Isolators, Attenuators, Directional Couplers – Waveguide Tees – E- plane, H-Plane andMagic Tee –- Matched Terminators – S – parameters for all the components

Unit –III: MicrowaveSources **9**

KlystronOscillator–MagnetronOscillator–TWTAAmplifier–Poweroutputandefficiency equations for all the devices

Unit–IV:SemiconductorMicrowave Devices **9**

PIN Diode – Varactor Diode (Manley – Rowe Power Relation) – Tunnel Diode – GunnDiode – Applications of all the diodes –

Unit–VMicrowaveMeasurements **9**

PowerMeasurements–FrequencyMeasurements–VSWRMeasurements(HighandLow VSWR) – Attenuation Measurements – Insertion Loss Measurements

TOTAL:45

TextBook:

1. SamuelY.LIAO:MicrowaveDevicesandCircuits–PrenticeHallof India – 3rd Edition (2003)
2. AnnapurnaDasandSisirK.Das:MicrowaveEngineering–TataMcGraw-Hill (2000) (UNIT V)

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

Reference:

1. R.E.Collin:FoundationsforMicrowaveEngg.–IEEEPressSecondEdition (2002)
2. DavidM.POZAR:MicrowaveEngg.–JohnWiley&Sons– 2nd Edition(2003)
3. P.A.RIZZI–MicrowaveEngg.(Passive)

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

19152C53P **SEMESTERV**

VLSIDESIGN **3104**

AIM

To introduce the technology, design concepts and testing of Very Large Scale Integrated Circuits.

OBJECTIVES

- TolearnthebasicCMOScircuits.
- TolearntheCMOSprocesstechnology.
- Tolearntechniquesofchip designusing programmabledevices.
- To learnthe conceptsofdesigningVLSIsubsystems.
- To learn the concepts of modeling a digital system using Hardware DescriptionLanguage.

UNITI CMOSTECHNOLOGY 9

An overview of Silicon semiconductor technology, Basic CMOS technology : nwell, Pwell, Twin tub and SOI Process. Interconnects, circuit elements: Resistors, capacitors,Electrically alterable ROMs, bipolar transistors, Latch up and prevention.

UNITII MOSTRANSISTORTHEORY 9

NMOS, PMOS Enhancement transistor, Threshold voltage, Body effect, MOS DCequations, channel length modulation, Mobility variation, MOS models, small signal ACcharacteristics, complementary CMOS inverter DC characteristics, Noise Margin, Risetime, fall time

UNITIIISPECIFICATIONUSINGVERILOGHDL 9

Basic Concepts: VLSI Design flow, identifiers, gate primitives, value set, ports, gatedelays, , Behavioral and RTL modeling: Operators, timing controls, Proceduralassignments conditional statements, Data flow modeling and RTL. Structural gate leveldescriptionofdecoder, equalitydetector, comparator, priorityencoder, D-latch, D-ff, halfadder, Full adder, Ripple Carry adder.

UNITIV CMOSCHIPDESIGN 9

Logic designwithCMOS: MOSFETS as switches, Basic logic gates in CMOS, Complexlogic gates, Transmission gates: Muxes and latches, CMOS chip design options: FullcustomASICs, Std. Cellbased ASICs, Gate Arraybased ASICsChannelled, Channellessand structured GA, Programmable logic structures;22V10, Programming ofPALs, ASICdesign flow.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

UNITV CMOSTESTING 9

Needfortesting, Designstrategies fortest, Chiplevelandsystemleveltesttechniques.

TUTORIAL15 TOTAL:60

TEXTBOOKS

1. Weste & Eshraghian: Principles of CMOS VLSI design (2/e) Addison Wesley, 1993 for UNIT I through UNIT IV.
2. SamirPalnitkar;VerilogHDL–GuidetoDigital design andsynthesis,IIIedition, Pearson Education, 2003 for UNIT V

REFERENCES

1. M.J.S.Smith:ApplicationSpecific integratedcircuits,PearsonEducation,1997.
2. Wayne Wolf,ModernVLSIDesign,PearsonEducation2003.
3. BobZeidmin;Introductiontoverilog,PrenticeHall, 1999
4. J. Bhaskar:VerilogHDLPrimer, BSP, 2002.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

19152L55P **SEMESTERV**

OPTICALCOMMUNICATION ANDMICROWAVELAB

0032

PartI:ExperimentspertainingtoFiberoptics

1. NumericalaperturedeterminationforfibersandAttenuationMeasurementin Fibers.
2. ModeCharacteristicsofFibers – SM Fibers.
3. CouplingFibersto Semi-ConductorSources – Connectors&Splices.
4. Fiberopticcommunicationlinks.
5. LED&Photo DiodeCharacteristics.

PartII:ExperimentspertainingtoMicrowave

1. VSWRMeasurements– Determinationofterminatedimpedance
2. Determinationofguidewavelength,frequencymeasurement.
3. RadiationPatternofHorns,Paraboloids.
4. MicrowavePower Measurement.
5. CharacteristicsofGunndiodeOscillator.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE-II

19158E54AP **SEMESTERV**

ENVIRONMENTALSCIENCEAND ENGINEERING 4004

UNIT:I INTRODUCTIONTOENVIRONMENTALSTUDIESAND NATURALRESOURCES 9

Definition,Scopeandimportance–Needforpublicawareness– Forestresources –Waterresources–Energyresources–Landresources–Roleofanindividualinconservation of natural resources –Equitable use of resource for sustainable life styles.

UNIT:II ECOSYSTEMAND BIODIVERSITY 9

Concept of an ecosystem – structure and Function of An ecosystem-Producers,consumers and decomposers – Energy flow in the ecosystem – Ecological succession –Food chainsFoodweband ecologicalpyramids.Introductionto Biodiversity–ValueofBiodiversity – Biodiversity at global, National and local levels – India as a mega –diversity nation Hot spots ofBiodiversity – Threats to Biodiversity Endangeredandendemic species ofIndia – Insitu and Excitu conservation of Biodiversity.

UNIT:III ENVIRONMENTALPOLLUTION 9

Definition – Causes, effects and control measure of **:** - Air pollution - Water Pollution-SoilPollution-MarinePollution-NoisePollution-ThermalPollution-Nuclearhazard – SolidWastemanagement– Role ofIndividual in prevention of pollution – Disastermanagement.

UNIT:IVSOCIAL ISSUESANDTHEENVIRONMENT 9

From Un sustainable to sustainable development – water conservation,Rain waterharvesting, water shed Management – Global warming – Ozone layer Depletion –Acidrain –Nuclear Accidents and holocaust –Environment Protection Act, Issues involvedin enforcement legislation.

UNIT:V HUMANPOPULATIONANDTHEENVIRONMENT 9

Populationgrowth– Populationexplosion– Familywelfare programme–Environmentand human health – Human rights –value education –HIV/AIDS–Role ofInformation Technology in Environment and human health.

Total=45

TEXT BOOK

1. GilbertMMasters,“IntroductiontoEnvironmentalEngineeringandscience, ”SecondEdition , Pearson Education Pvt, Ltd, 2007.
2. MillerT.G.Jr.“Environmentalscience,”, WadworthPublishingCo.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

REFERENCES

1. KurianJoseph,"EssentialsofEnvironmental studies",Firstedition,Pearson Education, 2004.
2. BharuchaErach,"TheBiodiversityofIndia,"MapinPublishing Pvt,Ltd.

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

ELECTIVE-II

19152E54BP **SEMESTERV**

OPTOELECTRONICDEVICES **4004**

AIM

Tolearn differenttypesof optical emission,detection,modulation andoptoelectronic integrated circuits and their applications.

OBJECTIVE

- Toknowthebasicsofsolidstatephysicsandunderstandthenatureand characteristics of light.
- Tounderstanddifferent methodsofluminescence, displaydevicesand laser typesand their applications.
- Tolearnthe principleofopticaldetectionmechanismindifferentdetectiondevices.
- Tounderstanddifferent light modulationtechniquesandtheconceptsandapplications of optical switching.
- To studythe integrationprocess and applicationofopto electronic integrated circuits in transmitters and receivers.

UNITI: ELEMENTSOFLIGHTANDSOLIDSTATEPHYSICS 9

Wave nature of light – Polarization – Interference – Diffraction – Light source – Reviewof quantum mechanical concept – Review of solid state physics – Review ofsemiconductor physics and semiconductor junction device.

UNITII: DISPLAYDEVICESANDLASERS 9

Introduction – Photo luminescence – Cathode luminescence – Electro luminescence – Injection luminescence – Injection luminescence – LED – Plasma display – LiquidCrystal Display (LCD) – Numeric displays – Laser emission – Absorption – Radiation –Population inversion – Optical feedback – Threshold condition – Laser modes – Classesof lasers – Mode locking – Laser applications.

UNITIII: OPTICALDETECTIONDEVICES 9

Photo detector – Thermal detector – Photo devices – Photo conductors – Photo diodes – Detector performance.

UNITIV: OPTOELECTRONICMODULATOR 9

Introduction– Analoganddigitalmodulation–Electro-optic modulators– Magnetoopticdevices – Acoustoptic devices – Optical – Switching and logic devices.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

UNITV: OPTOELECTRONICINTEGRATEDCIRCUITS 9

Introduction–Hybridandmonolithicintegration–Applicationofoptoelectronicintegrated circuits – Integrated transmitters and receivers – Guided wave devices.

Total:45

TEXTBOOK

1. WilsonJandHaukesJ.,"OptoElectronics–AnIntroduction",PHI Pvt.Ltd.,1995.

REFERENCES

1. Bhattacharya,"SemiconductorOptoElectronicDevices",PHIPvtLtd.,1995.
2. Jasprit Singh, "OptoElectronics – AsIntroductionto MaterialsandDevices", TMH International Edition, 1998.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE-II

19152E54CP **SEMESTERV**

RADARANDNAVIGATIONALAIDS **4004**

AIM

Tomakethestudentunderstandtheprinciplesof Radaranditsuseinmilitaryand civilian environment

Alsotomakethestudentfamiliarwithnavigationalaidsavailablefornavigationof aircrafts and ships.

OBJECTIVES

- Toderiveand discussthe Rangeequationand the natureofdetection.
- To apply doppler principle to radars and hence detect moving targets, cluster, alsoto understand tracking radars
- To refresh principles of antennas and propagation as related to radars, also studyof transmitters and receivers.
- To understand principles of navigation, in addition to approach and landing aids as related to navigation
- To understandnavigationofshipsfromshoretoshore.

UNITI **INTRODUCTIONTORADAR** **9**

Basic radar – The simple form of the radar equation – Radar block diagram – Radarfrequencies – Applications of radar – The origins of radar – The radar equation – Introduction – Detectionofsignals in noise – Receiver noise and the signal-to-noise ratio– Probability density functions – Probabilities of detection and false alarm – Integrationof radar pulses – Radar cross section of targets – Radar cross section fluctuations – Transmitter power – Pulse repetition frequency – Antenna parameters – System losses – Other radar equation considerations

UNITII: **MTIANDPULSEDOPPLER RADAR** **9**

Introduction to Doppler and MTI radar – Delay-line cancellers – Staggered pulserepetition frequencies – Doppler filter banks – Digital MTI processing – Moving targetdetector – Limitations to MTI performance – MTI from a moving platform (AMIT) –Pulse Doppler radar – Other Doppler radar topics – Tracking with radar – Mono pulsetracking – Conicalscanand sequentiallobing – Limitations to tracking accuracy – Low –Angle tracking – Tracking in range – Other tracking radar topics – Comparison oftrackers – Automatic tracking with surveillance radars (ADT).

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

UNITIII **9**

Detection of signals in noise – Introduction – Matched – Filter receiver – Detection – Detectors – Automatic detector – Integrators – Constant – False – Alarmrate receivers – The radar operator – Signal management – Propagation radar waves – Atmospheric – Standard propagation – Nonstandard propagation – The radar antenna – Reflectorantennas – Electronically steered phased array antennas – Phase shifters – Frequency –Scan arrays – Radar transmitters – Introduction – Linear beam power tubes – Solid stateRF power sources – Magnetron – Crossed field amplifiers – Other RF power sources –Other aspectsofradar transmitter –Radar receivers–Theradar receiver –Receiver noisefigure – Super heterodyne receiver – Duplexers and receiver protectors – Radar displays.

UNITIV **9**

Introduction – Four methods of navigation – Radio direction finding – The loop antenna– Loop input circuits – An aural null direction finder – The goniometer – Errors indirection finding – Adcock direction finders – Direction finding at very high frequencies– Automatic direction finders – The commutated aerial direction finder – Range andaccuracy of direction finders – Radio ranges – The Lf/Mf four course radio range – Vhfomni directional range (Vor) – Vor receiving equipment – Range and accuracy of Vor –Recent developments – Hyperbolic systems of navigation (loran and decca) – Loran-Aequipment – Range and precision of standard loran – Loran-C – The decca navigationsystem – Decca receivers – Range and accuracy of decca – The omega system

UNITV **9**

DME and TACAN – Distance measuring equipment – Operation of DME – TACAN – TACAN equipment – Aids to approach and landing – Instrument landing system – Ground controlled approach system – Microwave Landing System (MLS) – Dopplernavigation – The Doppler effect – Beamconfigurations – Doppler frequency equations –Trackstabilization–Dopplerspectrum–ComponentsoftheDopplernavigationsystem – Dopplerrangeequation–Accuracyof Dopplernavigationsystems–Inertialnavigation – Principles of operation – Navigation over the earth – Components of an inertialnavigation system – Earth co-ordinate mechanization – Strapped – Down systems –Accuracyofinertialnavigationsystems –Satellite navigationsystem–Thetransit system – NavstarGlobalPositioning System(GPS)

Total:45

TEXTBOOK

1.MerrillI.Skolnik,"IntroductiontoRadar Systems",3rdEdition,TMH,2003.

REFERENCES

1. PeytonZ.Peebles,"RadarPrinciples",Johnwiley,2004

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

2. ToomayJ.C, “PrinciplesofRadar”, 2ndEdition, PHI, 2004

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

ELECTIVE-II

19152E54DP **SEMESTERV**

DIGITALIMAGEPROCESSING **4004**

AIM

Tointroducethestudenttovarious imageprocessing techniques.

OBJECTIVES

- To studythe image fundamentals and mathematicaltransforms necessaryfor image processing.
- Tostudytheimageenhancementtechniques
- Tostudyimagerestorationprocedures.
- Tostudytheimagecompressionprocedures.
- Tostudytheimagesegmentationand representationtechniques.

UNIT-I: DIGITALIMAGE FUNDAMENTALS **9**

Elementsofvisualperception–Imagesampling,Quantization–Basicrelationshipbetween pixels-monochrome vision model- color space model-convolution.

UNIT– IIIMAGETRANSFORM **9**

Basic geometric transforms-Introduction to Fourier transform and DFT – properties of2D Fourier transform– FFT- Separable image transforms – Walsh – Hadamard-Discretecosine and Haar Transfroms

UNIT-III: IMAGEENHANCEMENTANDRESTORATIONTECHNIQUES9

Spatial domain methods- Basic gray level transformation-Histogram equalization-Spatialfiltering-Laplacian filtering- Frequency Domain filters- homomorphic filtering-Model ofimage degradation/Restoration process- Noise models.

UNITIV:IMAGECOMPRESSION **9**

Losslesscompression-: Variable lengthcoding- LZWcoding- -Predictive coding-DPCM.Lossy compression- Transform coding-– Image compression standards-JPEG,MPEG.

UNIT–V:IMAGESEGMENTATION&REPRESENTATION **9**

Edge detection – Thresholding- region based segmentation- Boundary representation – chair codes- Boundary segments – boundarydescriptors-: simple descriptors-Fourierdescriptors- Regional descriptors- Texture.

TOTAL:45

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

TextBook:

1. RafeelC.Gonzalez,RichardEwoods2nd edition–Digital Image processing–Pearson education 2003.

Referencebooks:

1. WilliamK.Pratt,DigitalImageprocessing, JohnWiley(2001)
2. ImageprocessingAnalysisandMachineVision -MillmanSonka ,Vaclav hlavac,Roger Boyle,Broos/Colic,Thompson Learnfy(1999)
3. A.K.JainPHI,(1995)–FundamentalsofDigitalImageprocessing

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

ELECTIVE-II

19152E54EP **SEMESTER V**

ENGINEERINGACOUSTICS **4004**

AIM

Thiscourseaimsatprovidinganoverviewofengineeringacoustics.

OBJECTIVE

- Toprovide mathematicalbasisforacousticswaves
- Tointroducetheconceptofradiationreceptionabsorptionandattenuationof acoustic waves.
- Topresentthecharacteristicbehaviourofsoundinpipes, resonatorsand filters.
- Tointroducethepropertiesofhearing and speech
- Todescribethearchitectureandenvironmentalinclusiveofreverberationand noise.
- Togiveadetailed studyon loud speakersandmicrophones.

UNITI:

Acoustics waves – Linear wave equation – Sound in fluids – Harmonic plane waves – Energy density – Acoustics intensity – Specific acoustic impedance – Spherical waves – Describer scales.

Reflection and Transmission: Transmission from one fluid to another normal andoblique incidence – Method of images.

UNITII: RADIATIONANDRECEPTION OFACOUSTICWAVES 9

Radiationfrompulsatingsphere–Acousticreciprocity–Continuouslinesource–Radiation impedance – Fundamental properties of transducers.

Absorptionandattenuationofsound: Absorptionfromviscosity–Complexsoundspeed and absorption – Classical absorption co-efficient

UNITIII: PIPERESONATORSANDFILTERS 9

Resonance in pipes – Standing wave pattern absorption of sound in pipes – Longwavelength limit – Helmoltz resonator – Acoustic impedance – Reflection andtransmission of waves in pipe – Acoustic filters – Low pass, high pass and band pass.

Noise, Signal detection, Hearing and speech: Noise, spectrum level and band level – Combing band levels and tones – Detecting signals in noise – Detection threshold – Theear – Fundamental properties of hearing – Loudness level and loudness – Pitch andfrequency – Voice.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

UNITIV: ARCHITECTURALACOUSTICS 9

Sound in endosure – A simple model for the growth of sound in a room – Reverberationtime – Sabine, sound absorption materials – Measurement ofthe acoustic outputofsoundsources in live rooms – Acoustics factor in architectural design.

Environmental Acoustics: Weighted sound levels speech interference – Highway noiseNoise induced hearing loss – Noise and architectural design specification andmeasurement of some isolation design of portions.

UNITV: TRANSDUCTION 9

Transducer as an electives network – Canonical equation for the two simple transducerstransmitters – Moving coil loud speaker – Loudspeaker cabinets – Horn loud speaker,receivers – Condenser – Microphone – Moving coil electrodynamics microphonePiezoelectric microphone – Calibration of receivers.

Total:45

TEXT BOOK

1.LawerenceE.Kinsler,AustinR.Frey,AlanB.CoppensandJamesV.Sanders, “Fundamentals of Acoustics”, 4th Edition, Wiley, 2000.

REFERENCE

1.BerarekL.,“Acoustics”, TMH, 2002.

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

19152C61P **SEMESTERVI**

MOBILEANDWIRELESSCOMMUNICATION 4004

AIM

To introduce the concepts of wireless / mobile communication using cellular environment. To make the students to know about the various modulation techniques, propagation methods, coding and multi access techniques used in the mobile communication. Various wireless network systems and standards are to be introduced.

Objectives

- It deals with the fundamental cellular radio concepts such as frequency reuse and handoff. This also demonstrates the principle of trunking efficiency and how trunking and interference issues between mobile and base stations combine to affect the overall capacity of cellular systems.
- It presents different ways to radio propagation models and predict the large –scale effects of radio propagation in many operating environment. This alsocovers small propagation effects such as fading, time delay spread and Doppler spreadanddescribeshowtomeasuresand modelthe impactthat signalbandwidth and motion have on the instantaneous received signal through the multi-path channel.
- It provides idea about analog and digital modulation techniques used in wireless communication.It also deals with the different types of equalization techniques and diversity concepts.
- It provides an introduction to speech coding principles which have driven the development of adaptive pulse code modulation and linear predictive coding techniques are presented. This unit also describes the time, frequency code division multiple access techniques as well as more recent multiple access technique such as space division multiple access.
- It deals with second generation and third generation wireless networks and worldwide wireless standards.

UNITI: PRINCIPLESOFWIRELESSCOMMUNICATION 10

Digital modulation techniques – Linear modulation techniques – Spread spectrummodulation – Performance of modulation – Multiple access techniques – TDMA –FDMA– CDMA–SDMA– Overviewofcellular networks –Cellular concept – Handoffstrategies – Path loss – Fading and Doppler effect.

UNITII: WIRELESSPROTOCOLS 11

Issuesandchallengesofwirelessnetworks–Locationmanagement–Resourcemanagement–Routing–Powermanagement–Security–Wirelessmediaaccess

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

techniques – ALOHA– CSMA– WirelessLAN – MAN – IEEE 802.11(a–b–e–f–g–h–i)– Bluetooth. Wireless routing protocols – Mobile IP – IPv4 – IPv6 – Wireless TCP.Protocolsfor3G&4Gcellularnetworks–IMT–2000–UMTS–CDMA2000–Mobility management and handover technologies – All-IP based cellular network

UNITIII: TYPESOFWIRELESS NETWORKS 9

Mobile networks – Ad-hoc networks – Ad-hoc routing – Sensor networks – Peer-Peernetworks – Mobile routing protocols – DSR – AODV – Reactive routing – Locationaided routing – Mobility models – Entitybased – Group mobility – Randomway – Pointmobility model.

UNITIV: ISSUESAND CHALLENGES 9

Issues and challenges of mobile networks– Security issues – Authentication in mobileapplications – Privacy issues – Power management – Energy awareness computing.

MobileIP andAd-hocnetworks –VoIPapplications.

UNITV: SIMULATION 6

Study of various network simulators (GloMoSim – NS2 – Opnet) – Designing andevaluating the performance of various transport and routing protocols of mobile andwireless networks using network simulator (any one).

Total:45

REFERENCES

1. TheodoreS.Rappaport,"WirelessCommunications,PrinciplesandPractice",Prentice Hall, 1996.
2. StallingsW., "WirelessCommunications&Networks",PrenticeHall, 2001.
3. SchillerJ.,"MobileCommunications",AddisonWesley,2000.
4. LeeW.C.Y.,"MobileCommunicationsEngineering:Theory andApplications", 2nd Edition, TMH, 1997.
4. PahlavanK.andKrishnamurthyP.,"PrinciplesofWirelessNetworks",Prentice Hall, 2002.
5. BlackU.D.,"MobileandWirelessNetworks",PHI,1996.
6. CharlesE.Perkins,"Ad –HocNetworking",Addison–Wesley,December2000
7. IEEEJournalsandProceedings

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

19152C62P **SEMESTERVI**

MEDICALELECTRONICS **3104**

AIM

Tomakestudentstounderstandtheapplicationsofelectronicsindiagnosticand therapeutic area.

OBJECTIVE

- To studythemethodsofrecordingvariousbiopotentials
- Tostudyhowtomeasurebiochemicalandvariousphysiologicalinformation
- Tounderstand theworking ofunitswhichwillhelptorestorenormalfunctioning
- Tounderstandtheuseofradiationfor diagnosticand therapy
- Tounderstandtheneed andtechniqueofelectricalsafetyinHospitals

UNITIELECTRO– PHYSIOLOGYANDBIO– POTENTIALRECORDING 9

The origin of bio-potentials – Bio-potential electrodes – Biological amplifiers – ECG – EEG –EMG –PCG –EOG –Lead systems and recording methods – Typicalwaveformsand signal characteristics.

UNITII BIO–CHEMICALANDNONELECTRICALPARAMETER MEASUREMENT 9

PH – PO2 – PCO2 – PHCO3 – Electrophoresis – Colorimeter – Photometer – Autoanalyzer – Blood flow meter – Cardiac output – Respiratory measurement – Bloodpressure – Temperature – Pulse – Blood cell counters.

UNITIII ASSISTDEVICESANDBIO– TELEMETRY 9

Cardiac pacemakers–DC defibrillator– Telemetry principles–Frequency selection–Bio-telemetry – Radio – Pill and tele-stimulation.

UNITIV RADIOLOGICALEQUIPMENTS 9

Ionosing radiation – Diagnostic X-ray equipments – Use of radio isotope in diagnosis – Radiation therapy.

UNITV RECENTTRENDSINMEDICALINSTRUMENTATION 9

Thermograph–Endoscopyunit–Laserinmedicine–Diathermyunits–Electricalsafety in medical equipment.

TUTORIAL15 **TOTAL:60**

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

TEXTBOOK

1. LeislieCromwell,“BiomedicalInstrumentationandMeasurement”,PHI,2002.

REFERENCES

1. Khandpur R.S., “Handbook of Biomedical Instrumentation”, TATA McGraw-Hill, 1997.
2. JosephJ.CarrandJohnM.Brown,“IntroductiontoBiomedicalEquipment Technology”, John Wiley and Sons, 1997.

19152C63P **SEMESTERVI**

MICROCONTROLLERANDEMBEDDED SYSTEMS **3104**

Aim

To make students familiar about microcontroller, programming and its applications.

Objective

- Tostudy8051architecture
- Towriteassemblylanguageprogramming
- Tostudytheembeddedarchitecture and realtime applications.

UNITI 8051MICROCONTROLLER 9

8051Micro controller hardware-I/Opins,portsandcircuits-Externalmemory–Countersand Timers-Serial Data I/O- Interrupts-

UNITII8051PROGRAMMINGANDAPPLICATIONS 9

8051 instruction set – Addressing modes – Assembly language programming – I/O portprogramming -Timer and counter programming – Serial Communication – Interruptprogramming –8051 Interfacing:, Stepper Motors.

UNITIIIINTRODUCTION TOEMBEDDED SYSTEMS 9

Definition and Classification – Overview of Processors and hardware units in anembedded system–Softwareembedded intothesystem–ExemplaryEmbedded Systems–Embedded Systems on a Chip (SoC)

UNITIVDEVICES ANDBUSES FOR DEVICES NETWORK 9

I/O Devices - Device I/O Types– Synchronous - Iso-synchronous and AsynchronousCommunications from Serial Devices -Communication Devices - UART and HDLC -Parallel Port Devices - Timer and Counting Devices - ‘12C’, ‘CAN’ - I/O Serial highspeed buses- ISA.

UNITV EMBEDDEDARCHITECTURE 9

Embedded computers, characteristics of embedded, computing applications- challengesin embedded computing systems design, embedded design process, requirements andspecifications, architectural design

TUTORIAL15 **TOTAL:60**

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

TEXTBOOKS

1. Ramesh S.Gaonkar, "Microprocessor - Architecture, Programming andApplications with the 8085", Penram International publishing private limited, fifth edition.
2. A.K. Ray & K.M.Bhurchandi, "Advanced Microprocessors and peripherals-Architectures, Programming and Interfacing", TMH, 2002 reprint.
3. Rajkamal, Embedded Systems Architecture, Programming and Design, TATA McGraw-Hill, First reprint Oct. 2003

REFERENCES

1. DouglasV.Hall,"Microprocessorsand Interfacing:ProgrammingandHardware", TMH, Third edition
2. Yu-cheng Liu, GlennA.Gibson, "Microcomputer systems: The 8086 / 8088Family architecture, Programming and Design", PHI 2003
3. MohamedAliMazidi,JaniceGillispieMazidi,"The8051microcontrollerand embedded systems", Pearson education, 2004.
4. SteveHeath,EmbeddedSystemsDesign, SecondEdition-2003, Newnes,
5. David E.Simon, An Embedded Software Primer, Pearson Education Asia, First Indian Reprint 2000.
6. Wayne Wolf, Computers as Components; Principles of Embedded Computing SystemDesign – Harcourt India, Morgan Kaufman Publishers, First Indian Reprint 2001

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

19152L65P **SEMESTERVI**

VLSIANDEMBEDDEDSYSTEMSLAB **0 0 3 2**

PART–I: VLSILAB

1. StudyofSimulationusingtoolsusingDigitalLogic Circuits.
2. StudyofSynthesistoolsusingDigitalLogic Circuits.
3. Studyofdevelopment toolfor FPGAusing Verilogand SchematicEntry.
4. DesignandSimulationof8bitSignedMultiplier.
5. PlaceandRoot andbackannotationfor FPGA.

PART-II:EMBEDDEDLAB

1. ProgrammingusingArithmetic,instructionof8051microcontroller.
2. ProgrammingandverifyingTimeroperationsin8051 microcontroller.
3. ARM-7basedOnboardLEDtesting
4. ARM7BasedADCtesting
5. ARM7based DAC testing

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE-III

19152E64AP **SEMESTERVI**

PRINCIPLESOFMANAGEMENT

(CommontoallBranches) **4004**

UNITI-Natureof Management 9

Definitions, meaning,scope,administrationandmanagement -Scienceandart Mgmt asaprofession, University of management Hierarchy (Top, middle and supervisory, Levels),Principles of Management

UNITII-DevelopmentofManagement Thought 9

Taylor andScientificManagement,PrinciplesofScientificManagement Contributionsoffayol,Barnardandsocialsystemtheory, ContributionsofHerbert Simon, ContributionsofPeter Drucker, Contributions of behavioral scientists ,Contribution of system scientists

UNITIII-Planning and organizing 9

Definitionandfeaturesofplanning,Natureofplanning,Importanceofplanning
Types ofplanning, Steps inplanning. Management byobjectives, Strategies and policies,Definition of organization, Importance of organization, Principles of organization, Spanof management

UNITIV-Direction and Coordination 9

Meaning, definition, principles of direction, Techniques of direction - Meaning ofsupervision, Functions of supervisor, Meaning of coordination Element and features ofcoordination, Importance of coordination Cooperation and coordination systemsapproach Steps for effective coordination Meaning and causes of conflicts, Managementof conflicts

UNITV–Controlling 9

Definition, Meaning .elements, steps in establishing control procedure ControlTechniques, Requirements of good control systems Budget –meaning, definitions, typesZero based budgeting, responsibility accounting, budgetary control, Report –meaningtypes PERT and CPMManagement by Exception

TOTAL:45

Textbooks:

1. Prasad L.M ., Principles and practice of Management ,New Delhi Sultan Chand and sons ,1998

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

References:

1. Saxena,S.Cprinciplesandpracticeofmanagement Agra:sahityabhawan1998
2. KoontzHaroldandothers,ManagementNewYork:McGrawHill1980
3. StonerJamesandothers,Management,NewDelhi:PHI,1997
4. DaleYoder:Personnel Managementandindustrial Relations,NewDelhi,PHI 1974

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

ELECTIVE-III

19152E64BP **SEMESTERVI**

SATELLITECOMMUNICATION **4004**

AIM

Toenablethestudenttobecomefamiliarwith satellitesandsatelliteservices.

OBJECTIVES

- Overviewofsatellitesystemsinrelationtootherterrestrialsystems.
- Studyofsatellite orbits andlaunching.
- Studyofearthsegmentand space segmentcomponents
- Studyofsatelliteaccessbyvarious users.
- StudyofDTHandcompressionstandards.

UNITI: ELEMENTSOFORBITAL MECHANICS **9**

Equationofmotion–Orbitalelements–Orbitalperturbation–Trackingandorbitdetermination – orbit control.

SatelliteLaunchsystems:FundamentalsofRocketpropulsion–Multistagerockets–Huffman transfer orbit circularization

UNITII:ELEMETSOFCOMMUNICATIONSATELLITEDESIGN **9**

Space environment – Spacecraft configuration – Spacecraft subsystems – Payload – Reliability consideration – Spacecraft integration – Testing facilities – Spacecraftoperations.

UNIT–III: SATELLITECOMMUNICATION SYSTEMS **9**

Typesofsystems–FSS,BSS-Noiseinterference,intermodulation–CDMA-Packetsatellite networks – The INSAT system -The INTELSAT/INMARSAT system.

UNIT–IV:EARTHSTATIONDESIGN **9**

Earthstationconfigurationoption – Site selection – Antenna systems – Tracking systems–Receiver subsystems – Low noise amplifiers – Down converters – Transmittersubsystems – Up converters- High power amplifiers- Terminal equipment .

UNIT-V: PERFORMANCE MEASUREMENTS **9**

Spacecraftcheckout–Groundstationmeasurements–Systemcoordinationandcontrol .Elements of Frequency coordination andmanagement: The ITU/IFRB requirements–Satellite system characterization – Ground system characteristics .

TOTAL:45

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

Textbook:

1. B.N.AGARWAL:DeignofGeosynchronousspacecraft, PrenticeHall

ReferenceBooks:

1. R.F.FILIPOWASKYand E.K.MUCHIDORF:SpacecommunicationSystems Mcgraw Hill
2. DENNISRODDY–Satellite communication
3. K.MIYA:Satellitecommunicationtechnology– Latticeand company

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

ELECTIVE-III

19152E64CP **SEMESTERVI**

ROBOTICS **4004**

AIM

Robots are slowly and steadily replacing human beings in many fields. The aim of this course is to introduce the students into this area so that they could use the same whenthey enter the industries.

OBJECTIVES

- Thecoursehasbeensodesignedtogivethestudentsanoverallviewofthe mechanical components and mathematics associated with the same.
- Actuatorsand sensorsnecessaryforthefunctioningofthe robot.

UNITI: ROBOTORGANIZATION 9

Coordinatetransformation,kinematicsandinversekinematics – Trajectoryplanningandremote manipulation.

UNITII: ROBOTHARDWARE 9

Robot sensors–Proximitysensors–Rangesensors–Visualsensors–Auditorysensors–Robot manipulators – Manipulator dynamics – Manipulator control – Wrists – Endefforts–Robotgrippers.

UNITIII: ROBOTANDARTIFICIALINTELLIGENCE 9

PrinciplesofAI–Basicsoflearning–Planningmovement–Basicsofknowledgerepresentations – Robot programming languages.

UNITIV: ROBOTICVISIONSYSTEMS 9

Principles ofedge detection – Determining optical flow and shape – Image segmentation–Pattern recognition – Model directed scene analysis.

UNITV: ROBOTCONTROLANDAPPLICATION 9

Robotcontrolusingvoiceandinfrared–Overviewofrobotapplications–Prostheticdevices – Robots in material handling, processing assembly and storage.

Total:45

REFERENCES

1. Koren,“Robotics forEngineers”,TMHInternationalCompany,1995.
2. Vokopravotic,“IntroductiontoRobotics”,Springer,1988.
3. RathmillK.,“RobotTechnologyandApplication”,Springer,1985.
4. CharniakandMcDarmott,“IntroductiontoArtificialIntelligence”,TMH, 1986.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

6. FuK.S,GonzallyR.C,LeeC.S.G.,“RoboticsControl,Sensing,Visionand Intelligence”, TMH Book Company, 1997.
7. Barry Leatham and Jones,“Elements of Industrial Robotics”,Pittman Publishing, 1987.
8. MikellP. Groover, Mitchell Weiss, Roger N.Nagel, NicholasG. Odrey, “Industrial Robotic TechnologyProgramming and Applications”, TMH Book Company, 1986.
9. Bernard Hodges and PaulHallam, “Industrial Robotics”, British Library Cataloguing Publication, 1990.

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

ELECTIVE-III

19152E64DP **SEMESTERVI**

REMOTE SENSING **4004**

AIM:

Tounderstandthebasicsforremotesensing.

OBJECTIVES:

- Introduce the principles of remote sensing and fundamental knowledge on the physics of remote sensing, aerial photographic techniques, photogrammetry, multispectral, hyperspectral and thermal imaging, and RADAR and LIDAR image analysis.
- Thenewesttechnologyinthefieldwill alsobe discussed.
- The course will be taught with an emphasis on the geographical applications of remotesensing;however, incertain instancesother disciplineswillbe introducedas well.

UNITI: REMOTESENSING 9

Definition – Components of Remote Sensing -Energy, Sensor, Interacting Body –Active and Passive Remote Sensing – Platforms – Aerial and Space Platforms –Balloons, Helicopters, Aircraft and Satellites – Synoptivity and Repetivity – ElectroMagnetic Radiation (EMR) – EMR spectrum – Visible, Infra Red (IR), Near IR, MiddleIR, Thermal IR and Microwave – Black Body Radiation – Planck's law – Stefan-Boltzman law.

UNITII: EMRINTERACTIONWITHATMOSPHEREAND EARTH MATERIALS 9

Atmospheric characteristics – Scattering of EMR – Raleigh, Mie, Non-selective andRaman Scattering – EMR Interaction with Water vapour and ozone – AtmosphericWindows – Significance ofAtmospheric windows – EMR interaction with Earth SurfaceMaterial– Radiance, Irradiance, Incident, Reflected, AbsorbedandTransmittedEnergy –Reflectance – Specular and Diffuse Reflection Surfaces – Spectral Signature – SpectralSignature curves – EMR interaction with water, soil and Earth Surface: Imagingspectrometry and spectral characteristics.

UNIT– III:OPTICALAND MICROWAVEREMOTESENSING 9

Satellites – Classification – Based onOrbits and purpose –Satellite Sensors – Resolution– Description of Multi Spectral Scanning – Along and Across Track Scanners – DescriptionofSensorsinLandsat,SPOT,IRSseries–CurrentSatellites–Radar

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

Speckle – Back Scattering – Side Looking Airbome Radar – Synthetic Aperture Radar – Radiometer – Geometrical characteristics ; Sonar remote sensing systems.

UNIT– IV: GEOGRAPHICINFORMATIONSYSTEM 9

GIS – Components of GIS – Hardware, Software and Organisational Context – Data – Spatial and Non-Spatial – Maps – Types of Maps – Projection – Types of Projection – Data Input – Digitizer, Scanner – Editing – Raster and Vector data structures – Comparition of Raster and Vector data structure – Analysis using Raster and Vector data–Retrieval, Reclassification, Overlaying, Buffering – Data Output – Printers and Plotters.

UNIT-V: MISCELLANEOUSTOPICS 9

Visual Interpretation of Satellite Images – Elements of Interpretation – InterpretationKeys Characteristics of Digital Satellite Image –Image enhancement – Filtering –Classification– IntegrationofGIS and Remote Sensing – ApplicationofRemote Sensingand GIS – UrbanApplications – IntegrationofGIS and RemoteSensing – ApplicationofRemote Sensing and GIS – Water resources – Urban Analysis – Watershed Management– Resources Information Systems.Global positioning system – an introduction.

TOTAL:45PERIODS

TEXTBOOK:

1. M.G. Srinivas(EditedBy),RemoteSensingApplications,NarosaPublishingHouse, 2001. (Units 1& 2).
2. AnjiReddy,RemoteSensingandGeographicalInformationSystems,BS Publications, 2001 (Units 3, 4, & 5).

REFERENCEBOOKS:

1. Jensen,J.R.,RemoteSensingoftheenvironment,PrenticeHall, 2000.
2. Kang-TsungChang,“IntroductiontoGeographicInformationSystems”,TMH, 2002.
3. Lillesand T.M. and Kiefer R.W., “Remote Sensing and Image Interpretation”, John Wiley and Sons, Inc, New York, 1987.
4. BurroughPA, “PriciplesofGISfor landresourceassessment”,Oxford.
5. Mischael Hord, “Remote Sensing and Methods and Applications” , John Wiley & Sons, New York, 1986.
6. Signal,“RemoteSensing”,TataMcGraw-Hill,NewDelhi,1990.
7. Floyd F. Sabins, RemoteSensing, “Priciples and interpretation”, WHFreemanand Company 1996.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE-III

19150E64EP **SEMESTERVI**

NETWORKSECURITY 4004

AIM

To understand the principles of encryption algorithms; conventional and public keycryptography. To have a detailed knowledge about authentication, hash functions and application level security mechanisms.

OBJECTIVES

- Toknowthe methodsofconventionalencryption.
- Tounderstandthe conceptsofpublic keyencryptionandnumbertheory
- TounderstandauthenticationandHashfunctions
- Toknowthenetwork securitytoolsand applications.
- Tounderstandthesystemlevelsecurityused.

UNITI: SYMMETRICCIPHERS 9

Overview–Classicalencryptiontechniques –Blockciphers anddataencryptionstandard–Finite fields – Advanced encryption standard – Contemporary symmetric ciphers – Confidentiality using symmetric encryption.

UNITII:PUBLIC-KEYENCRYPTION AND HASH FUNCTIONS9

Number theory – Public-key cryptography and RSA – Keym – Diffie-hellman keyexchange – Elliptic curve cryptography – Message authentication and hash functions –Hash algorithms – Digital signatures and authentication protocols.

UNITIII: NETWORKSECURITYPRACTICE 9

Authentication applications – Kerberos-X.509 authentication service – Electronic mailsecurity – Pretty good privacy – S/MIME – IP security – IP security architecture – Authentication header – Encapsulating security payload – Key management.

UNITIV: SYSTEMSECURITY 9

Intruders–Intrusiondetection–Passwordmanagement –Malicioussoftware–Firewalls–Firewall design principles – Trusted systems.

UNITV: WIRELESSSECURITY 9

WirelessLANsecuritystandards –WirelessLANsecurityfactorsandissues.

Total:45

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

TEXT BOOK

1. WilliamStallings, “CryptographyandNetworkSecurity–PrinciplesandPractices”, 3rd Edition, Pearson Education, 2003.

REFERENCES

1. AtulKahate,“Cryptographyand NetworkSecurity”,2nd Edition,TMH,2007.
2. Bruce Schneier,“Applied Cryptography”,2nd Edition,John Wiley and Sons Inc, 2001.
3. StewartS.Miller,“Wi-FiSecurity”,TMH,2003.
4. CharlesB.PfleegerandShariLawrencePfleeger,“SecurityinComputing”,3rd Edition, Pearson Education, 2003.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

19160S71P **SEMESTERVII**

TOTALQUALITYMANAGEMENT **3003**

OBJECTIVE

- TounderstandtheTotalQualityManagementconceptandprinciplesandthevarious tools available to achieve Total Quality Management.
- Tounderstandthestatisticalapproachforqualitycontrol.
- To create an awareness about the ISO and QS certification process and its need for the industries.

1. INTRODUCTION 9

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - AnalysisTechniques for Quality Costs, Basic concepts of Total Quality Management, HistoricalReview, Principles of TQM, Leadership – Concepts, Role of Senior Management,Quality Council, QualityStatements, Strategic Planning, Deming Philosophy, Barriers toTQM Implementation.

2. TQMPRINCIPLES 9

Customer satisfaction – Customer Perception of Quality, Customer Complaints, ServiceQuality, Customer Retention, Employee Involvement – Motivation, Empowerment,Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous ProcessImprovement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership –Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development,Performance Measures – Basic Concepts, Strategy, Performance Measure.

3. STATISTICALPROCESSCONTROL(SPC) 9

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency andDispersion, Population and Sample, Normal Curve, Control Charts for variables andattributes, Process capability, Concept of six sigma, New seven Management tools.

4. TQMTOOLS 9

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality FunctionDeployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality LossFunction, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA– Stages of FMEA.

5. QUALITYSYSTEMS 9

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, TS16949, ISO 14000 – Concept, Requirements and Benefits.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

TOTAL:45

TEXT BOOK

1. DaleH.Besterfiled,etal.,TotalQualityManagement,PearsonEducation,Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6.

REFERENCES

1. JamesR.Evans&William M.Lidsay,TheManagementandControlofQuality,(5th Edition),South-Western(ThomsonLearning),2002(ISBN0-324-06680-5).
2. Feigenbaum.A.V.“TotalQualityManagement, McGraw-Hill,1991.
3. Oakland.J.S.“Total Quality ManagementButterworth – Hcinemann Ltd.,Oxford. 1989.
4. NarayanaV.andSreenivasan,N.S.QualityManagement–ConceptsandTasks, New Age International 1996.
5. Zeiri.“TotalQualityManagementforEngineersWoodHeadPublishers, 1991

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

19152C72P **SEMESTERVII**

WIRELESSNETWORKS **3104**

AIM

Tostudysomefundamentalconceptsinwirelessnetworks.

OBJECTIVES

- TounderstandphysicalaswirelessMAC layeralternativestechniques.
- Tolearnplanning and operationofwireless networks.
- TostudyvariouswirelessLANandWAN concepts.
- TounderstandWPANandgeo-locationsystems.

UNITI: PHYSICALANDWIRELESSMACLAYERALTERNATIVES9

Wired transmission techniques: Design of wireless modems – Power efficiency – Outof band radiation – Applied wireless transmission techniques – Short distance base bandtransmission – VWB pulse transmission – Broad modems for higher speeds – Diversityand smart receiving techniques – Randomaccess fordataoriented networks – Integrationof voice and data traffic.

UNITII:WIRELESSNETWORKPLANNING ANDOPERATION9

Wireless networks topologies – Cellular topology – Cell fundamentals signal tointerference ratio calculation – Capacity expansion techniques – Cell splitting – Use ofdirectional antennas for cell sectoring – Micro cell method – Overload cells – Channelsallocation techniques and capacity expansion FCA – Channel borrowing techniques –DCA – Mobility management – Radio resources and power management securities inwireless networks.

UNITIII: WIRELESSWAN 9

Mechanismto support a mobile environment – Communication inthe infrastructure –IS-95 CDMA forward channel – IS-95 CDMA reverse channel – Pallert and frame formatsin IS-95, IMT-2000 – Forward channel in W-CDMA and CDMA-2000 – Reversechannels in W-CDMA and CDMA-2000 – GPRS and higher data rates – ShortMessaging Service in GPRS mobile application protocols.

UNITIV: WIRELESSLAN 9

Historical overviews of the LAN industry – Evolution of the WLAN industry – WirelessHome Networking – IEEE 802.11 – The PHY layer – MAC layer – Wireless ATM –HYPER LAN – HYPER LAN – 2.

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UNITV: WPANANDGEOLOCATIONSYSTEMS 9

IEEE 802.15 WPAN – Home RF – Bluetooth – Interface between luetoothand802.11– Wireless geolocation technologies for wireless geolocation – Geolocation standards forE.911 service.

Tutorial:15 **Total: 60**

TEXT BOOK

1. Kaveh Pahlavan, Prashant Krishnamoorthy, “Principles of Wireless Networks, – A United Approach”, Pearson Education, 2002.

REFERENCES

1. JochenSchiller,“MobileCommunications”,2ndEdition,PersonEducation,2003.
2. Wang X. and Poor H.V., “Wireless Communication Systems”, Pearson Education, 2004.
3. MallickM.,“MobileandWirelessDesignEssentials”,WileyPublishingInc.2003.
4. NicopolitidisP,ObaidatM.S,PapadimitriaG.I,PomportsisA.S.,“Wireless Networks”, John Wiley and Sons, 2003.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

19152C73P **SEMESTERVII**

TELECOMMUNICATIONSWITCHINGAND NETWORKS

4004

AIM

- To introduce fundamentals functions of a telecom switching office, namely, digital multiplexing, digital switching and digital subscriber access.
- Tointroduceamathematicalmodelfortheanalysisoftelecommunicationtraffic.

OBJECTIVES

- Tointroducethe conceptsofFrequencyandTimedivisionmultiplexing.
- TointroducedigitalmultiplexinganddigitalhierarchynamelySONET/SDH
- Tointroducetheconceptsofspaceswitching,timeswitchingandcombination switching, example of a switch namely No.4 ESS Toll switch.
- Tointroducetheneedfornetworksynchronizationandstudysynchronizationissues. To outline network control and management issues.
- Tostudytheenhancedlocalloopsystemsindigitalenvironment.Tointroduce ISDN, DSL / ADSL, and fiber optic systems in subscriber loop.
- Tointroducestatisticalmodelingoftelephonetraffic.Tostudyblockingsystem characteristics and queuing system characteristics.
- Tocharacterize blockingprobabilityholdingservicetimedistributionsfor inspeech and data networks.

UNITI EVOLUTIONOFTELECOMMUNICATION SWITCHINGAND CIRCUITS 9

Evolution of Public Switched Telecommunication Networks Strowger exchange,Crossbar exchange,– Basic Tele communicationequipments – Telephone handset, , Echosuppressors and cancellors, PCM coders, Modems and Relays.

UNITII ELECTRONICSWITCHING 9

CircuitSwitching,Messageswitching,Centralizedstoredprogrammeswitching,Timeswitching, Space switching – Digital switching system hardware configuration,

UNITIIITELECOMMUNICATIONSIGNALLINGANDTRAFFIC9

Channel associated signaling, Common channel signaling, SS7 signaling protocol, SS7protocol architecture, Grade of service, Modeling switching systems, Blocking modelsand Delay systems.

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UNITIV INTEGRATEDDIGITALNETWORKS 9

Subscriber loop characteristics, Local access wire line and wire less PCM / TDM carrierstandards transmission line codes, Synchronous, Asynchronous, SONET / SDH,Integrated DigitalNetwork(IDN)environment –PrinciplesofIntegrated ServicesDigitalNetwork (ISDN)

UNITV DATANET WORKS 9

DatatransmissioninPSTN – ConnectionorientedandConnectionlessprotocols – packetswitching – ISO-OSIarchitecture-Satellitebaseddatanetworks –LAN, WAN – standards– TCP / IP – Internet

TOTAL:45

TEXTBOOKS:

1. Viswanathan. T, “TelecommunicationSwitchingSystemandNetworks”, Prentice Hall of India Ltd., 1994.
2. BehrouzForouzan,“IntroductiontoDataCommunicationandNetworking”,McGraw-Hill, 1998.

REFERENCES

1. L.S.Lawton,“Integrated Digital Networks,Galgotta Publication Pvt.,Ltd.,New Delhi,1996.
2. SyedR. Ali,“DigitalSwitchingSystems”,McGraw-HillInc., NewYork,1998.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE–IV

19152E74AP **SEMESTERVII**

POWERELECTRONICS **3003**

AIM

ApplicationofElectronicknowledgeinindustryforrectificationofpolyphasesupply voltage and for control of motor speed and for thermal heating.

OBJECTIVES

- Tostudyaboutpowerelectroniccircuitsforvoltageandcurrentcontroland protection.
- To learn the switching characteristics of transistors and SCRs. Series and parallel functions of SCRs, Programmable triggering methods of SCR.
- TolearncontrolledrectificationACsupplies.
- Tostudyofconverters andinverters.
- Tolearnaboutmotorcontrol,charges,SMPSandUPS.

UNITI POWERSEMICONDUCTOR DEVICES 9

Powertransistors,Thyristors,PowerTRIAC,MOSFET,IGBT,GTOcharacteristics,rating, Protection circuits.

UNITII POWERSUPPLIES 9

Single Phase and Three Phase Controlled rectifiers, DesignofTrigger circuits, Switchingmode regulators – Boost, Buck, Buck-Boost and Cuk regulators, AC voltage regulator.

UNITIII INVERTERS 9

Voltageandcurrentsourceinverters,Resonant,Series inverter,PWM inverter.

UNITIV CHOPPERS 9

TypeA, B,CandDchoppers,Pulsewidthmodulation-Gating requirements.

UNITV MOTORCONTROL&Applications 9

Single Phase DC series motor drives, Inductionand Synchronous motor drives, Switchedreluctance motor Drive, SMPS and UPS

TOTAL:45

TEXTBOOK:

1. M.D.Singh,K.B.Khanchandani,“PowerElectronics”,TataMcGraw-Hill,1998.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

REFERENCES:

1. Ned Mohan, Tore M.Undeland, William P.Robbins, "Power Electronics, Converters, Applications and Design", John Wiley & Sons, 1994.
2. MuhamedH.Roshid, "PowerElectronicsCircuits,Devicesand Application", Prentice Hall of India, 1995.
3. B.K.Bose,"ModernPowerElectronics",Jaico PublishingHouse,1999.
4. Sen,PowerElectronics",TataMcGraw-Hill,1987

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE–IV

19152E74BP **SEMESTERVII**

ADVANCEDMICROPROCESSORS **3003**

AIM

To learnthe architecture and programming ofadvanced Intelfamily microprocessors and microcontrollers.

OBJECTIVES

- Tointroducetheconceptsininternalprogrammingmodelof Intelfamilyof microprocessors.
- To introduce the programming techniques using MASM, DOS and BIOS function calls.
- Tointroducethe basic architecture ofPentiumfamilyofprocessors.
- To introduce the architecture programming and interfacing of 16 bit microcontrollers.
- To introducetheconceptsand architectureofRISCprocessorandARM.

UNITI ADVANCEDMICROPROCESSORARCHITECTURE 9

Internal microprocessor architecture – Real mode memory addressing – Protected modememory addressing – Memory paging – Data addressing modes – Program memoryaddressing modes – Stack memory addressing modes – Data movement instructions –Program control instructions – Arithmetic and logic instructions.

UNITII MODULARPROGRAMMINGANDITS CONCEPTS 9

Modularprogramming– Using keyboard and video display – Data conversions – Diskfiles – Interrupt hooks – Using assembly languages with C/ C++

UNITIII PENTIUMPROCESSORS 9

Introduction to pentium microprocessor – Special pentium registers – Pentium memorymanagement – New pentium instructions – Pentium processor – Special pentium profeatures – Pentium IV processor

UNITIV 16–BITMICROCONTROLLER 9

8096/8097 architecture – CPU registers – RALU – Internal program and data memorytimers – High speed input and output – Serial interface – I/O ports – Interrupts – A/Dconverter – Watch dog timer – Power down feature – Instruction set – External memoryinterfacing – External I/O interfacing.

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UNITV RISCPROCESSORSANDARM 9

The RISC revolution – Characteristics of RISC architecture – The berkeley RISC – Register windows – Windows and parameter passing – Window overflow – RISCarchitecture and pipelining – Pipeline bubbles – Accessing external memory in RISCsystems – Reducing the branch penalties – Branch prediction – ARM processors – ARMregisters – ARM instructions – ARM built-in shift mechanism – ARM branchinstructions – Sequence control – Data movement and memory reference instructions.

TOTAL:45

TEXTBOOKS

1. Barry B. Brey, "The Intel Microprocessors 8086/8088, 80, 86, 80286, 80386,80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium 4, Architecture, Programming and Interfacing", PHI Private Limited, 2003.
2. JohnPeatman, "DesignwithMicrocontroller",TMHPublishingCoLtd,2003.
3. Alan Clements, "The Principles of Computer Hardware", 3rd Edition, Oxford University Press, 2003.

REFERENCES

1. Rajkamal, "The Concepts and Feature of Micro Controllers 68HC11, 8051 and 8096", S Chand Publishers, 2000.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE–IV

19152E74CP **SEMESTERVII**

ELECTROMAGNETICINTERFERENCEANDCOMPATIBILITY

3003

AIM

To understand different electromagnetic Interference problems occurring in Intersystem and in inter system and their possible mitigation techniques in Electronic design

OBJECTIVES

- To understand EMI Sources,EMI problems andtheir solution methodsin PCB level / Subsystem and system level design.
- To measure the emission.immunity level from different systems to couple with the prescribed EMC standards

UNITI BASICCONCEPTS 9

Definition of EMI and EMC with examples – Classification of EMI/EMC – CE – RE – CS – RS – Unitsofparameters – SourcesofEMI –EMI coupling modes – CMand DM–ESD phenomena and effects – Transient phenomena and suppression.

UNITII EMIMEASUREMENTS 9

Basic principles of RE, CE, RS and CS measurements – EMI measuring instruments – Antennas – LISN – Feed through capacitor – Current probe – EMC analyzer anddetection technique open area site – Shielded anechoic chamber – TEM cell.

UNITIII EMCSTANDARD AND REGULATIONS 8

National and intentional standardizing organizations – FCC – CISPR – ANSI – DOD – IEC – CENEEC – FCC – CE and RE standards – CISPR – CE and RE standards – IEC/EN – CS standards – Frequency assignment – Spectrum conversion.

UNITIV EMICONTROLMETHODS ANDFIXES 10

Shielding–Grounding–Bonding–Filtering–EMIgasket–Isolationtransformer–Opto-isolator.

UNITV EMCDESIGNANDINTERCONNECTION TECHNIQUES 9

Cableroutingandconnection–Componentselectionandmounting–PCBdesign–Trace routing – Impedance control – Decoupling – Zoning and grounding

TOTAL:45

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TEXTBOOKS

1. Prasad Kodali V., “Engineering Electromagnetic Compatibility”, S. Chand and Co, 2000.
2. ClaytonR.Paul,“IntroductiontoElectromagneticCompatibility”,Wileyand Sons, 1992.

REFERENCES

1. Keiser, “Principles of Electromagnetic Compatibility”, 3rd Edition, Artech House, 1994.
2. DonwhiteConsultantIncorporate,“Handbook OfEMI/EMC”,VolI,1985

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE–IV

19152E74DP **SEMESTERVII**

SOLIDSTATEELECTRONICDRIVES **3003**

AIM

To have fundamentalknowledge about structure of devices, VI characteristics of devices like PN Junction diode, Zener diode, MOSFET, BJT and Opto electronic.

OBJECTIVES:

- To learn crystal structures of elements used for fabrication of semiconductor devices.
- Tostudyenergybandstructureofsemiconductordevices.
- To understand fermi levels, movement of charge carriers, Diffusion current and Drift current.
- To study behavior of semiconductor junction under different biasing conditions. Fabrication of different semiconductor devices, Varactor diode, Zener diode, Schottky diode, BJT, MOSFET, etc.
- To study the VI Characteristics of devices and their limitations in factors like current, power frequency.
- Tolearnphotoelectriceffectandfabricationofoptoelectronic devices.

UNITI:CRYYSTALPROPERTIES ANDGROWTH SEMICONDUCTORS9

Semiconductormaterials–periodicStructures –CrystalLattices–Cubic lattices–Planesand Directions – Diamond lattice – Bulk Crystal Growth – Starting Material – Growth ofSingle Crystal Ingots – Wafers – Doping – Epitaxial Growth – Lattice Matching inEpitaxial Growth – Vapor – Phase Epitaxy – Atoms and Electronics – Introduction toPhysical Models – Experimental Observations – Photoelectric Effect – Atomic spectra –Bhr model – Quantum Mechanics – Probability and Uncertainty Principle – SchrodingerWave Equation – Potential Well Equation – Potential well Problem – Tunneling.

UNITII: ENERGYBANDSANDCHARGECARRIERSINSEMICONDUCTORS AND JUNCTIONS 9

Energybands inSolids, EnergyBands inMetals, Semiconductors,andInsulators –Directand Indirect Semiconductors – Variation of Energy Bands with Alloy Composition -Charge Carriers in Semiconductors – Electrons and Holes – Electrons and holes inQuantum Wells – Carrier Concentrations –Femi Level – Electron and HoleConcentrations at Equilibrium – Temperature Dependence of Carrier Concentrations –Compensation and Space Charge Neutrality – Drift of Carrier in Electric and MagneticFieldsconductivityandMobility–DriftandResistance–EffectsofTemperatureand

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

DopingonMobility–HighFieldeffects–HallEffect–invarianceofFermilevelatequilibrium – Fabrication of p-n junctions, Metal semiconductor junctions.

UNITIII: METALOXIDESEMICONDUCTOR FET 9

GaAS MESFET – High Electron Mobility Transistor – Short channel Effects – MetalInsulator Semiconductor FET – Basic Operation and Fabrication – Effects of RealSurfaces – Threshold Voltage – MOS capacitance Measurements – Current – VoltageCharacteristics of MOS Gate Oxides – MOS Field Effect Transistor – OutputCharacteristics – Transfer characteristics - Short Channel MOSFET V-I characteristics –Control of Threshold Voltage – Substrate Bias Effects -Sub threshold characteristics –Equivalent Circuit for MOSFET –MOSFET Scaling and Hot Electron Effects – Drain –InducedBarrierLowering –short channelandNarrowwidthEffect – GateInducedDrainLeakage.

UNITIV: OPTOELECTRONDEVICES 9

Photodiodes – Current and Voltage in illuminated Junction – Solar Cells – Photodetectors – Noise and Bandwidth of Photo detectors – Light Emitting Diodes – LightEmitting Material – Fiber Optic Communication Multilayer Heterojunctions for LEDS –Lasers – Semiconductor lasers – Population Inversion at a Junction Emission Spectra forp-n junction – Basic Semiconductor laser – Materials for Semiconductor laser.

UNITV HIGH FREQUENCYANDHIGH POWERDEVICES9

Tunnel Diode, IMPATT Diode, operation of TRAPATT and BARITT Diodes, GunnDiode – transferred – electron mechanism, formation and drift of space charge domains,p-n-p-n diode, Semiconductor Controlled Rectifier, Insulated Gate Bipolar Transistor.

TOTAL:45

TEXTBOOKS

1. Ben. G.Streetman & Sanjan Banerjee, Solid State Electronic Devices, 5th Edition, PHI, 2003.

REFERENCES

1. Donald A.Neaman,SemiconductorPhysicsandDevices,3rdEdition,TMH, 2002.
2. YannisTsividis,Operation & Modelineof MOSTransistor,2ndEdition,Oxford University Press, 1999.
3. NanditaDasGupta&aamitavaDasGupta,SemiconductorDevicesModeling Technology, PHI, 2004.
4. D.K.Bhattacharya&RajinishSharma,SolidStateElectronicDevices,Oxford University Press, 2007.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE–IV

19152E74EP **SEMESTERVII**

COMPUTERHARDWAREANDINTERFACING 3003

AIM

To enable the student to get a detailed knowledge of all the hardware components that make up a computer and to understand the different interfaces required for connecting these hardware devices.

OBJECTIVES

- TointroduceissuesrelatedtoCPUandmemory.
- To understandthecomponentsonthe motherboard
- Tounderstanddifferentstorage media
- TointroducethefeaturesofdifferentI/Operipheraldevicesandtheirinterfaces.

UNITI CPUANDMEMORY 9

CPU essentials – processor modes – modern CPU concepts – Architectural performancefeatures – the Intel’s CPU – CPU over clocking – over clocking requirements – overclocking the system – over clocking the Intel processors – Essential memory concepts –memory organizations – memory packages – modules –memory.

UNITII MOTHERBOARDS 9

Pentium4 mother board -form factor – upgrading a mother board – chipsets – northbridge – south bridge –motherboard BIOS – POST – BIOS features – BIOS and Bootsequences – BIOS shortcomings and compatibility issues – power supplies and powermanagement – concepts of switching regulation – potential power problems – powermanagement.

UNITIII STORAGE DEVICES 9

The floppy drive – magnetic storage – magnetic recording principles – data and diskorganization – floppy drive – hard drive – data organization and hard drive – sectorlayout –CDROM electronics – DVD-ROM – DVD media – DVD drive and decoder.

UNITIV I/OPERIPHERALS 9

Parallel port – signals and timing diagram – IEEE1284 modes – asynchronouscommunication- serialport signals – video adapters – graphic accelerators – 3D graphicsaccelerator issues

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UNITV BUSARCHITECTURE 9

Buses – Industrystandard architecture (ISA), peripheral component Interconnect (PCI) – Accelerated Graphics port (AGP) – plug-and-play devices – SCSI concepts – USBarchitecture.

TOTAL:45

TEXT BOOK

1. StephenJ.Bigelow,“TroubleShooting,maintainingandRepairingPCs”,TataMcGraw-Hill, New Delhi, 2001.

REFERENCES

1. CraigZacker&JohnRourke,“Thecompletereference:PChardware”,Tata McGraw-Hill, New Delhi, 2001.
2. Mike Meyers, “Introductionto PCHardware andTrouble shooting”, Tata McGraw-Hill, New Delhi, 2003.
3. B.Govindarajulu, “IBM PC and Clones hardware trouble shooting and maintenance”, Tata McGraw-Hill, New Delhi, 2002.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

DEPARTMENTOFELECTRONICSAND COMMUNICATION

PROGRAMMEHANDBOOK

M.TECH.–COMMUNICATIONSYSTEMS

FULLTIMEPROGRAMME
Regulation2019

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

M.TECH.COMMUNICATIONSYSTEMS-FULLTIME-R-2019

SEMESTER I – IV CURRICULUM

SEMESTERI

S.N	SUB CODE	SUBJECT	L	T	P	C
		Theory				
1	19248S11B	AppliedMathematicsfor Electronics Engineering	3	1	0	4
2	19271C12	StatisticalSignalProcessing	3	1	0	4
3	19271C13	ModernDigitalCommunicationSystems	3	1	0	4
4	19271C14	CommunicationProtocolEngineering	4	0	0	4
5	19271C15	AdvancedRadiationSystems	4	0	0	4
6	**19271E16_**	**Elective-I**	3	0	0	3
		Practical				
7	19271L17	CommunicationSystemsLab-I	0	0	3	3
		ResearchSkillDevelopment(RSD)Course				
8	19271CRS	ResearchLed Seminar	1	0	0	1
		Total	21	3	3	**27**

SEMESTERII

S.N	SUB CODE	SUBJECT	L	T	P	C
		Theory				
1	19271C21	MobileCommunicationNetworks	4	0	0	4
2	19271C22	AdvancedMicrowaveSystems	4	0	0	4
3	19271C23	FiberOpticNetworking	4	0	0	4
4	**19271E24_**	**Elective-II**	**3**	**0**	**0**	**3**
5	**19271E25_**	**Elective-III**	**3**	**0**	**0**	**3**
		Practical				
6	19271L26	CommunicationSystemsLab-II	0	0	3	3
7	192TECWR	TechnicalWriting/Seminars	0	0	3	3
		ResearchSkillDevelopment(RSD)Course				
8	19271CRM	ResearchMethodology	**3**	**0**	**0**	**3**
9	19271CBR	ParticipationinBoundedResearch	**2**	**0**	**0**	**2**
		Total	23	0	6	**29**

SEMESTERIII

S.N	SUB CODE	SUBJECT	L	T	P	C
		Theory				
1	19271C31	WirelessSensor Networks	4	0	0	4
2	**19271E32_**	**Elective –IV**	**3**	**0**	**0**	**3**
3	**19271E33_**	**Elective –V**	**3**	**0**	**0**	**3**
4	**19271E34_**	**Elective –VI**	**3**	**0**	**0**	**3**

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S.N	SUB CODE	SUBJECT	L	T	P	C
Project						
5	19271P35	ProjectPhase–I	0	0	10	10
ResearchSkillDevelopment(RSD)Course						
6	19271CSR	Design/Socio-TechnicalProject	**0**	**0**	**6**	**6**
		Total	13	0	16	**29**

SEMESTERIV

S.N	SUB CODE	SUBJECT	L	T	P	C
1	19271P41	ProjectPhase–II	0	0	15	15
		Total	0	0	15	**15**
				TOTALNO.OFCREDITS		**100**

LISTOF ELECTIVES

Elective-I(SEMESTER– I)

S.N	SUBCODE	SUBJECT	L	T	P	C
1.	19271E16A	InternetworkingandMultimedia	3	0	0	3
2.	19271E16B	DigitalImageProcessing	3	0	0	3
3.	19271E16C	LASERCommunication	3	0	0	3

Elective-II(SEMESTER –II)

S.N	SUBCODE	SUBJECT	L	T	P	C
1.	19271E24A	HighSpeedSwitchingArchitecture	3	0	0	3
2.	19271E24B	DSPProcessorArchitectureand Programming	3	0	0	3
3.	19271E24C	DigitalSpeech Processing	3	0	0	3

Elective-III(SEMESTER–II)

S.N	SUBCODE	SUBJECT	L	T	P	C
1.	19271E25A	DigitalCommunicationReceivers	3	0	0	3
2.	19271E25B	SoftComputing	3	0	0	3
3.	19271E25C	CommunicationNetworkSecurity	3	0	0	3

Elective-IV(SEMESTER –III)

S.N	SUBCODE	SUBJECT	L	T	P	C
1.	19271E32A	SoftwareDefined Radio	3	0	0	3
2.	19271E32B	SatelliteCommunication	3	0	0	3
3.	19271E32C	CDMASystems	3	0	0	3

Elective-V(SEMESTER–III)

S.N	SUBCODE	SUBJECT	L	T	P	C
1.	19271E33A	Waveletsand MultiResolution Processing	3	0	0	3
2.	19271E33B	HighPerformanceCommunication Networks	3	0	0	3

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S.N	SUBCODE	SUBJECT	L	T	P	C
3.	19271E33C	AdvancedMicroprocessorsand Microcontrollers	3	0	0	3

Elective-VI(SEMESTER – III)

S.N	SUBCODE	SUBJECT	L	T	P	C
1.	19271E34A	SimulationofCommunication Networks	3	0	0	3
2.	19271E34B	MedicalImaging	3	0	0	3
3.	19271E34C	MobileADHOCNetworks	3	0	0	3

M.TECH.COMMUNICATIONSYSTEMS- FULLTIME-R-2019

CourseStructureandCredit Distribution

Sem.	CoreCourses						Elective Courses		Foundation Courses		Total Credits
	Theory Courses		Practical Courses		Courseson *RSD						
	Nos.	Credits	Nos.	Credits	Nos.	Credits	Nos.	Credits	Nos.	Credits	
I	04	16	01	03	01	01	01	03	01	04	27
II	03	12	02	06	02	05	02	06	-	-	29
III	01	04	01	10	01	06	03	09	-	-	29
IV	-	-	01	15	-	-	-	-	-	-	15
										TotalCredits	**100**

*RSD-ResearchSkillDevelopment

HOD **DEAN** **DEAN - ACADEMICAFFAIRS**

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SEMESTERI

19248S11B APPLIEDMATHEMATICSFORELECTRONICSENGINEERING

L T PC
3104

AIM:

Theprimaryaimofthiscourseistodemonstratevariousanalyticalskillsinapplied mathematics and extensive experience with the tactics of problem solving and logical thinkingapplicable in communication engineering.

OBJECTIVES:

The primary objective of this coursewill help the students to identify, formulate, abstract, and solve poblems using mathematical tools from a variety of mathematical areas, including fuzzy logic, matrix linear programming, probability, numerical solution of ordinary differential equations and queuing models.

UNITICALCULUS OFVARIATIONS 9

Functional – Euler's equation-Variational problems involving one unknown function-severalunknown functions-functional dependent on higher order derivatives-several independentvariables-isoperimetric problems.

UNITIIINTEGRALTRANSFORMSANDWAVE EQUATIONS 9

Fourier transformpairs, Properties – Fourier Sine and Cosine transforms, Convolution integrals,Evaluation of integrals using Fourier Transform.Discrete Fourier Transform -properties.Application of Fourier transform to wave equation.Z-transform-properties-inverse transform-solution to difference equation.

UNITIIILINEARPROGRAMMING 9

Simplexalgorithm-twophasemethod-duality-transportationandassignment problems-inventory-scheduling.

UNITIVRANDOMPROCESSANDQUEUINGTHEORY 9

Classification – auto correlation-cross correlation-ergodicity-power spectral density function-Poisson process.Single and multiple server Markovian queuing models- customer impatience-queuing applications.

UNITVTESTINGOF HYPOTHESIS 9

Sampling distributions-Testing of hypothesis of normal, t, chi square, F distributions for testingmean and variance- large sample test. Analysis of variance – one way classification.

Tutorial :15 Total:60

OUTCOMES:

Aftercompletingthiscourse,studentsshoulddemonstratecompetencyinthefollowing skills:

- Concepts on vector spaces, linear transformation, inner product spaces, eigenvalues and generalized eigenvectors.

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- Applyvarious methodsinlinearalgebratosolvesystemsoflinearequations.
- Could develop a fundamental understanding of linear programming models, able to develop a linear programming model from problem description, apply the simplex method for solving linear programming problems.
- Numericalsolutionofdifferentialequations bysingleandmultistepmethods.
- Computationofprobability,randomvariablesandtheirassociateddistributions, correlations and regression.
- Conceptualizetheprincipleofoptimalityandsub-optimization,formulationand computational procedure of dynamic programming.
- Exposingthebasiccharacteristicfeaturesof aqueuingsystemandacquiringskillsin analyzing queuing models.
- Usingdiscrete time Markovchainstomodelcomputer systems.

BOOKSFORREFERENCES:

1. Grewal.B.S."HigherEngineeringMathematics",KhannaPublications,2005.
2. Kapoor.J.N.&Saxena.H.C.,MathematicalStatistics,S.Chand&Co.,NewDelhi.
3. Taha.H.A. "OperationResearch–AnIntroduction",6thEdition,PHI,1997.
4. M.K.Venkataraman,"HigherMathematicsforEngineering&Science",National Publishing Company, 2000.
5. Kandasamy,"EngineeringMathematicsVolumeII,S.Chand&Co.
6. P.K.Guptha,D.S.Hira,OperationsResearch,S.Chand&Co.,1999
7. T.Veerarajan,Probability,StatisticsandRandomProcesses,TMH,2002

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

SEMESTERI

19271C12 STATISTICALSIGNALPROCESSING LT PC 3104

AIM:

Thestudentcomprehendsmathematicaldescriptionandmodellingofdiscretetime randomsignals.

OBJECTIVES:

- Thestudentisconversantwithimportanttheoremsand algorithms.
- Thestudentlearnsrelevantfiguresofmeritsuchaspower,energy,biasand consistency.
- Thestudentisfamiliarwithestimation,predictionandfilteringconceptsandtechniques.

UNITIDISCRETERANDOMSIGNAL PROCESSING 9

Discrete RandomProcesses-, Autocorrelationand Autocovariance matrices. Parseval's Theorem,Wiener - Khintchine Relation- Power Spectral Density-Periodogram -, Parameter estimation:Bias and consistency.

UNITII SPECTRUMESTIMATION 9

Non-Parametric Methods-Correlation Method, Periodogram Estimator, Performance Analysis ofEstimators –Unbiased Consistent Estimators-; Bartlett, Blackman –Tukey method. ParametricMethods- AR, MA, andARMAmodelbasedspectralestimation.

UNITIIISIGNALMODELINGANDOPTIMUMFILTERS 9

Introduction- Least square method – Pade approximation – Prony's method – LevinsonRecursion – Lattice filter - FIR Wiener filter – Filtering – Linear Prediction – Non Causal andCausal IIR Weiner Filter –- Mean square error – Discrete Kalman filter

UNITIV ADAPTIVEFILTERS 9

FIR adaptive filters -adaptive filter based on steepest descent method-Widrow-Hoff LMSadaptive algorithm Adaptive recursive filters (IIR). RLS adaptive filters-Exponentially weightedRLS-sliding window RLS.

UNITVMULTIRATEDIGITALSIGNAL PROCESSING 9

Mathematicaldescriptionofchange ofsampling rate -Interpolationand Decimation, Decimationby an integer factor - Interpolation by an integer factor, Filter implementation for sampling rateconversion- Application to sub band coding and Filter bank implementation of waveletexpansion of signals.

Total:45 Periods

OUTCOMES:

- Formulatetimedomainandfrequencydomaindescriptionof WideSenseStationaryprocessin terms of matrix algebra and relate to linear algebra concepts.
- State Parseval's theorem, W-K theorem, principle of orthogonality, spectral factorization theorem, Widrow-HoffLMS algorithmandShannon'ssamplingtheorem, anddefinelinear prediction, linear

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estimation,sampleauto-correlation,periodogram,biasandconsistency.

- Explain various noise types, Yule-Walker algorithm, parametric and non-parametric methods, Wiener and Kalman filtering, LMS and RMS algorithms, Levinson Durbin algorithm, adaptive noise cancellation and adaptive echo cancellation, speed verses convergence issues, channel equalization, sampling rate change, subband coding and wavelet transform.
- Calculate mean, variance, auto-correlation and PSD for WSS stochastic processes, and derive prediction error criterion, Wiener-Hoff equations, Parseval'stheorem,W-K theorem and normal equations.
- Design AR, MA, ARMA models, Weiner filter, anti aliasing and anti imaging filters, and develop FIR adaptive filter and polyphase filter structures.
- Simulatespectralestimationalgorithmsandbasicmodelsoncomputingplatforms.

BOOKSFORREFERENCES:

1. MonsonH.Hayes,StatisticalDigitalSignalProcessingandModeling,JohnWileyand Sons, Inc., Singapore, 2002.
2. JohnG.Proakis,DimitrisG.Manolakis,DigitalSignalProcessingPearsonEducation, 2002.
3. JohnG.Proakiset.al.,'AlgorithmsforStatisticalSignalProcessing',PearsonEducation, 2002.
4. DimitrisG.Manolakiset.al.,'Statisticalandadaptivesignal Processing',McGrawHill, Newyork,2000.

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SEMESTERI

19271C13 MODERNDIGITALCOMMUNICATIONSYSTEMS

LTPC
3104

AIM:

Tounderstandthebasicsofsignal-spaceanalysisanddigitaltransmission.

OBJECTIVES:

- Tounderstandthecoherentandnoncoherentreceiversanditsimpactondifferentchannel characteristics.
- TounderstandthedifferentEqualizers
- To understandthe different block codedand convolutionalcoded digitalcommunication systems.
- TounderstandthebasicsofMulticarrierandMultiuser Communications.

UNITICOHERENTANDNON-COHERENTCOMMUNICATION: 9

Coherent receivers – Optimum receivers in WGN – IQ modulation & demodulation – Non coherentreceivers in random phase channels; M-FSK receivers – Rayleigh and Rician channels– Partially coherent receives – DPSK; M-PSK; M-DPSK,-BER Performance Analysis.

UNITIIBANDLIMITEDCHANNELSANDDIGITALMODULATIONS: 9

Eye pattern; demodulation in the presence of ISI and AWGN; Equalization techniques – IQmodulations; QPSK; QAM; QBOM; -BER Performance Analysis. – Continuous phasemodulation;CPFM;CPFSK;MSK,OFDM. OFDM signalprocessing;Peak Power Problem: PAPreduction schemes-Clipping, Filtering, Coding and Scrambling.

UNITIIIBLOCKCODEDDIGITAL COMMUNICATION: 9

Architecture and performance – Binaryblock codes;Orthogonal;Biorthogonal;Transorthogonal– Shannon's channel coding theorem; Channel capacity; Matched filter; Concepts of Spreadspectrum communication – Coded BPSK and DPSK demodulators – Linear block codes;Hammning; Golay;Cyclic; BCH ; Reed – Solomon codes.

UNITIVCONVOLUTIONALCODEDDIGITAL COMMUNICATION: 9

Representation of codes using Polynomial, State diagram, Tree diagram, and Trellis diagram – Decoding techniques using Maximum likelihood, Viterbi algorithm, Sequential and Thresholdmethods – Errorprobabilityperformance for BPSKand Viterbialgorithm, Turbo Coding. Modelof spread Spectrum Digital Communication System-Direct Sequence Spread Spectrum Signals,Error rate performance of the coder, Generation of PN Sequences- Frequency-Hopped SpreadSpectrum Signals, Performance of FH Spread Spectrum Signals in an AWGN Channel-Synchronization of Spread Spectrum Systems.

UNITVMULTICARRIERANDMULTIUSERCOMMUNICATIONS 9

Single Vs multicarrier modulation, orthogonal frequency division multiplexing (OFDM), Modulation and demodulation in an OFDM system, An FFT algorithmic implementation of an OFDM system, Bit and power allocation in multicarrier modulation, Peak-to-average ratio in multicarrier modulation.Introduction to CDMA systems, multiuser detection in CDMA systems– optimum multiuser receiver, sub optimum detectors, successive interference cancellation.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

Total:45Periods

OUTCOMES:

UponCompletionofthecourse, thestudentswillbeableto:

- Developthe ability tounderstand the conceptsofsignal space analysisforcoherent and non- coherent receivers.
- ConceptuallyappreciatedifferentEqualizationtechniques
- Possessknowledgeondifferentblockcodesandconvolutionalcodes.
- ComprehendthegenerationofOFDMsignalsandthetechniquesofmultiuser detection.

BOOKSFORREFERENCES:

1. M.K.Simon, S.M.Hinedi and W.C.Lindsey, Digital communication techniques; Signalling and detection, Prentice HallIndia, New Delhi. 1995.
2. SimonHaykin,Digitalcommunications,JohnWileyandsons, 1998
3. WayneTomasi,Advancedelectroniccommunicationsystems,4thEditionPearson Education Asia, 1998
4. B.P.LathiModerndigitalandanalogcommunicationsystems,3rdEdition,Oxford University press 1998.
5. JohnG.Proakis, DigitalCommunications,4thEdition, McGraw-Hill,Newyork, 2001

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SEMESTERI

19271C14 COMMUNICATIONPROTOCOLENGINEERING L TPC 4 004

AIM:

Toexposethestudentstothelayeredarchitectureforcommunicationnetworksandthe specificfunctionalityofthe networklayer.

OBJECTIVES:

- To enable the student to understand the basic principles ofrouting and the manner this is implemented in conventional networks and the evolving routing algorithms based on Internetworking requirements, optical backbone and the wireless access part of the network.
- To enable the student to understand the different routing algorithms existing and their performance characteristics.

UNITINETWORKINTRODUCTION 9

Introduction: Communication model, Communication Software, Communication Subsystems,Communication Protocol Definition/Representation Formal and Informal Protocol DevelopmentMethods, Protocol Engineering Phases Error Control, Flow Control Type of TransmissionErrors, Linear Block Code, Cyclic Redundancy Checks, Introduction to Flow Control, WindowProtocols

UNITIINETWORKREFERENCEMODEL 9

Sequence Numbers, Negative Acknowledgments, Congestion Avoidance Network ReferenceModel: Layered Architecture, Network Services and Interfaces, Protocol FunctionsEncapsulation, Segmentation, Reassembly, Multiplexing, Addressing, OSI Model LayerFunctions, TCP/IP Protocol Suite, Application Protocols

UNITIIIPROTOCOL SPECIFICATIONS 9

Components of protocol, Specifications of Communication service, Protocol entity, Interface,Interactions,Multimedia protocol, Internet protocol, SDL, SDL based protocol- other protocolspecification languages

UNITIVPROTOCOLCONFORMANCE/PERFORMANCETESTING9

Conformance testing methodology and framework, Conformance test architectures, Testsequence generation methods, Distributed architecture by local methods, Conformance testingwith TTCN, systems with semi controllable interfaces - RIP,SDL based tools for conformancetesting, SDL based conformance testing of MPLS Performance testing, SDL based performancetesting of TCP and OSPF, Interoperability testing, SDL based interoperability testing ofCSMA/CD and CSMA/CA protocol using Bridge, Scalabilitytesting

UNITVPROTOCOLSYNTHESISANDIMPLEMENTATION 9

Protocol synthesis, Interactive synthesis algorithm, Automatic synthesis algorithm, Automaticsynthesis of SDL from MSC, Protocol Re-synthesis; Requirements of protocol implementation,Object based approach to protocol implementation, Protocol compilers, Tool for protocolengineering

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Total:45Periods

COURSEOUTCOMES:

- Given the network and user requirements and the type of channel over which the network has to operate, the student would be in a position to apply his knowledge for identifying a suitable routing algorithm, implementing it and analyzing its performance.
- The student would also be able to design a new algorithm or modify an existing algorithm to satisfy the evolving demands in the network and by the user applications.

BOOKSFORREFERENCES:

1. PallapaVenkataramandSunilkumarS.Manvi,"CommunicationprotocolEngineering", EasternEconomy edition, 2004
2. Richard Lai and Jirachiefpattana, "Communication Protocol Specification and Verification", KluwerPublishers, Boston, 1998.
3. Tarnay,K.,"ProtocolSpecificationandTesting",Plenum,NewYork,1991.
4. MohamedG.Gouda,"Elements of NetworkProtocol Design",JohnWiley&Sons,Inc. New York,USA, 1998
5. V.Ahuja,"DesignandAnalysisofComputerCommunicationnetworks",McGraw-Hill, London,1982.
6. G.J.Holtzmann, "Design and validation of Computer protocols", Prentice Hall, New York, 1991.

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SEMESTERI

19271C15 ADVANCEDRADIATIONSYSTEMS LT PC
4004

AIM:

Toenhancethestudent'sknowledgeintheareaofvariousantennadesign.

OBJECTIVES:

- Tounderstandantennaradiationanditsparameters.
- Toenhancethestudent'sknowledgeintheareaofvariousantennadesign.
- To design monopole, dipole and patch antenna and to impart the knowledge about modern antennas.

UNITIANTENNA FUNDAMENTALS 9

Antenna fundamental parameters, Radiation integrals ,Radiation from surface and line currentdistributions – dipole, monopole, loop antenna; Mobile phone antenna- base station, handsetantenna; Image; Induction ,reciprocity theorem, Broadband antennas and matching techniques,Balance to unbalance transformer, Introduction to numerical techniques.

UNITIIRADIATIONFROMAPERTURES 9

Field equivalence principle, Radiation from Rectangular and Circular apertures, Uniformaperture distribution on an infinite ground plane; Slot antenna; Horn antenna; Reflector antenna,aperture blockage, and design consideration.

UNITIIIANTENNASYNTHESIS 9

Synthesis problem-Line source based beam synthesis methods (Fourier transform andWoodward-Lawson sampling method – Linear array shaped beam synthesis method – Low sidelobe, narrow main beam synthesis methods - discretization of continuous sources. Schelkunoffpolynomial method

UNITIVAPERTUREANTENNAS 9

Radiation from apertures - Huygens Principle. Rectangular apertures- techniques for evaluatinggain, Circular apertures and their design considerations- Babinets principle Fraunhofer andFresnel diffraction.Complimentary screens and slot antennas. Slot and dipoles as dual antennas.Fourier transform of aperture antenna theory.

UNITVHORN,MICROSTRIP,REFLECTORANTENNAS. 9

E and H plane sectoral Horns. Pyramidal horns. Conical and corrugated Horns. Multimodehorns. Phasecenter.Microstripantennas –feedingmethods. Rectangular patch- Transmissionlinemodel – Circular patch Parabolic Reflector antennas – Prime focus and cassegrain reflectors.Equivalent focal length of Cassegrain antennas. Spillover and taper efficiencies. Optimumillumination.

Total:45Periods

OUTCOMES:

- Abilitytounderstandantennaconcepts
- Abilitytodesignantennaforvarious applications

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- Knowledgeofmodernantennadesign

BOOKSFORREFERENCES:

1. Balanis,C.A.,“AntennaTheory” Wiley,2003
2. WarrenL. Stutzmanand GaryA. Thiele,“Antennatheoryand design”John Wileyand sons 1998
3. Jordan,E.C.,“ElectromagneticwavesandRadiatingsystems”.PHI2003
4. Krauss,J.D.,“RadioAstronomy”McGraw-Hill1966, forthelastunit(reprintsavailable)
5. Krauss,J.D.,,Fleisch,D.A.,“Electromagnetics”McGraw-Hill,1999

SEMESTERI

19271L17 COMMUNICATIONSYSTEMLAB-I

LTPC
0033

OBJECTIVES:

- ToacquireknowledgeonTransmissionlineandS-parameterestimationofmicrowave devices.
- TointroducethebasicsofMicrostripPatchAntennaandits analysis.
- Tostudy& measuretheperformanceofdigitalcommunicationsystems.
- ToprovideacomprehensiveknowledgeofWirelessCommunication.
- Tolearnaboutthedesignofdigitalfiltersanditsadaptivefiltering algorithms.

LISTOF EXPERIMENTS:

1. AntennaRadiationPatternmeasurement.
2. SimulationofModulationandCodinginaAWGNCommunicationChannelusingSimulation Packages.
3. Implementation ofAdaptiveFilters,periodgram andmultistagemultiratesystem inDSPProcessor
4. PerformanceevaluationofDigitalData TransmissionthroughFiberOptic Link.
5. StudyofSpreadSpectrumTechniques.
6. SimulationofQMFusing SimulationPackages.
7. ImplementationofVideoLink using OpticalFiber.
8. ImplementationofLinearandCyclic Codes.

TOTAL:45PERIODS

OUTCOMES:

Upon thecompletion ofcourse,studentsareableto

- Measureandanalyzevarioustransmissionlineparameters.
- DesignMicrostrippatchantennas.
- Implementtheadaptivefilteringalgorithms
- Togenerateanddetect digitalcommunicationsignalsofvariousmodulation techniques using MATLAB.

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LISTOF ELECTIVES

ELECTIVE–I(SEMESTERI)

ELECTIVE-I
SEMESTERI

19271E16A INTERNETWORKINGAND MULTIMEDIA LT PC
3003

AIM:

Theaimofthismoduleistoaddressthetechnicalissuesandthesolutionsforthe implementationofmultimediaservicesontheInternet.

OBJECTIVES:

- Recent advances in multimedia and networking technologies have made possible the evolution of the Internet from a text-based environment to a multimedia global communication network.
- The objective of this module is to address the technical issues and the solutions for the implementation of multimedia services on the Internet.
- Afterstudyingthis module, studentsareexpectedto beabletoappreciatethestate-of-the- art in Internet technologies for multimedia services.

UNITIMULTIMEDIA NETWORKING 9

Digital sound, video and graphics, basic multimedia networking, multimedia characteristics,evolution of Internet services model, network requirements for audio/ video transform,multimedia coding and compression for text, image, audio and video.

UNITIIBROADBANDNETWORKTECHNOLOGY 9

Broadband services, ATM and IP, IPV6, High speed switching, resource reservation, Buffermanagement, traffic shaping, caching, scheduling, and policing, throughput, delay and jitterperformance. Storage and media services, voice and video over IP, MPEG-2 over ATM/IP,indexing synchronization of requests, recording and remote control.

UNITIIIRELIABLETRANSPORTPROTOCOLANDAPPLICATIONS9

Multicast over shared media network, multicast routing and addressing, scaling multicast andNBMA networks, Reliable transport protocols, TCP adaptation algorithm, RTP, RTCP. MIME,Peer- to-Peer computing, shared application, video conferencing, centralized and distributedconference control,distributed virtual reality, lightweight session philosophy.

UNITIVMULTIMEDIACOMMUNICATIONSTANDARDS 9

Objective ofMPEG- 7 standard, Functionalities and systems ofMPEG-7, MPEG-21 MultimediaFramework Architecture, - Content representation, Content Management and usage, Intellectualproperty management, Audio visual system- H322: Guaranteed QOS LAN systems; MPEG_4video Transport across internet.

UNITVMULTIMEDIACOMMUNICATIONACROSSNETWORKS 9

PacketAudio/videointhenetworkenvironment,videotransportacrossGenericnetworks-Layeredvideocoding,errorResilientvideocodingtechniques,ScalableRatecontrol,Streaming

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videoacross Internet,Multimedia transportacross ATMnetworks and IP network,Multimediaacross wireless networks.

Total:45Periods

Outcomes

Uponcompletionofthesubject, studentswillbeableto:

- Understandthestate-of-artdevelopmentsinInternettechnologiesandapplications
- UnderstandthedevelopmentofnextgenerationInternet
- Appreciatetheprinciples usedindesigningInternet protocols for multimedia applications, andso understand why standard protocols are designed the way that they are
- Beabletosolveproblemsfor thedesignof multimediaapplicationsonInternet.

BOOKSFORREFERENCES:

1. Jon Crowcroft, Mark Handley, Ian Wakeman, Internetworking Multimedia, Harcourt Asia Pvt. Ltd.Singapore, 1998.
2. B.O.Szuprowicz,MultimediaNetworking,McGrawHill,Newyork. 1995.
3. TayVaughan,Multimedia -Makingittowork,4ed,TataMcGrawHill,NewDelhi, 2000.
4. K.R.Rao,Zoran S.BojkovicandDragorad A.Milovanovic,MultimediaCommunication systems, PHI ,

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ELECTIVE-I
SEMESTERI

19271E16B **DIGITALIMAGEPROCESSING** **L T PC**
3003

AIM:

Theaimofthiscourseistoexplainthefundamentalsofdigitalimageprocessing.

OBJECTIVES:

- Tounderstandtheimagefundamentals.
- Tounderstandthevariousimagesegmentationtechniques.
- Toextractfeaturesforimageanalysis.
- Tointroducetheconceptsofimageregistrationand imagefusion.

UNITIDIGITALIMAGEFUNDAMENTALS **9**

Elements of digital image processing systems - Elements of visual perception - Psycho visualmodel- Brightness - Contrast - Hue - Saturation - Mach band effect- Color image fundamentals– RGBHSI models - Image sampling - Quantization - Dither - Two-dimensional mathematicalpreliminaries.

UNITIIIMAGE TRANSFORMS **9**

1D DFT - 2Dtransforms - DFT - DCT - DiscreteSine - Walsh- Hadamard - Slant - Haar - KLTSVD - Wavelet Transform.

UNITIIIENHANCEMENTANDRESTORATION **9**

Histogram modification and specification techniques - Noise distributions - Spatial averaging - DirectionalSmoothing – Median- Geometric mean- Harmonic mean– Contra harmonic and Ypmean filters - Homomorphic filtering - Color image enhancement - Image Restoration – Degradation model - Unconstrained and Constrained restoration - Inverse filtering - Removal ofblur caused by uniform linear motion - Wiener filtering - Geometric transformations - Spatialtransformations -Gray Level interpolation.

UNITIVIMAGESEGMENTATIONAND RECOGNITION **9**

Edge detection - Image segmentation by region growing - Region splitting and merging – Edgelinking - Image Recognition - Patterns and pattern classes - Matching by minimum distanceclassifier - Matching by correlation - Back Propagation Neural Network - Neural Networkapplications in Image Processing.

UNITVIMAGECOMPRESSION **9**

Need for datacompression- Huffman- RunLengthEncoding - Shift codes- Arithmeticcoding - VectorQuantization-BlockTruncationCoding-TransformCoding-DCTandWavelet-JPEG -MPEG–Standards-ConceptsofContextbasedCompression.

Total:45Periods

OUTCOMES:

UponCompletionofthecourse, thestudentswillbeableto

- Explainthefundamentalsofdigitalimageprocessing.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

- Describeimagevarioussegmentationandfeatureextractiontechniquesforimageanalysis.
- Discusstheconceptsofimageregistrationandfusion.

BOOKSFORREFERENCES:

1. RafaelC.Gonzalez,RichardE.Woods,‘DigitalImageProcessing’,SecondEdition,PearsonEducation Inc., 2004.
2. AnilK.Jain,‘FundamentalsofDigitalImageProcessing’,PrenticeHallofIndia,2002.
3. David Salomon , “Data Compression The Complete Reference”, 2nd Edition, SpringerVerlag , New York Inc., 2001.
4. Rafael C.Gonzalez,Richard E.Woods, Steven Eddins,“Digital Image Processing using MATLAB”, Pearson Education, Inc., 2004.
5. WilliamK. Pratt,“DigitalImageProcessing”, JohnWiley,NewYork, 2002.
6. MilmanSonka,VaclavHlavac,RogerBoyle,“ImageProcessingAnalysisandMachine Vision”, 2nd edition, Brooks/Cole, Vikas Publishing House, 1999.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE-I
SEMESTERI

19271E16C **LASERCOMMUNICATION** **LT PC**
3003

AIM:
Theaimofthiscourseistogainknowledgeabout lightandits propagation

OBJECTIVES:
- Tostudythenonlinearopticdevices.
- To learnabouthholography.
- Tostudythedifferenttypesoflaser andits effects.

UNITI LASERCOMMUNICATIONS 9
Atmospheric low loss windows, opticalsources and detectors forthese windows, Characteristicsof source and detectors. Optical transmitting and receiving antennas.

UNITII SYSTEMDESIGN 9
Link equation, Transmitter terminal, Antenna design, Antenna gain, Beam width, C/N, Opticaldetectors, Optical modulation formats, Deriving error statistics, Signal requirements foracquisition and tracking, Fundamentals of system design.

UNITIIISEMICONDUCTORANDMETALLASERSOURCESFORSATELLITE COMMUNICATIONS 9
PerformanceandGeometries,outputwavelengthcontrol,Semiconductorlaserlifetime,Directand indirect modulation techniques and radiation effects.

UNITIVOPTICALRECEIVERSANDSYSTEMDESIGN 9
Direct detection, coherent detection and demodulation. Gimbals in transceiver design, Receiveroptions and optics; Lasers; antennas / Telescope, Internal optical systems, Transmitter analysis.

UNITVLASERBEAMPOINTINGCONTROL 9
Acquisition andTrackingsystems,System description,Acquisitionmethodology,rackingandpointing control system, RF cross link system design, link equation.

Total:45Periods

Outcomes:
Studentsareableto
- RecognizeandclassifythestructuresofOpticalfiberandtypes.
- Discussthechannelimpairmentslikelossesanddispersion.
- Analyzevariouscouplinglosses.
- ClassifytheOpticalsourcesanddetectorsandtodiscusstheirprinciple.
- FamiliarwithDesignconsiderationsoffiberopticsystems.
- Toperformcharacteristicsofopticalfiber,sourcesanddetectors,designaswellasconduct experiments in software and hardware, analyze the results to provide valid conclusions.

BOOKSFORREFERENCES:

1. MorrisKatzman,“LaserSatelliteCommunications”,PrenticeHallInc,NewYork, 1991.
2. J. FranzandV.K.Jain, “OpticalCommunicationSystems”, NarosaPublication, NewDelhi, 1994.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

SEMESTERII

19271C21 MOBILECOMMUNICATION NETWORKS LT PC 4004

AIM:

Theaimofthiscourseistoprovidethebasiccellular systemconcepts.

OBJECTIVES:

- Tounderstandthebasiccellularsystemconcepts.
- Tohaveaninsightintothevariouspropagationmodelsandthespeechcodersusedin mobile communication.
- Tounderstandthemultipleaccesstechniquesandinterferenceeducation techniquesin mobile communication

UNITIWIRELESSCHANNELPROPAGATION ANDMODEL 9

PropagationofEM signals inwirelesschannel–Reflection, diffractionandScattering-Small scale fading-channel classification-channel models–COST-231 Hata model, Longley-Rice Model,NLOSMultipathFadingModels:Rayleigh,Rician,Nakagami,CompositeFading–shadowingDistributions,Linkpowerbudget Analysis

UNITIIOPERATIONANDPROPAGATIONMODELSANDAIRPROTOCOLS9

Operation of first, second, and third generation wireless networks: cellular systems, mediumaccess techniques, Mobile networks Elementary Principles of cellular Telephony ChannelDivision Techniques(TDMA, FDMA, CDMA) Cellular Coverage Methods Network Planningand Resource Allocation,Network Dimensioning ,Mobility Management Procedures

UNITIIIMOBILENETWORKARCHITECTURE 9

GeneralArchitecturedefinition,MobileTerminals(MT,SIM)
RadioSection(BTS, BSC)CoreNetwork(MSC,G-MSC, VLR,HLR,AuC)
User and ControlPlane ProtocolStack, MAP &SS#7, The KeyRole ofSignaling Interfaces andNetworkEntities Relation The Physical Channel, The Logical Channels Terminal, Call andNetwork ManagementProcedures, Network Planning.

UNITIVWIRELESSLOCALAREA NETWORKS 9

Wireless Local Area Networks , General Characteristics of the Hiperlan System, 802.11Standard, BasicDCF access schemeDCF Access Scheme with Handshaking, PCF AccessScheme, The 802.11a Standard, Mobile Ad HocNetworks, Wireless Sensor Networks, RoutingEnergy Efficiency, Localization, Clustering.

UNITVSECURITYISSUESINWIRELESSNETWORKS 9

Security in Wireless Networks, Secure routing, Key Pre-distribution and Management,Encryption andAuthentication, Security in Group Communication, Trust Establishment andManagement, Denial ofService Attacks, Energy-aware security mechanisms, Locationverification, Security on Data fusion.

Total:45Periods

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

Outcomes:

- Discusscellularradio concepts.
- Identifyvariouspropagationeffects.
- Tohaveknowledgeofthemobilesystemspecifications.
- Classifymultipleaccesstechniquesinmobilecommunication.
- Outlinecellular mobilecommunicationstandards.
- Analyzevariousmethodologiesto improvethecellular capacity

BOOKSFORREFERENCES:

1. W.Stallings,"WirelessCommunicationsandNetworks",SecondEditionPrenticeHall, 2007.
2. V.K.Garg,"IS-95CDMAandCDMA2000",PrenticeHallPTR,2000.
3. T.S.Rappaport,"WirelessCommunications:Principles&Practice",SecondEdition, Prentice Hall,2002.
4. Leon-GarciaandI.Widjaja,"CommunicationNetworks,FundamentalConceptsand KeyArchitectures", McGraw-Hill, 2000.
5. J.Schiller,"MobileCommunications",AddisonWesley,2000.
6. FredHalsall,"MultimediaCommunications,Applications,Networks,Protocolsand Standards",Addison Wesley, 2001.
7. UylessBlack,"MobileandWirelessNetworks",PrenticeHallPTR, 1996.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

SEMESTERII

19271C22 ADVANCEDMICROWAVE SYSTEMS LTPC 4004

AIM:

Theaimofthiscourseistoexplainfundamentalsofmicrowaveintegrated circuits.

OBJECTIVES:

- Tounderstandthefundamentalsof Microwaveintegrated circuits.
- Tounderstandthevariouscomponentsfor WirelessCommunications.
- Toknowthebasictechniques neededforanalysis ofMicrowave systems.

UNITIINTRODUCTIONTOMONOLITHICMICROWAVE INTEGRATED CIRCUITS 9

Introduction to Monolithic Microwave Integrated Circuits (MMICs), their advantages overdiscrete circuits, materials, MMIC fabrication techniques, MOSFET fabrication. Thin filmformation.

UNITIIMICROSTRIPANALYSIS 9

Planar transmission lines for MICs. Methodofconformaltransformation for microstrip analysis,concept of effective dielectric constant, Effective dielectric constant for microstrip, Losses inMicrostrip

UNITIIISLOTLINE ANALYSIS 9

SlotLineApproximateanalysisandfielddistribution,Transverseresonancemethodandevaluation of slot line impedance, comparison with micro strip line.

UNITIVLUMPEDELEMENTSFORMICS 9

Lumped Elements for MICs: Use ofLumped Elements, Capacitive elements, Inductive elementsand Resistive elements.

UNITVMICROWAVESEMICONDUCTORDEVICES& MICROWAVE PASSIVE COMPONENTS 9

Microwave semiconductor Devices & Microwave passive components Parametric amplifiers,tunnel diode, varactor diode, PIN diode, Gunn diode, their principle of operation, performancecharacteristics & applications, scattering parameter calculations of E plane-Tee, Magic Tee,Directional Coupler.

Total:45Periods

OUTCOMES:

- CapabilitytodesignMicrowavecircuits.
- Tobeabletoanalyzemicrowaveintegratedcircuits.

REFERENCES:

1. Gupta,K.C, and Amarjitsingh"Microwave IntegratedCircuits"John Wileyand sons – Wiley EasternReprint, 1978.
2. Hoffmann,R.K"HandbookofMicrowaveIntegratedCircuits"ArtechHouse,1987.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

SEMESTERII

19271C23 FIBEROPTICNETWORKING LTPC 4004

AIM:

Theaimofthe course istodesignandanalyze networkcomponents.

OBJECTIVES:

Thestudentsshould bemadetounderstand:

- Opticalsystemcomponentslikeopticalamplifiers,wavelengthconverters.
- Up-to-datesurveyofdevelopmentinOpticalNetworkArchitectures.
- Packetswitching.
- Networkdesignperspectives.
- DifferentOpticalNetworkmanagementtechniquesandfunctions.

UNITI OPTICALFIBERCOMMUNICATIONANDTRANSMISSION CHARACTERISTICS 9

Introduction, Historical development, general system, advantages, disadvantages, andapplications of optical fiber communication, optical fiber waveguides, Ray theory, cylindricalfibersingle mode fiber, cutoff wavelength, mode field diameter. Optical Fibers: fiber materials,photonic crystal, fiber optic cables specialty fibers.

Attenuation, absorption, scattering losses, bending loss, dispersion, Intra modaldispersion, Intermodal dispersion.

UNITII OPTICALSOURCESANDDETECTORS,OPTICALAMPLIFIERSAND NETWORKS 9

Introduction, LED’s, LASER diodes, Photo detectors, Photo detector noise, Response time,double hetero junction structure, Photo diodes, comparison of photo detectors.

Optical amplifiers, basic applications and types, semiconductor optical amplifiers, EDFA.Optical Networks: Introduction, SONET / SDH, Optical Interfaces, SONET/SDH rings, High –speed light – waveguides.

UNITIII FIBERCOUPLERSANDCONNECTORSANDANALOGAND DIGITAL LINKS 9

Introduction, fiber alignment and joint loss, single mode fiber joints, fiber splices, fiberconnectors and fiber couplers.

Analog links – Introduction, overview of analog links, CNR, multichannel transmissiontechniques, RF over fiber, key link parameters, Radio over fiber links, microwave photonics.Digital links – Introduction, point–to–point links, System considerations, link power budget,resistive budget, short wavelength band, transmission distance for single mode fibers, Powerpenalties, nodal noise and chirping.

UNITIV OPTICALRECEIVER 9

Introduction,OpticalReceiverOperation,receiversensitivity,quantumlimit,eyediagrams,coherent detection, burst mode receiver operation, Analog receivers.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

UNITV WDMCONCEPTSANDCOMPONENTS 9

WDM concepts, overview of WDM operation principles, WDM standards, Mach-Zehenderinterferometer, multiplexer, Isolators and circulators, direct thin film filters, active opticalcomponents, MEMS technology, variable optical attenuators, tunable optical fibers, dynamicgain equalizers, optical drop multiplexers, polarization controllers, chromatic dispersioncompensators, tunable light sources.

Total:45Periods

OUTCOMES:

Attheendofthecourse,thestudentshouldbeableto:

- DesignandAnalyzeNetworkComponents
- AssessandEvaluateoptical networks

BOOKSFORREFERENCES:

1. RajivRamaswamiandKumarSivarajan,OpticalNetworks:Apracticalperspective, MorganKaufmann, 2nd edition, 2001.
2. VivekAlwayn,OpticalNetworkDesignandImplementation,PearsonEducation, 2004.
3. HusseinT.MouftabandPin-HanHo,OpticalNetworks:ArchitectureandSurvivability, Kluwer Academic Publishers, 2002.
4. BiswanathMukherjee, OpticalCommunicationNetworks,McGrawHill, 1997

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

LISTOF ELECTIVES

ELECTIVE–II(SEMESTERII)

ELECTIVE-II
SEMESTERII

19271E24A HIGHSPEEDSWITCHINGARCHITECTURE LT PC
3003

AIM:

Toexposethestudentto theadvancesin packetswitchingarchitecturesand IP addressing andswitchingsolutionsandapproachestoexploitandintegratethebestfeaturesofdifferent architectures for high speed switching.

OBJECTIVES:

- Toenablethestudenttounderstandthebasicsofswitchingtechnologiesandtheir implementation LANs, ATM networks and IP networks.
- To enable the student to understand the different switching architectures and queuing strategies and their impact on the blocking performances.

UNITIHIGHSPEED NETWORK 9

LANandWANnetworkevolutionthroughISDNtoBISDN-TransfermodeandcontrolofBISDN -SDH multiplexing structure - ATM standard; ATM adaptation layers.

UNITIILANSWITCHINGTECHNOLOGY 9

Switchingconcepts;Switchforwardingtechniques;switchpathcontrol-LANswitching;cutthrough forwarding; store and forward - virtual LANs.

UNITIIIATMSWITCHING ARCHITECTURE 9

Switch models - Blocking networks – basic and enhanced banyan networks - sorting networks – merge sorting – rearrangeable networks - full and partial connection networks – non-blockingnetworks –recursive network – construction and comparison of non-blocking network - switcheswith deflection routing – shuffle switch - tandem banyan.

UNITIVMULTIMEDIACOMMUNICATIONSTANDARDS 9

Objective ofMPEG- 7 standard, Functionalities and systems ofMPEG-7, MPEG-21 MultimediaFramework Architecture, - Content representation, Content Management and usage, Intellectualproperty management, Audio visual system- H322: Guaranteed QOS LAN systems; MPEG_4video Transport across internet.

UNITVIPSWITCHING 9

Addressing mode -IPswitching types-flow driven andtopologydrivensolutions -IPOver ATMaddress and next hop resolution – multicasting - IPv6 over ATM.

Total:45Periods

OUTCOMES:

- Thestudentwouldbeabletoidentifysuitableswitcharchitecturesforaspecifiednetworking scenario and demonstrate its blocking performance.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

- The student would be in a position to apply his knowledge of switching technologies,architectures and buffering strategies for designing high speed communication networks and analyse their performance

BOOKSFORREFERENCES:

1. AchillePatavina,SwitchingTheory:ArchitecturesandperformanceinBroadbandATM Networks.John Wiley & Sons Ltd., New York.1998.
2. ChristopherYMetz,Switchingprotocols&Architectures.McGrawHill,NewYork.1998.
3. RanierHandel,ManfredNHuber,Stefan Schrodder.ATMNetworks-concepts,protocols, applications,3rd Edition, Adisson Wesley, New York,1999.
4. JohnA.Chiong:InternetworkingATMfortheinternetandenterprisenetworks.McGraw Hill, NewYork, 1998.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE-II
SEMESTERII

19271E24B DSPPROCESSORARCHITECTUREAND PROGRAMMING

L T PC
3003

AIM:

Theaimofthiscourseistoprovidein-depthknowledgeondigitalsignalprocessor basics.

OBJECTIVES:

Theobjectiveofthiscourseistoprovidein-depthknowledgeon

- DigitalSignalProcessorbasics
- ThirdgenerationDSPArchitectureandprogrammingskills
- AdvancedDSParchitecturesandsomeapplications.

UNITIFUNDAMENTALSOFPROGRAMMABLEDSPs 9

Multiplier and Multiplier accumulator (MAC) – Modified Bus Structures and Memoryaccess inProgrammable DSPs – Multiple access memory – Multi-port memory – VLIW architecture-Pipelining –Special Addressing modes in P-DSPs – On chip Peripherals.

UNITIITMS320C3XPROCESSOR 9

Architecture–Dataformats-Addressingmodes–Groupsofaddressingmodes-Instructionsets -Operation – Block Diagram of DSP starter kit – Application Programs for processing real time signals –Generating and finding the sum of series, Convolution of two sequences, Filter design

UNITIIIADSPPROCESSORSI 9

Architecture of ADSP-21XXandADSP-210XXseriesof DSPprocessors-Addressingmodesand assembly language instructions – Application programs –Filter design, FFT calculation.

UNITIVADVANCEDPROCESSORS 9

Architectureof TMS320C54X:Pipelineoperation,Addressingmodesandassemblylanguageinstructions Introduction to Code Composer studio

UNITVADVANCEDPROCESSORSII 9

ArchitectureofTMS320C6X-ArchitectureofMotorolaDSP563XX–Comparisonofthefeatures of DSP family processors.

Total:45Periods

OUTCOMES:

Studentsshouldbeableto:

- BecomeDigitalSignalProcessorspecializedengineer
- DSPbasedSystemDeveloper

BOOKSFORREFERENCES:

1. B.Venkataramani and M.Bhaskar, “Digital Signal Processors – Architecture, Programming andApplications” – Tata McGraw – Hill Publishing Company Limited. New Delhi, 2003.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

2. UserguidesTexasInstrumentation,AnalogDevices,Motorola.

ELECTIVE-II
SEMESTERII

19271E24C DIGITALSPEECHPROCESSING LT PC
3003

AIM:

Toillustratethe conceptsofspeechsignalrepresentations andcoding.

OBJECTIVES:

- Tointroduce speechproductionandrelatedparametersofspeech.
- Tounderstanddifferentspeechmodelingproceduressuch asMarkov andtheir implementation issues.
- Togainknowledgeabouttext analysisand speechsynthesis.

UNITIMECHANICS OFSPEECH 9

Speech production mechanism – Nature of Speech signal – Discrete time modelling of Speechproduction – Representation of Speech signals – Classification of Speech sounds – Phones –Phonemes – Phonetic and Phonemic alphabets – Articulatory features.
Music production – Auditory perception – Anatomical pathways from the ear to the perceptionof sound – Peripheral auditory system – Psycho acoustics

UNITIITIMEDOMAINMETHODSFORSPEECHPROCESSING 9

Time domain parameters of Speech signal – Methods for extracting the parameters Energy, Average Magnitude – Zero crossing Rate – Silence Discrimination using ZCR and energy – ShortTime AutoCorrelationFunction–PitchperiodestimationusingAuto CorrelationFunction

UNITIIIFREQUENCYDOMAINMETHODFORSPEECHPROCESSING 9

Short Time Fourier analysis – Filter bank analysis – Formant extraction – Pitch Extraction – Analysis by Synthesis- Analysis synthesis systems- Phase vocoder—Channel Vocoder. Homomorphic speech analysis: Cepstral analysis of Speech – Formant and Pitch Estimation –

UNITIVLINEARPREDICTIVEANALYSISOFSPEECH 9

Formulation of Linear Prediction problem in Time Domain – Basic Principle – Auto correlationmethod– Solution of LPC equations — Durbin's Recursive algorithm – lattice formation andsolutions – Comparison of different methods — Formant analysis – VELP – CELP.

UNITV APPLICATIONOFSPEECH&AUDIOSIGNALPROCESSING 9

Algorithms: SpectralEstimation, dynamic time warping, hiddenMarkovmodel – Music analysis– Pitch Detection – Feature analysis for recognition – Music synthesis – Automatic SpeechRecognition – Feature Extraction for ASR — ASR systems– Voice response system – SpeechSynthesis: Text to speech, voice over IP.

Total:45Periods

OUTCOMES:

Studentswillbeableto:

- Modelspeechproductionsystemanddescribethefundamentalsof speech.
- Extractandcomparedifferentspeechparameters.

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

- Chooseanappropriatestatisticalspeechmodelforagivenapplication.
- Designaspeechrecognitionsystem.
- Usedifferenttextanalysisandspeechsynthesistechniques.

BOOKSFORREFERENCES:

1. Ben Gold and Nelson Morgan, Speech and Audio SignalProcessing, John Wileyand Sons Inc. , Singapore,2004
2. L.R.RabinerandR.W.Schaffer–DigitalProcessingofSpeechsignals–PrenticeHall- 1978
3. Quatieri– Discrete-timeSpeechSignalProcessing–PrenticeHall– 2001.
4. J.L.Flanagan–Speechanalysis:SynthesisandPerception –2ndedition–Berlin–1972
5. I.H.Witten–PrinciplesofComputerSpeech– AcademicPress– 1982

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

LISTOF ELECTIVES

ELECTIVE–III(SEMESTERII)

ELECTIVE-III
SEMESTERII

19271E25A	**DIGITALCOMMUNICATIONRECEIVERS**	**LT PC** **3003**

AIM:

Theaimofthiscourseistounderstandthebasicprinciplesofdigitalcommunication techniques.

OBJECTIVES:

- Tounderstandthebasicprinciplesofdigitalcommunicationtechniques.
- Togainknowledgeaboutreceivers forAWGNchannelandFadingchannels.
- Tounderstandtheconceptsofsynchronizationandadaptiveequalizationtechniques.

UNITIREVIEW OFDIGITALCOMMUNICATION TECHNIQUES 9

Basebandandbandpasscommunication,signalspacerepresentation,linearandnon-linearmodulation techniques, and spectral characteristics of digital modulation.

UNITIIOPTIMUMRECEIVERSFORAWGNCHANNEL 9

Correlation demodulator, matched filter, maximum likelihood sequence detector, Optimumreceiver for CPM signals, M-aryorthogonalsignals, envelope detectors for M-aryand correlatedbinary signals.

UNITIIIRECEIVERSFORFADINGCHANNELS 9

Characterizationof fading multiple channels, statisticalmodels, slow fading, frequencyselectivefading, diversity technique, RAKE demodulator, coded waveform for fading channel

UNITIVSYNCHRONIZATIONTECHNIQUES 9

Carrier and symbol synchronization, carrier phase estimation – PLL, Decision directed loops,symbol timing estimation, maximum likelihood and non-decision directed timing estimation,joint estimation.

UNITVADAPTIVEEQUALIZATION 9

Zero forcing algorithm, LMS algorithm, Adaptive decision – feedback equalizer, andequalizationofTrellis-codedsignals, Kalmanalgorithm, blindequalizers, andstochasticgradientalgorithm, Echo cancellation

Total:45Periods

OUTCOMES:

UponCompletionofthecourse, thestudentswillbeableto

- Applybasicprinciples ofdigitalcommunicationtechniques.
- DiscussonreceiversforAWGN&Fadingchannel
- Describevarioussynchronizationtechniques.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

- Designadaptiveequalizationalgorithmstosatisfytheevolvingdemandsindigitalcommunication.

BOOKSFOR REFERENCES:

1. HeinrichMeyer,MareMoeneclacyandStefan.A.Fechtel,“DigitalCommunication Receivers”, VolI&II, John Wiley, New York, 1997
2. John.G.Proakis, “DigitalCommunication”,4thed.,McGrawHill,NewYork, 2001
3. E.A.LeeandD.G.Messerschmitt,“DigitalCommunication”,2ndedition,AlliedPublishers, NewDelhi, 1994
4. SimonMarvin,“DigitalCommunicationOverFadingchannel;Anunifiedapproachto performanceAnalysis”, John Wiley, New York, 2000
5. BernardSklar,“DigitalCommunicationFundamentalsandApplications,PrenticeHall, 1998

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE-III
SEMESTERII

19271E25B **SOFTCOMPUTING** **LT PC**
3003

AIM:

Theaimofthiscourse istoknowthe basicsofartificialneuralnetworks.

OBJECTIVES:

- Toprovideadequateknowledgeaboutfeedforward/feedbackneural networks
- Toapplytheconceptoffuzzylogicinvarioussystems.
- Tohavetheideaaboutgeneticalgorithms.
- ToprovideadequateknowledgeabouttheapplicationsofSoftComputing.

UNITIARTIFICIALNEURAL NETWORKS 9

Basicconcepts-single layerperceptron-Multilayer perceptron-Adaline-Madaline-Learningrules-Supervised learning-Back propagation networks-Training algorithm, Practical difficulties, Advanced Algorithms-Adaptive network- Radial basis network-modular network-Applications

UNITIIUNSUPERVISED NETWORKS 9

Introduction- unsupervised learning -Competitive learning networks-Kohonen self organisingnetworks-Learning vector quantisation - Hebbian learning - Hopfield network-Contentaddressable nature, Binary Hopfield network, Continuous Hopfield network TravelingSalesperson problem - Adaptive resonance theory –Bidirectional Associative Memory-Principlecomponent Analysis

UNITIIIFUZZYSYSTEMS 9

Fuzzy sets-Fuzzy rules: Extension principle, Fuzzy relation- fuzzy reasoning – fuzzy inferencesystems:Mamdani model, Sugeno model. Tsukamoto model -Fuzzy decision making-Multiobjective Decision Making,-Fuzzy classification-Fuzzy control methods -Application

UNITIVNEURO-FUZZYMODELLING 9

Adaptive Neuro Fuzzy based inference systems – classification and regression trees: decisiontress, Cart algorithm – Data clustering algorithms: K means clustering, Fuzzy C meansclustering, Mountain clustering, Subtractive clustering – rule base structure identification – Neuro fuzzy control: Feedback Control Systems, Expert Control, Inverse Learning, SpecializedLearning, Back propagation through Real –Time Recurrent Learning.

UNITVGENETIC ALGORITHM 9

Fundamentals of genetic algorithm-Mathematical foundations-Genetic modeling-Survival of thefittest crossover-Inversion and Deletion-mutation-reproduction-Generational cycle-rank method-rank space method- Other derivative free optimization-simulated annealing, Random search,Downhill simplex search-Application

Total:45Periods

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

OUTCOMES:

- Knowledgeonconceptsofsoftcomputationaltechniques.
- Abletoapplysoftcomputationaltechniquestosolvevariousproblems.
- Motivatetosolveresearchoriented problems.

BOOKSFORREFERENCES:

1. JangJ.S.R.,SunC.TandMizutaniE–“NeuroFuzzyandSoftcomputing”,Pearson education(Singapore) 2004
2. DavidE.Goldberg: “Genetic Algorithms inSearch, Optimization, andMachine Learning”, PearsonEducation, Asia,1996
3. LaureneFauseett:”Fundamentals of Neural Networks”, Prentice Hall India, New Delhi,1994.
4. TimothyJ.Ross:”FuzzyLogicEngineeringApplications”,McGrawHill,ewYork,1997.
5. S.RajasekaranandG.A.VijayalakshmiPai“Neuralnetworks,Fuzzylogics,andGenetic algorithms”,Prentice Hall of India,2003
6. GeorgeJ.KlirandBoYuan,”FuzzySetsandFuzzyLogic”,PrenticeHallInc.,New Jersey,1995.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE-III
SEMESTERII

19271E25C COMMUNICATIONNETWORKSECURITY LTPC
3003

AIM:

Theaimofthiscourseistounderstandtheneedand conceptofsecurity.

OBJECTIVES:

Thestudentsshouldbemadeto:

- Understandtheneedandconceptofsecurity
- Learn cryptosystems

UNITISYMMETRIC CIPHERS 9

Introduction – Services, Mechanisms and Attacks, OSI securityArchitecture, Modelfor networkSecurity; Classical Encryption Techniques- Symmetric Cipher Model, Substitution Techniques,Transposition Techniques, Product ciphers , DataEncryption Standard- Block Cipher Principles,Strength of DES,Differential and Linear CryptAnalysis, Block Cipher Design Principles, BlockCipher Modes of operation, Stegnography.

UNITIIADVANCEDENCRYPTIONSTANDARDANDSTREAMCIPHERS9

Evaluation Criteria for AES, AES Cipher; Contemporary Symmetric Ciphers- Triple DES,Blowfish, RC5-Characteristics of Advanced Symmetric Block Ciphers, Streamciphers based onLFSRs,RC4 Stream Cipher; Random Number Generation. Traffic Confidentiality, KeyDistribution.

UNITIIIPUBLIC-KEYENCRYPTION ANDHASH FUNCTIONS 9

Public Key Cryptography and Key Management- RSA Algorithm and other public keycryptosystems-,Diffie-Hellman Key Exchange, Elliptic Curve arithmetic, Elliptic CurveCryptography; Message Authentication and Hash Functions- Authentication Requirements, -MD5 Message Digest Algorithm; Secure Hash Algorithm, RIPEMD 160, HMAC; DigitalSignatures and Authentication Protocols- Digital Signature Standards.

UNITIVNETWORKSECURITYPRACTICE 9

Authentication Applications- Kerberos, X.509 Authentication Service; Electronic MailSecurity- Pretty Good Privacy, S/MIME; IP Security- overview and Architecture, Authentication Header,Encapsulating SecurityPayload, Combining Security Associations; Web Security- Web SecurityConsiderations, Secure Sockets Layer and Transport Layer Security, Secure ElectronicTransaction.

UNITVSYSTEMSECURITY 9

Intruders-IntruderDetection,PasswordManagement;MaliciousSoftware-VirusandRelatedThreats, Virus Countermeasures; Firewalls- Firewall Design Principles, Trusted Systems.

Total:45Periods

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

OUTCOMES:

Attheendofthiscourse, thestudentsshouldbeableto:

- Explaindigitalsignaturestandards
- Discussauthentication
- Explainsecurityatdifferent layers

BOOKSFORREFERENCES:

1. WilliamStallings,“CryptographyandNetworkSecurity”,3rdEdition.PrenticeHallof India, New Delhi,2004
2. WilliamStallings, “Network SecurityEssentials”, 2nd Edition. Prentice HallofIndia, New Delhi, 2004
3. CharlieKaufman,“NetworkSecurity:PrivateCommunicationinPublicWorld”,2nd Edition. PrenticeHall of India, New Delhi ,2004

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

SEMESTERII

19271L26 COMMUNICATIONSYSTEMSLAB-II LT PC 0033

OBJECTIVES:

- To enable the students to verify the basic principles and design aspects involved in high frequency communication systems components
- To expose the student to different high frequency components and conduct the experiments to analyze and interpret data to produce meaningful conclusions and match with theoretical concepts.
- TodesignanddevelopRFcomponentsusingmicrostrip technology

LISTOF EXPERIMENTS:

1. SimulationofAudioandspeechcompressionalgorithms
2. SimulationofEZW/SPIHTImagecoding algorithm.
3. SimulationofMicrostripAntennas
4. S-parameterestimationofMicrowavedevices.
5. StudyofGlobalPositioningSystem.
6. PerformanceevaluationofsimulatedCDMASystem.
7. DesignandtestingofaMicrostripcoupler.
8. Characteristicsofλ/4andλ/2transmissionlines.

TOTAL:45PERIODS

OUTCOMES:

UponCompletionofthecourse, thestudentswillbeableto:

- Applyknowledgetoidentifyasuitablearchitectureandsystematicallydesignan RFsystem.
- Comprehensivelyrecord and report the measured data, and would be capable ofanalyzing, interpreting the experimentally measured data and producing meaningful conclusions.
- Designanddevelopmicrostrip filters.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

SEMESTERII

19271CRM **RESEARCHMETHODOLOGY** **LT PC**
3003

AIM:

Togiveanexposuretodevelopmentofresearchquestionsandthevariousstatistical methodssuitabletoaddressthemthroughavailableliterature,withbasiccomputational operators.

OBJECTIVES:

- Tounderstand theapproachestowardsandconstraintsingoodresearch.
- Toidentifyvariousstatisticaltoolsusedinresearch methodology
- Toappreciateandcomposethemanuscriptforpublication
- Totraininbasiccomputationalandexcel-skillsforresearchinengineering.

OUTCOME:

Ability todevelopresearchquestionsandthevariousresearchstrategies,andcompile research results in terms of journal manuscripts.

PREREQUISITES:

ResearchMethodologycourseinUGlevelorequivalentknowledge.

UNITI

Introduction to Research — Criteria of Good Research,Research Problem:Definition ofresearch problem, selecting the problem - Necessity of defining the problem - Techniquesinvolved in defining the problem-Basic principles of experimental designs-Descriptive andexperimentaldesign– different typesofexperimentaldesign – Validityoffindings – internalandexternal validity – Variables in Research – Measurement and Scaling – Different scales. Ethics& Misconduct in research, Plagiarism

UNITII

Formulation of Hypothesis – Sampling techniques –Sampling error and sample size-Methods ofdata collection – Primary and secondary data – observation – Collection of literature, manualcollection from library, usage of library, collection of literature fromScopus, ScienceDirect etc.,compiling literature, software utilization in literature collection- Processing and analysis of data– editing – coding – transcription – tabulation –outline of statistical analysis.

UNITIII

Data Analysis using Excel- Tabulation of Data in excel (Creating Master Table and Sub Table),Formulas and Functions, Filters and Sort and ValidationLists, Data fromExternalSources. DataAnalysis Using Charts and Graphs(Pivot Table & Charts), Time Value of Money, Measure ofcentral tendency: mean, median, mode, Measure of dispersion: variance, standard deviation,Coefficient of variation. Correlation, regression lines. Z-test, t- test F-test, ANOVA one wayclassification, Chi square test, independence of attributes. Time series: forecasting Method ofleast squares, Moving average method, Introduction to presentation tool, features and functions,Creating Presentation, Customizing presentation.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

UNITIV
Various research methods-Design of Experiments, Response Surface Methodology, Taguchi Methods- Modeling & Simulation of Engineering Systems, ArtificialNeuralNetworks,FuzzyLogic,MATLAB-GraphTheory-FiniteElementMethods, ComputationalFluidDynamics-RprogramminginStatistics-opensourcesoftware

UNITV
Review of literature, Report writing – target audience – types of reports – contents of reports – styles and Conventions in reporting – steps in drafting a report. Basic concept of research paperwriting for Journals and formats of publications in Journals, Report Structure - writing researchabstract - introduction, review of literature, result, conclusions, Concepts of Bibliography andreferences

OUTCOMES:
UponCompletionofthecourse, thestudentswillbeableto:

- Understandtheapproachestowardsandconstraintsin goodresearch.
- Identifyvariousstatisticaltoolsusedinresearch methodology
- Traininbasiccomputationalandexcel- skills forresearchinengineering.

References:

1. C.R.Kothari,ResearchMethodology, NewAgeInternationalPublishers.NewDelhi, 2004.
2. Rajammal.P.Devadas,1976,Ahandbookofmethodologyofresearch,RMMVidyalaya Press.
3. R.ADayandA.L. Underwood,Quantitativeanalysis, PrenticeHall, 1999.
4. R.Gopalan, Thesiswriting, VijayNicoleImprintsPrivateLtd.,2005.
5. W.J.DeCoursey,StatisticsandProbabilityforEngineeringApplicationsWith Microsoft® Excel, Newnes, 2003.
6. ArchibaldFripp,JonFripp,MichaelFripp; Just-in-TimeMathforEngineers,Elsevier Science & Technology Books, 2003.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

SEMESTERIII

19271C31 WIRELESSSENSOR NETWORKS LT PC
4004

AIM:

Theaimofthiscourseistostudyaboutwireless IParchitecture,PacketDataProtocol and LTEnetworkarchitecture.

OBJECTIVES:

- To study about advanced wireless networks, LTE, 4G and Evolutions from LTE to LTE.
- Tostudyaboutadaptivelinklayer, hybridARQandgraphrouting protocol.
- Tostudyaboutmobilitymanagement,cellularnetwork,andmicrocellular networks

UNITI OVERVIEWOFWIRELESSSENSOR NETWORKS 8

ChallengesforWirelessSensorNetworks,EnablingTechnologiesForWirelessSensorNetworks.

UNITII ARCHITECTURES 9

Single-Node Architecture - Hardware Components, Energy Consumption of SensorNodes ,Operating Systems and Execution Environments, Network Architecture -Sensor NetworkScenarios, Optimization Goals and Figures of Merit, GatewayConcepts.

UNITIII NETWORKINGSENSORS 10

Physical Layer and Transceiver Design Considerations, MAC Protocols for WirelessSensorNetworks, Low Duty Cycle Protocols and Wake Up Concepts - S-MAC , TheMediation DeviceProtocol, Wake Up Radio Concepts, Address and Name Management,Assignment of MACAddresses, Routing Protocols- Energy-Efficient Routing,Geographic Routing.

UNITIV INFRASTRUCTUREESTABLISHMENT 9

TopologyControl,Clustering,TimeSynchronization,LocalizationandPositioning,SensorTasking and Control.

UNITVSENSORNETWORKARCHITECTUREANDMACPROTOCOLS9

Single node architecture – Hardware components, energyconsumptionofsensornodes, Networkarchitecture – Sensor network scenarios, types ofsources and sinks, single hop versus multi-hopnetworks, multiple sinks and sources, design principles, Development of wireless sensornetworks. , physical layer and transceiver design consideration in wireless sensor networks,Energy usage profile, choice of modulation, Power Management - MAC protocols – fundamentals of wireless MAC protocols, low duty cycle protocols and wakeup concepts,contention-based protocols, Schedule-based protocols - SMAC, BMAC, Traffic-adaptivemediumaccess protocol(TRAMA), Link Layer protocols – fundamentals task and requirements,error control, framing, link management.

TOTAL- 45PERIODS

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

OUTCOMES:

- Familiarwiththelatest4GnetworksandLTE
- UnderstandaboutthewirelessIParchitectureandLTEnetworkarchitecture.
- Familiarwiththeadaptivelinklayerandnetworklayergraphsand protocol.
- Understandaboutthemobilitymanagementandcellular network.
- Understandaboutthewirelesssensornetworkarchitectureanditsconcept.

BOOKSFORREFERENCES:

1. HolgerKarl&AndreasWillig,"ProtocolsAndArchitecturesforWirelessSensor Networks" , John Wiley, 2005.
2. Feng Zhao &LeonidasJ. Guibas, "WirelessSensor Networks- AnInformation Processing Approach", Elsevier, 2007.
3. KazemSohraby, Daniel Minoli, &TaiebZnati, "Wireless Sensor Networks- Technology, Protocols, And Applications", John Wiley, 2007.
4. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

LISTOF ELECTIVES

ELECTIVE–IV(SEMESTERIII)

ELECTIVE-IV
SEMESTERIII

19271E32A SOFTWAREDEFINEDRADIO LT PC
3003

AIM:

Theaimofthiscourseistounderstandthe conceptsofsoftwaredefinedradio.

OBJECTIVES:

Thestudentsshould bemadeto be

- Understandtheconceptsofsoftwaredefined radio
- Learnspectrumsensinganddynamic spectrumaccess

UNITI: IntroductiontoSDR 9

The Need for Software Radios-Characteristics and Benefits of a Software Radio. DesignPrinciples of a Software Radio.Radio frequency implementation issues-The Purpose of the RFFront-End. Dynamic Range: The Principal Challenge of Receiver Design. RF Receiver Front-End Topologies. Enhanced Flexibility of the RF Chain with Software Radios. Importance of theComponents -Transmitter Architectures and their Issues. Noise and Distortion in the RF Chain.ADC and DAC Distortion.

UNITII:DirectDigitalSynthesis 9

Introduction. Comparison ofDirect DigitalSynthesis with Analog SignalSynthesis. Approachesto Direct Digital Synthesis. Analysis of Spurious Signals. Spurious Components due to PeriodicJitter. Band pass Signal Generation. Performance of Direct Digital Synthesis Systems. HybridDDS-PLL Systems. Applications of direct Digital Synthesis. Generation of Random Sequences.ROM Compression Techniques.

UNITIIISignalProcessorandMultiRateProcessing Techniques 9

Introduction.SampleRateConversionPrinciples. PolyphaseFilters.DigitalFilterBanks.TimingRecovery in Digital Receivers Using Multirate Digital Filters.
DSPProcessors;FieldProgrammableGateArrays;Trade-OffsinUsingDSPs,FPGAs,andASICs; Power Management Issues; Using a Combination of DSPs, FPGAs, and ASICs.

UNITIV:Smart Antennas 9

Vector channel modeling; Benefits of smart antennas; Structures for Beam forming Systems;Smart Antenna Algorithms.Diversity and Space-Time Adaptive Signal Processing; Algorithmsfor Transmit STAP; Hardware Implementation of Smart Antennas; Array Calibration.

UNITV: Applications–WirelessAspectsofTele-Health Care 9

The application of advanced telecommunication , the special requirements especially related toreliability, privacy and trust, Regulatory and safety aspects of tele-health care, Cognitive radioand flexible spectrum usage for tele-healthcare, Cooperative Communications for Tele-health.Case studies: JTRS radio system ,Software defined base stations.

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

TOTAL:45PERIODS

OUTCOMES:
Attheendofthiscourse, thestudentshouldbeableto

- CompareMACandnetworklayer designfor softwaredefinedradio
- DiscusscognitiveradioforInternetofThingsandM2Mtechnologies

BOOKSFORREFERENCES:

1. JeffreyH.Reed-SoftwareRadio:AModernApproachtoRadioEngineeringPublisher: Prentice Hall PTR; May 2002 ISBN: 0170811580.
2. WirelessCommunications:PrinciplesandPractice,2nded,byRappaport,Prentice-Hall 2002. ISBN 0-17-042232-0.
3. Wireless ApplicationDevelopment, bySkelton, Thomson,2003, ISBN0-619-15931-6

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE-IV
SEMESTERIII

19271E32B **SATELLITECOMMUNICATION** **LT PC**
3003

AIM:

Tounderstandthebasicsofsatelliteorbits.Tounderstandthesatellitesegmentandearth segment.

OBJECTIVES:

Thestudentsshould bemadeto be

- LearnM2Mdevelopmentsandsatellite applications
- UnderstandSatelliteCommunicationInIpv6Environment

UNITIORBITAL MECHANICS **9**

Kepler's laws of motion, Orbits, Orbit Equations, Orbit Description, Locating the Satellite in theOrbit and with Respect to Earth, Orbital Elements-Look Angle Determination and Visibility -Orbital Perturbations,Orbit Determination, Launch Vehicles, Orbital Effects in CommunicationSystem - Performance Attitude control; Satellite launch vehicles. spectrum allocations forsatellite systems.

UNITIISPACECRAFTSUBSYSTEMSANDEARTH STATION **9**

Spacecraft Subsystems, Altitude and Orbit Control, Telemetry and Tracking, PowerSystems,Communication Subsystems, Transponders, Antennas, Equipment Reliability, EarthStations, Example of payloads of operating and planned systems.

UNITIIISPACELINKS **9**

The Space Link, Satellite Link Design - Satellite uplink -down link power Budget, BasicTransmission Theory, System Noise Temp, G/T Ratio, Noise Figure, Downlink Design, Designof Satellite Links for Specified C/N - Microwave Propagation on Satellite-Earth Paths.Interference betweensatellite circuits, EnergyDispersal, propagationcharacteristics of fixed andmobile satellite links.

UNITIVMULTIPLEACCESSTECHNIQUESANDNETWORKASPECTS **9**

Single access vs. multiple access (MA). Classical MA techniques: FDMA, TDMA. Singlechannel per carrier (SCPC) access - Code division multiple access (CDMA). Demandassignment techniques. Examples of MA techniques for existing and planned systems (e.g. thesatellite component of UMTS).Mobile satellite network design, ATM via satellite. TCP/IP viasatellite - Call control, handover and call set up procedures.
Hybridsatellite-terrestrialnetworks

UNITVSERVICESAND APPLICATIONS **9**

Fixed and mobile services - Multimedia satellite services - Advanced applications based onsatellite platforms - INTELSAT series - INSAT, VSAT, Remote Sensing - Mobile satelliteservice: GSM. GPS,INMARSAT, Navigation System, Direct to Home service (DTH), Specialservices, E-mail, Videoconferencing and Internet connectivity

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

OUTCOMES:

Attheendofthiscourse,thestudentshouldbeableto:

- Discusssatellitenavigationandglobalpositioningsystem
- Outlinedeepspacenetworksandinterplanetarymissions

BOOKSFORREFERENCES:

1. DennisRoddy,“SatelliteCommunications”,3rdEdition,McGrawHillInternational Editions, 2001
2. BruceR.Elbert,“IntroductiontoSatelliteCommunication”,ArtechHouseInc.,1999.
3. TimothyPratt,CharlesW.Bostian,JeremyAllnutt,“SatelliteCommunications”,2ndEdition, Wiley, John& Sons, 2002
4. WilburL.Pritchard,HendriG.Suyderhood,RobertA.Nelson,“SatelliteCommunication SystemsEngineering”, 2nd Edition, Prentice Hall, New Jersey, 1993
5. TriT.Ha,"Digitalsatellitecommunication",2ndEdition,McGrawHill,Newyork.1990.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE-IV
SEMESTERIII

19271E32C **CDMASYSTEMS** **LT PC**
3003

AIM:

Theaimofthiscourseistodefinethebasicsofcellularcommunicationsandexplainthe ArchitectureOFGSM&itsRadioChannels.

OBJECTIVES:

Thestudentsshould bemadeto be

- understand cellular concept, widelypopular 2G digital, TDMA based mobile systemGSM and modern mobile wireless system CDMA.

UNITIBASICCONCEPTS OFCDMA **9**

Spread spectrum communication techniques (DS-CDMA, FH-CDMA),Synchronization inCDMA system, Detection and False alarm probabilities, Early-Late gate measurement statistics,Information capacity of Spread Spectrum Systems.

UNITIIIS-95 CDMA TECHNIQUES **9**

SpreadingCodes,Powercontrol,Handovertechniques,Physicalandlogicalchannelsandprocessing (Forward and reverse links)

UNITIIIWCDMA /CDMA 2000 **9**

IntroductiontoIMT2000,CDMA2000-Physicallayercharacteristics,modulation&demodulationprocess , Handoff and power control in 3G systems.

UNITIVMULTICARRIERCDMA SYSTEMS **9**

MulticarrierCDMA,Systemdesign,Performanceparameters–BERlowerbound,Multiuserdetection, UTRA, FDD and TDD systems.

UNITVOPTICALCDMA **9**

Prime Codes and it's properties, Generalized and Extended Prime Codes,Experimentaldemonstration of Optical CDMA, Synchronization of Optical CDMA networks, Multiwavelength Optical CDMA networks.

TOTAL:45PERIODS

OUTCOMES:

Attheendofthecourse,thestudent shouldbeableto:

- AnalyzeMIMOsystem.
- Discussmillimeterwavecommunication.
- Demonstratesoftwaredefined radio andcognitiveradio.

BOOKSFORREFERENCES:

1. JohnG.Proakis,"DigitalCommunications",McGrawHillInternationalLtd,4thed., Singapore, 2000.
2. AndrewJ.Viterbi,"CDMA:PrinciplesofSpreadSpectrumCommunication",Addison- Wesley, 1sted. , 1995.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

3. KavethPahlavan,.K.PrashanthKrishnamuorthy,"PrinciplesofWirelessNetworks",Prentice Hall of India, 2006.
4. Vijay Kumar Garg, “IS –95 CDMAand CDMA2000: Cellular/PCS Systems Implementation”, Pearson Education , 2st ed. , 2003.
5. RichardVan Nee,RamjeePrasad,”OFDMfor WirelessMultimediaCommunication”, Artech House , Boston ,London, 2000.
6. AndreasF.Molisch,“WirelessCommunication”,WileyIndia,2006.
7. RaymondSteele,Chin-ChunLee,PeterGould,“GSMCDMAOneand3GSystems”,Wiley India, 2004.
8. Guu-ChangYang,“PrimeCodeswithApplicationtoOpticaland WirelessNetworks”, Artech House, Inc., 2002.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

LISTOF ELECTIVES

ELECTIVE–V(SEMESTERIII)

ELECTIVE- V
SEMESTERIII

19271E33A WAVELETSANDMULTIRESOLUTIONPROCESSING

L T PC
3003

AIM:

Tointroducethefundamentalsconceptsofwavelet transforms.

OBJECTIVE:

- TostudysystemdesignusingWavelets
- Tolearnthedifferentwaveletfamilies&theirapplications.

UNITI INTRODUCTION 9

Vector Spaces - properties - dot product - basis - dimension, orthogonality and orthonormality - relationship between vectors and signals - Signal spaces - concept of Convergence – GeneralisedFourier Expansion.

UNITIIMULTIRESOLUTIONANALYSIS 9

Definition of Multi Resolution Analysis (MRA) – Haar basis - Construction of generalorthonormal MRA Wavelet basis– Continuous time MRA interpretation for the DTWT – Discrete time MRA- Basis functions for the DTWT – PR-QMF filter banks

UNITIIICONTINUOUSWAVELETTRANSFORM 9

Wavelet Transform- definitionand properties - concept ofscale and itsrelationwith frequency- Continuous Wavelet Transform (CWT) - Scaling function and wavelet functions (Daubechies, Coiflet,Mexican Hat, Sinc, Gaussian, Bi-Orthogonal) - Tiling of time -scale plane for CWT.

UNITIVDISCRETEWAVELETTRANSFORM 9

Filter Bank and sub band coding principles - Wavelet Filters - Inverse DWT computation byFilterbanks -Basic Properties of Filter coefficients - Choice of wavelet function coefficients - Derivations of Daubechies Wavelets - Multi-band Wavelet transforms. Introduction to liftingScheme

UNITVAPPLICATIONS 9

Signal Compression – Image Compression techniques: EZW-SPHIT Coding - Imagedenoisingtechniques:Noise estimation - Shrinkage rules -. Shrinkage Functions - Edge detectionand object Isolation, Image Fusion, and Object Detection.

TOTAL:45PERIODS

OUTCOME:

- ThestudentswillbeabletoapprehendthedetailedknowledgeabouttheWavelettransform & its applications.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

BOOKSFORREFERENCES:

1. Rao.R.MandA.S.Bopardikar,"WaveletTransforms:Introductiontotheoryand Applications”,Pearson Education Asia Pte. Ltd., 2000.
2. StrangG,NguyenT,"WaveletsandFilterBanks,"WellesleyCambridgePress, 1996
3. VetterliM, KovacevicJ.,"WaveletsandSub-bandCoding,"PrenticeHall, 1995
4. MallatS.,"WavelettourofSignalProcessing”,AcademicPress, 1996
5. DavidC.Lay.,“LinearAlgebraanditsapplications”Pearsoneducation,2007.(UnitIonly)

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE- V
SEMESTERIII

19271E33B HIGHPERFORMANCECOMMUNICATION NETWORKS
L T PC
3003

AIM:
Tofamiliarizeconceptsandterminologyassociatedwith ATM,FrameRelay,MPLS, Bluetooth technology**.**

OBJECTIVES:

- Toappreciatetheneedforinteroperablenetworkmanagementasatypical distributed application
- To beaware ofcurrent trendsin networktechnologies

UNITIPACKETSWITCHED NETWORKS 9
OSIandIPmodels,Ethernet(IEEE802.3),Tokenring(IEEE802.5),WirelessLAN(IEEE802.11) FDDI,DQDB, SMDS: Internetworking with SMDS

UNITIIISDNANDBROADBAND ISDN 9
ISDN-overview,interfacesandfunctions,Layersandservices-SignalingSystem7(SS7)-Broadband ISDN architecture and Protocols.

UNITIIIATMANDFRAMERELAY 9
ATM: Main features-addressing, signaling and routing, ATM header structure-adaptation layer,management and control, ATM switching and transmission.
Frame Relay: Protocols and services,Congestion control,Internetworking with ATM,Internetand ATM, Frame relay via ATM.

UNITIVADVANCEDNETWORKARCHITECTURE 9
IP forwarding architectures overlay model, Multi Protocol Label Switching (MPLS), integratedservices in the Internet, Resource Reservation Protocol (RSVP), Differentiated services

UNITVBLUETOOTH TECHNOLOGY 9
The Bluetooth module-Protocol stack Part I: Antennas, Radio interface, Base band, The Linkcontroller, Audio, The Link Manager, The Host controller interface; The Bluetooth module-Protocolstack Part I:Logical link controland adaptation protocol, RFCOMM, Service discoveryprotocol, Wireless access protocol, Telephony control protocol.

TOTAL:45PERIODS

OUTCOMES:
Afterthecompletionofthiscourse,studentswillbeableto

- Diagnoseproblemsandmakeminorrepairstocomputernetworksusingappropriate diagnostics software
- DemonstratehowtocorrectlymaintainLANcomputersystems
- Maintainthenetworkbyperformingroutinemaintenancetasks
- Applynetworkmanagementtools

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

BOOKSFORREFERENCES:

1. William Stallings,”ISDN and Broadband ISDN with Frame Relay and ATM”, 4th edition,Pearsoneducation Asia, 2002.
2. LeonGracia,Widjaja,“Communicationnetworks",TataMcGraw-Hill,NewDelhi,2000.
3. JenniferBrayandCharlesF.Sturman,”BlueTooth”PearsoneducationAsia,2001.
4. SumitKasera,PankajSethi,“ATMNetworks",TataMcGraw-Hill,NewDelhi,2000.
5. RainerHandel,ManfredN.HuberandStefanSchroder,”ATMNetworks”,3rdedition,Pearsoneducation asia,2002.
6. JeanWalrandandPravinVaraiya,”HighPerformanceCommunicationnetworks”,2nd edition,Harcourt and Morgan Kauffman,London,2000.
7. WilliamStallings,”High-speedNetworksandInternets”,2ndedition,Pearsoneducation Asia, 2003.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE- V
SEMESTERIII

19271E33C ADVANCEDMICROPROCESSORSAND MICROCONTROLLERS
L T PC
3003

AIM:

Tointroducetheadvancedfeaturesinmicroprocessorsandmicrocontrollers.

OBJECTIVES:

- Toenablethestudentstounderstandvariousmicrocontrollerarchitectures
- Toexposethe studentstothefundamentalsofmicroprocessor architecture.

UNITIMICROPROCESSORARCHITECTURE 9

Instruction set – Data formats – Instruction formats – Addressing modes – Memory hierarchy – register file – Cache–Virtualmemoryandpaging –Segmentation–Pipelining –The instructionpipeline –pipeline hazards – Instruction level parallelism – reduced instruction set – Computerprinciples – RISC versus CISC – RISC properties – RISC evaluation – On-chip register filesversus cache evaluation

UNITIIHIGHPERFORMANCECISCARCHITECTURE– PENTIUM 9

The software model – functional description – CPU pin descriptions – RISC concepts – busoperations – Super scalar architecture – pipelining – Branch prediction – The instruction andcaches –Floating point unit –protected mode operation – Segmentation – paging – Protection –multitasking –Exception and interrupts – Input /Output – Virtual 8086 model – Interruptprocessing -Instruction types –Addressing modes – Processor flags – Instruction set - programming the Pentium processor.

UNITIIIHIGHPERFORMANCERISCARCHITECTURE:ARM 9

TheARMarchitecture–ARMassemblylanguageprogram–ARMorganizationandimplementation – The ARM instruction set - The thumb instruction set – ARM CPU cores.

UNITIVMOTOROLA68HC11MICROCONTROLLERS 9

Instructions and addressing modes – operating modes – Hardware reset – Interrupt system – ParallelI/O ports – Flags – Real time clock – Programmable timer – pulse accumulator – serialcommunication interface – A/D converter – hardware expansion – Assembly languageProgramming

UNITVPICMICROCONTROLLER 9

CPUarchitecture–Instructionset-Interrupts–Timers–I/Oportexpansion–I2Cbusforperipheral chip access – A/D converter – UART

TOTAL:45PERIODS

OUTCOMES:

- The studentwill be able to workwith a suitablemicroprocessor/ microcontrollerfora specific real world application.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

BOOKSFORREFERENCES:

1. DanielTabak,‘’AdvancedMicroprocessors”McGrawHill.Inc., 1995
2. JamesL.Antonakos,“ThePentiumMicroprocessor‘’PearsonEducation, 1997.
3. SteveFurber, ‘’ARMSystem–On–Chiparchitecture“AddisonWesley,2000.
4. Gene.H.Miller.”Micro ComputerEngineering,”PearsonEducation,2003.
5. John.B.Peatman,“DesignwithPICMicrocontroller,Prenticehall,1997.
6. James L.Antonakos, An Introduction to the Intel family of Microprocessors”, PearsonEducation 1999.
7. Barry.B.Breg,”TheIntelMicroprocessorsArchitecture,ProgrammingandInterfacing“, PHI, 2002.
8. Valvano"EmbeddedMicrocomputerSystems"ThomsonAsiaPVTLTDfirstreprint2001

Readings : Web links: www.ocw.nit.edu,www.arm.com,

SKILLDEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

LISTOF ELECTIVES

ELECTIVE–VI(SEMESTERIII)

ELECTIVE- VI
SEMESTERIII

19271E34A SIMULATIONOFCOMMUNICATION NETWORKS **L T PC**

3003

AIM:

Theaimofthiscourseistolearnmodelingand simulation.

OBJECTIVES:

Thestudentsshould bemadeto be

- Learnmodelingand simulation
- UnderstandMonteCarlosimulation
- Studychannelmodeling andmobility modeling

UNITIMODELLINGOFCOMMUNICATION SYSTEM 9

Model of speech and picture signals, Pseudo noise sequences, Non-linear sequences, Analogchannel model, Noise and fading, Digital channel model-Gilbert model of bursty channels, HF,Troposcatter and satellite channels, Switched telephone channels, Analog and Digitalcommunication system models, Light wave system models.

UNITIISIMULATIONOFRANDOMVARIABLESANDRANDOMPROCESS9

Univariate and multivariate models, Transformation of random variables, Bounds andapproximation,Random process models-Markov and ARMA Sequences, Sampling rate forsimulation, Computer generation and testing of random numbers

UNITIIIESTIMATIONOFPERFORMANCEMEASURES 9

Quality of an estimator, estimator for SNR, Probability density functions of analogcommunication system, BER of digital communication systems, Monte Carlo method andImportance of sampling method, estimation of power spectral density

UNITIVCOMMUNICATIONNETWORKS 9

Queuingmodels,M/M/IandM/M/I/Nqueues,Littleformula,Burke'stheorem ,M/G/Iqueue,Embedded Markov chain analysis of TDM systems, Polling, Random access systems

UNITVNETWORKOF QUEUES 9

Queues in tandem, store and forward communication networks, capacity allocation, Congestionand flowchart, Routing model, Network layout and Reliability

TOTAL:45PERIODS

OUTCOMES:

Attheendofthiscourse, thestudentshouldbeableto

- ApplyMonteCarlosimulation
- DiscussLowerLayerandLinkLayerWirelessModeling
- Comparechannelmodelingandmobility modeling

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

BOOKSFORREFERENCES:

1. M.C.Jeruchim,PhilipBalabanand K.SamShanmugan,"Simulationofcommunication systems",Springer, 2nd Edition, 2002.
2. A.M.LawandW.DavidKelton,"SimulationModellingandanalysis",3rdEdition, McGraw Hill Inc.,1999.
3. J.F.Hayes,“Modeling and Analysis of Computer Communication networks (Applications ofCommunication Theory)”, Plenum Press, 1984.
4. JerryBanks and John S.Carson and BarryL. Nelson, “Discrete-Event SystemSimulation”, 4th Edition,Prentice Hall Inc., 2004.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE- VI
SEMESTERIII

19271E34B **MEDICALIMAGING** **LT PC**
3003

AIM:

Tostudytheproductionofx-raysanditsapplicationtodifferentmedicalImaging techniques.TostudythedifferenttypesofRadiodiagnostictechniques.

OBJECTIVES:

- Tostudythespecialimagingtechniquesusedfor visualizingthecrosssectionsofthebody.
- Tostudytheimagingofsofttissuesusingultrasoundtechnique

UNITI PRINCIPLESOFRADIOGRAPHICEQUIPMENTS 8

X-Raytubes,coolingsystems,removalofscatters,constructionofimageIntensifiertubes,angiographic setup, digital radiology.

UNITII COMPUTERAIDEDTOMOGRAPHY 10

Need forsectional images,Principles of sectional scanning,Method of convolution and Back-Propagation, Methods of reconstruction, Artifacts, Principle of 3D imaging

UNITIII RADIOISOTOPICIMAGING 9

Radiationdetectors,Radioisotopicimagingequipment,scanners,Principleofsemiconductordetectors, Gamma ray camera, Positron Emission tomography.SPECT.

UNITIVULTRASONICSYSTEMS 9

Wave propagation and interaction in Biological tissues, Acoustic radiation, continuous andpulsed excitation, Transducers and imaging systems, Scanning methods, Principle of imagegeneration.

UNITV MAGNETICRESONANCEIMAGING 9

PrinciplesofMRI,Relaxationprocessesandtheirmeasurements,PulsesequencingandMRimage acquisition.

TOTAL:45PERIODS

OUTCOMES:

Attheendofthiscourse,thestudentsshouldbeableto:

- Explaincomputeraidedtomography
- Discussultrasonicsystems
- Outlinemagneticresonanceimaging

BOOKSFORREFERENCES:

1. D.N.ChesneyandM.O.ChesneyRadiographicimaging,CBSPublications,NewDelhi, 1987.
2. Peggy,W.,RogerD.Ferimarch,MRIforTechnologists,McGrawHill,NewYork,1995.
3. SteveWebb, ThePhysicsofMedicalImaging, Taylor&Francis, NewYork.1988.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

ELECTIVE- VI
SEMESTERIII

19271E34C MOBILEADHOC NETWORKS L T PC
3003

AIM:

Theaimofthiscourse istounderstandthe basicsofAd-hoc &SensorNetworks.

OBJECTIVES:

- Tolearnvariousfundamentalandemerging protocolsofalllayers.
- Tostudyabout theissuespertainingto major obstacles inestablishment andefficient management of Ad-hoc and sensor networks.
- TounderstandthenatureandapplicationsofAd-hocandsensornetworks.
- TounderstandvarioussecuritypracticesandprotocolsofAd-hocandSensor Networks.

UNITI INTRODUCTION 9

Introduction to Ad Hoc networks – definition, characteristics features, applications.Characteristics of Wireless channel, Adhoc Mobility Models: - entity and group models.

UNITIIMEDIUMACCESSPROTOCOLS 9

MAC Protocols: design issues, goals and classification. Contention based protocols, reservationbased protocols, scheduling algorithms, protocols using directional antennas. IEEE standards:802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.

UNITIIINETWORKPROTOCOLS 9

Addressing issues in ad hoc network, Routing Protocols: Design issues, goals and classification.Proactive Vs reactive routing, Unicast routing algorithms, Multicast routing algorithms, hybridrouting algorithm, Power/ Energy aware routing algorithm,Hierarchical Routing, QoS awarerouting.

UNITIVEND-TO-ENDDELIVERYANDSECURITY 9

Transport layer: Issues in designing- Transport layer classification, adhoc transport protocols.Security issues in adhoc networks: issues and challenges, network security attacks, securerouting protocols.

UNITVCROSS LAYERDESIGN AND INTEGRATIONOFADHOC FOR 4G9

CrosslayerDesign:Need forcrosslayerdesign,crosslayeroptimization,parameteroptimizationtechniques, Cross layer cautionaryperspective, Co-operative networks:-Architecture, methodsofcooperation, co-operative antennas, Integrationofad hoc networkswithother wired and wirelessnetworks.

TOTAL:45PERIODS

OUTCOMES:

UponCompletionofthecourse, thestudentsshould beableto

- Identifydifferentissuesinwirelessadhocandsensornetworks.
- Toanalyzeprotocolsdevelopedforadhocandsensornetworks.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

- Toidentifyandaddressthesecuritythreatsinadhocandsensornetworks.
- EstablishaSensornetworkenvironmentfordifferenttypesofapplications.

BOOKSFORREFERENCES:

1. C.Siva Ram Murthy and B.S.Manoj, “Ad Hoc Wireless Networks Architectures and protocols”, 2nd edition, Pearson Education, 2007.
2. CharlesE.Perkins,“AdhocNetworking”,Addison–Wesley, 2000.
3. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, “Mobile Ad Hoc networking”, Wiley-IEEE press, 2004.
4. MohammadIlyas, “Thehandbookofadhocwirelessnetworks”, CRCpress,2002.
5. T. Camp, J. Boleng, and V. Davies “A Survey of Mobility Models for Ad Hoc Network Research,” Wireless Communication and Mobile Comp., Special Issue on Mobile Ad Hoc Networking Research, Trends and Applications, vol. 2,no. 5, 2002, pp. 483–502.
6. Fekri M. Abduljalil and Shrikant K. Bodhe , “A survey of integrating IP mobility protocols and Mobile Ad hoc networks”, IEEE communication Survey and tutorials, v 9.no.1 2007.
7. V.T.Raisinhani and S.Iyer “Cross layer design optimization in wireless protocol stacks”, Computer communication, vol 27 no. 8, 2004.
8. V.T.Raisinhani and S.Iyer, ” ÉCLAIR; An Efficient Cross-Layer Architecture for wireless protocol stacks”, World Wireless cong., San Francisco, CA,May 2004.

SKILLDEVELOPMENT **EMPLOYABILITY** **ENTREPRENUEURSHIP**

PRIST
DEEMED TO BE
UNIVERSITY
NAAC ACCREDITED
THANJAVUR – 613 403 - TAMIL NADU

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

PROGRAM HANDBOOK

B.TECH FULL TIME

[REGULATION 2019]
[for candidates admitted to B.Tech EEE program from June 2019 onwards]

PROGRAMME EDUCATIONAL OBJECTIVES:

PEO1: To enable graduates to pursue research, or have a successful career in academia or industries associated with Electronics and Communication Engineering, or as entrepreneurs.

PEO2: To provide students with strong foundational concepts and also advanced techniques and tools in order to enable them to build solutions or systems of varying complexity.

PEO3: To prepare students to critically analyze existing literature in an area of specialization and ethically develop innovative and research oriented methodologies to solve the problems identified.

PROGRAMME OUTCOMES:

Engineering Graduates will be able to:

A. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

B. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

C. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

D. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

E. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

F. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

G. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

H. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

I. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

J. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

K. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

L. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

PROGRAMME EDUCATIONAL OBJECTIVES	**PROGRAMM OUTCOMES**												
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**
1	3	3	2	3	2	1	1	2	1	1	3	1	3
2	3	3	3	3	3	1	1	1	1	1	1	2	2
3	3	3	3	3	3	2	2	3	1	2	2	2	2

1-Reasonable: 2- Significant: 3- Strong

COURSE STRUCTURE

B.TECH-EEE
R 2019

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEURSHIP

SEMESTER I

S.No	Course Code	Course Title	L	T	P	C
1	**19147S11**	Communicative English	4	0	0	4
2	**19148S12**	Engineering Mathematics - I	4	0	0	4
3	**19149S13**	Engineering Physics	3	0	0	3
4	**19149S14**	Engineering Chemistry	3	0	0	3
5	**19154S15**	Engineering Graphics	2	0	4	4
6	**19150S16**	Problem Solving and Python programming	3	0	0	3
PRACTICAL						
7	**19150L17**	Problem Solving and Python Programming Laboratory	0	0	4	2
8	**19149L18**	Physics and Chemistry Laboratory	0	0	4	2
9	**191VEA19**	Value Education				-
					TOTAL CREDITS	**25**

SEMESTER – II

S.No	Course Code	Course Name	L	T	P	C
1	**19147S21**	Technical English	4	0	0	4
2	**19148S22A**	Engineering Mathematics - II	4	0	0	4
3	**19149S23B**	Physics for Electronics Engineering	3	0	0	3
4	**19149S24A**	Environmental Science and Engineering	3	0	0	3
5	**19153S25C**	Circuit Theory**	2	2	0	3
6	**19154S26C**	Basic Civil and Mechanical Engineering	4	0	0	2
PRACTICAL						
7	**19154L27**	Engineering Practices Laboratory	0	0	4	2
8	**19153L28C**	Electric Circuits Laboratory	0	0	4	2
9	**191ICA29**	Fundamentals of Indian Constitution and Economy				-
					TOTAL CREDITS	**25**

SEMESTER III

S.No	Course Code	Course Name	L	T	P	C
1	**19149S31C**	Transforms and Partial Differential Equations	3	1	0	4
2	**19153C32**	Digital Logic Circuits	3	1	0	4
3	**19153C33**	Electromagnetic Theory	2	2	0	4
4	**19153C34**	Electrical Machines - I[**]	2	2	0	4
5	**19153C35**	Electron Devices and Circuits	3	0	0	4
6	**19153C36**	Power Plant Engineering	3	0	0	4
PRACTICAL						
7	**19153L37**	Electronics Laboratory	0	0	3	2
8	**19153L38**	Electrical Machines Laboratory - I[##]	0	0	3	2
					TOTAL CREDITS	**28**

SEMESTER IV

S.No	Course Code	Course Name	L	T	P	C
1	**19149C41C**	Numerical Methods	3	1	0	4
2	**19153C42**	Electrical Machines - II[**]	2	2	0	4
3	**19153C43**	Transmission and Distribution	3	1	0	4
4	**19153C44**	Measurements and Instrumentation	3	1	0	4
5	**19153C45**	Linear Integrated Circuits and Applications	3	1	0	4
6	**19153C46**	Control Systems	2	2	0	4
PRACTICAL						
7	**19153L47**	Electrical Machines Laboratory - II[##]	0	0	4	2
8	**19153L48**	Linear and Digital Integrated Circuits Laboratory	0	0	4	2
9	**19153L49**	Technical Seminar	0	0	2	1
10	**19153CRS**	Research Led Seminar	1	0	0	1
					TOTAL CREDITS	**30**

SEMESTER – V

S.No	Course Code	Course Name	L	T	P	C
1	**19153C51**	Power System Analysis**	3	1	0	4
2	**19153C52**	Microprocessors and Microcontrollers	4	0	0	4
3	**19153C53**	Power Electronics**	4	0	0	4
4	**19153FE54_**	Free Elective - I*	3	0	0	3
5	**19153C55**	Digital Signal Processing	2	2	0	4
6	**19153C56**	Object Oriented Programming	3	1	0	4
		PRACTICAL				
7	**19153L57**	Control and Instrumentation Laboratory##	0	0	3	2
8	**19153L58**	Object Oriented Programming Laboratory	0	0	3	2
9	**19153L59**	Professional Communication	0	0	2	1
		RESEARCH SKILL DEVELOPMENT (RSD) COURSE				
10	**19153CRM**	Research Methodology	3	0	0	3
					TOTAL CREDITS	**31**

SEMESTER – VI

S.No	Course Code	Course Name	L	T	P	C
1	**19153C61**	Solid State Drives**	4	0	0	4
2	**19153C62**	Protection and Switchgear	4	0	0	4
3	**19153C63**	Embedded Systems	4	0	0	4
4	**19153E64_**	Elective - I	3	0	0	3
5	**19153E65___**	Elective - II	3	0	0	3
		PRACTICAL				
6	**19153L66**	Power Electronics and Drives Laboratory##	0	0	3	2
7	**19153L67**	Microprocessors and Microcontrollers Laboratory	0	0	3	2
8	**19153MP68**	Mini Project	0	0	4	2
		RESEARCH SKILL DEVELOPMENT (RSD) COURSE				
9	**19153CBR**	Participation in Bounded Research	0	0	3	2
					TOTAL CREDITS	**26**

SEMESTER – VII

S.No	Course Code	Course Name	L	T	P	C
1	**19153C71**	High Voltage Engineering	4	0	0	4
2	**19153C72**	Power System Operation and Control	4	0	0	4
3	**19153C73**	Renewable Energy Systems**	4	0	0	4
4	**19153FE74_**	Free Elective -II	3	0	0	3
5	**19153E75_**	Elective - III	3	0	0	3
6	**19153E76_**	Elective - IV	3	0	0	3
		PRACTICAL				
7	**19153L77**	Power System Simulation Laboratory##	0	0	3	2
8	**19153L78**	Renewable Energy Systems Laboratory	0	0	3	2
		RESEARCH SKILL DEVELOPMENT (RSD) COURSE				
9	**19153CSR**	Participation in Scaffolded Research (Design / Socio Technical Project)	0	0	5	5
					TOTAL CREDITS	**30**

SEMESTER – VIII

S.No	Course Code	Course Name	L	T	P	C
1.	**19153E81_**	Elective - V	3	0	0	3
2.	**19153E82_**	Elective - VI	3	0	0	3
		PRACTICAL				
3.	**19153P81**	Project Work	-	-	-	15
4.	**19153PEE**	Programme Exit Examination				2
		TOTAL CREDITS				**23**
		TOTAL NO.OF CREDITS =226				

** **Experiential based learning courses (Theory)**

##.- **Highly Significant Laboratory Courses (Practical)**

LIST OF ELECTIVES

ELECTIVE –I (VI SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1.	**19153E64A**	Design of Electrical Apparatus	3	0	0	3
2.	**19153E64B**	Power Systems Stability	3	0	0	3
3.	**19153E64C**	Modern Power Converters	3	0	0	3
4.	**19153E64D**	Intellectual Property Rights	3	0	0	3

ELECTIVE – II (VI SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1.	**19153E65A**	Principles of Robotics	3	0	0	3
2.	**19153E65B**	Special Electrical Machines	3	0	0	3
3.	**19153E65C**	Power Quality	3	0	0	3
4.	**19153E65D**	EHVAC Transmission	3	0	0	3

ELECTIVE – III (VII SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1	**19153E75A**	Disaster Management	3	0	0	3
2	**19153E75B**	Human Rights	3	0	0	3
3	**19153E75C**	Operations Research	3	0	0	3
4	**19153E75D**	Probability and Statistics	3	0	0	3

ELECTIVE – IV (VII SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1.	**19153E76A**	System Identification and Adaptive Control	3	0	0	3
2.	**19153E76B**	Control of Electrical Drives	3	0	0	3
3.	**19153E76C**	Power Systems Transients	3	0	0	3
4.	**19153E76D**	Total Quality Management	3	0	0	3

ELECTIVE – V (VIII SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1.	**19153E81A**	Flexible AC Transmission Systems	3	0	0	3
2.	**19153E81B**	Soft Computing Techniques	3	0	0	3
3.	**19153E81C**	SMPS and UPS	3	0	0	3
4.	**19153E81D**	Electric Energy Generation, Utilization and Conservation	3	0	0	3

ELECTIVE – VI (VIII SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1.	**19153E82A**	Energy Management and Auditing	3	0	0	3
2.	**19153E82B**	High Voltage Direct Current Transmission	3	0	0	3
3.	**19153E82C**	Smart Grid	3	0	0	3
4.	**19153E82D**	Biomedical Instrumentation	3	0	0	3

FREE ELECTIVE (V SEM)

S.No	Course Code	Course Name	L	T	P	C
1	**19150FE54A**	Database Management System	3	0	0	3
2	**19152FE54A**	Basics of Biomedical Instrumentation	3	0	0	3
3	**19154FE54A**	Renewable Energy Sources	3	0	0	3
4	**19155FE54A**	Air Pollution and Control Engineering	3	0	0	3
5	**19150FE54B**	Cloud computing	3	0	0	3
6	**19152FE54B**	Sensors and Transducers	3	0	0	3
7	**19154FE54B**	Automatic System	3	0	0	3
8	**19155FE54B**	Geographic Information System	3	0	0	3

FREE ELECTIVE (VII SEM)

S.No	Course Code	Course Name	L	T	P	C
1	**19150FE74A**	Introduction to C Programming	3	0	0	3
2	**19152FE74A**	Robotics	3	0	0	3
3	**19154FE74A**	Industrial safety	3	0	0	3
4	**19155FE74A**	Green Building Design	3	0	0	3
5	**19150FE74B**	Datastructures and Algorithms	3	0	0	3
6	**19152FE74B**	Electronic Devices	3	0	0	3
7	**19154FE74B**	Testing of Materials	3	0	0	3
8	**19155FE74B**	Waste water Treatment	3	0	0	3

CREDITS DISTRIBUTION

CGPA CREDITS

COURSE STRUCTURE AND CREDITS DISTRIBUTION

Sem.	Core Courses						Elective Courses				Foundation Courses		CGPA Credits	Non- CGPA Credits		Total Credits
	Theory Courses		Practical Courses		Courses on *RSD		Dept. Elective		Free Elective							
	Nos.	Credits	Nos.	Credits	Nos.	Credits	Nos.	Credits	Nos.	Credits	Nos.	Credits		Nos.	Credits	
I	02	08	02	04	-	-	-	-	-	-	04	16	28	01	01	29
II	03	12	02	04	-	-	-	-	-	-	03	12	28	01	01	29
III	05	20	02	04	-	-	-	-	-	-	01	04	28	-	-	28
IV	05	20	02	04	01	01	-	-	-	-	01	04	30	01	01	30
V	05	20	02	04	01	03	-	-	01	03	-	-	31	01	01	31
VI	03	12	03	06	01	02	02	06	-	-	-	-	26	-	-	26
VII	03	12	02	04	01	05	02	06	01	03	-	-	30	-	-	30
VIII	-	-	01	15	-	-	02	06	-	-	-	-	21	01	02	23
TOTAL CREDITS													222		04	226

*RSD-Research Skill Development

SYLLABI

19147S11 **COMMUNICATIVE ENGLISH**

L	T	P	C
4	1	0	4

OBJECTIVES:

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills

UNIT I SHARING INFORMATION RELATED TO ONESELF/FAMILY& FRIENDS 12

Reading- short comprehension passages, practice in skimming-scanning and predicting- **Writing-** completing sentences-- developing hints. **Listening-** short texts- short formal and informal conversations. **Speaking-**introducing oneself - exchanging personal information- **Language development-** Wh- Questions- asking and answering-yes or no questions- parts of speech. **Vocabulary development--** prefixes- suffixes- articles.- count/ uncount nouns.

UNIT II GENERAL READING AND FREE WRITING 12

Reading - comprehension-pre-reading-post reading- comprehension questions (multiple choice questions and /or short questions/ open-ended questions)-inductive reading- short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts)- register- **Writing** – paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions using some suggested vocabulary and structures –**Listening-** telephonic conversations. **Speaking –** sharing information of a personal kind—greeting – taking leave- **Language development**
– prepositions, conjunctions **Vocabulary development-** guessing meanings of words in context.

UNIT III GRAMMAR AND LANGUAGE DEVELOPMENT 12

Reading- short texts and longer passages (close reading) **Writing-** understanding text structure- use of reference words and discourse markers-coherence-jumbled sentences **Listening** – listening to longer texts and filling up the table- product description- narratives from different sources. **Speaking-** asking about routine actions and expressing opinions. **Language development-** degrees of comparison- pronouns- direct vs indirect questions- **Vocabulary development –** single word substitutes- adverbs.

UNIT IV READING AND LANGUAGE DEVELOPMENT 12

Reading- comprehension-reading longer texts- reading different types of texts- magazines **Writing-** letter writing, informal or personal letters-e-mails-conventions of personal email- **Listening-** listening to dialogues or conversations and completing exercises based on them. **Speaking-** speaking about oneself- speaking about one's friend- **Language development-** Tenses- simple present-simple past- present continuous and past continuous- **Vocabulary development-** synonyms-antonyms- phrasal verbs

UNIT V EXTENDED WRITING 12

Reading- longer texts- close reading –**Writing-** brainstorming -writing short essays – developing an outline- identifying main and subordinate ideas- dialogue writing-**Listening** – listening to talks- conversations- **Speaking –** participating in conversations- short group conversations-**Language development**-modal verbs- present/ past perfect tense **- Vocabulary development**-collocations- fixed and semi-fixed expressions

REFERENCES

1. Bailey, Stephen. **Academic Writing: A practical guide for students**. New York: Rutledge,2011.
2. Comfort, Jeremy, et al. **Speaking Effectively : Developing Speaking Skillsfor BusinessEnglish.** Cambridge University Press, Cambridge: Reprint 2011
3. Dutt P. Kiranmai and RajeevanGeeta. **Basic Communication Skills,** Foundation Books: 2013
4. Means,L. Thomas and Elaine Langlois. **English & Communication For Colleges.** CengageLearning ,USA: 2007
5. Redston, Chris &Gillies Cunningham **Face2Face** (Pre-intermediate Student's Book& Workbook) Cambridge University Press, New Delhi: 2005
.

19148S12	ENGINEERING MATHEMATICS - I	L	T	P	C
		4	1	0	4

OBJECTIVES :

- The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

UNIT I DIFFERENTIAL CALCULUS **12**

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

UNIT II FUNCTIONS OF SEVERAL VARIABLES **12**

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT III INTEGRAL CALCULUS **12**

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT IV MULTIPLE INTEGRALS **12**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

UNIT V DIFFERENTIAL EQUATIONS **12**

Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients - Method of undetermined coefficients.

TOTAL : 60 PERIODS

OUTCOMES :

After completing this course, students should demonstrate competency in the following skills:

- Use both the limit definition and rules of differentiation to differentiate functions.
- Apply differentiation to solve maxima and minima problems.
- Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
- Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
- Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
- Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
- Apply various techniques in solving differential equations.

TEXT BOOKS :

1. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015. [For Units I & III - Sections 1.1, 2.2, 2.3, 2.5, 2.7(Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1(Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCES :

1. Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10th Edition, 2016.
2. Jain R.K. and Iyengar S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, New Delhi, 3rd Edition, 2007.
3. Narayanan, S. and Manicavachagom Pillai, T. K., “Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.
4. Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.
5. Weir, M.D and Joel Hass, "Thomas Calculus", 12th Edition, Pearson India, 2016.

19149S13	**ENGINEERING PHYSICS**	**L**	**T**	**P**	**C**
		4	**1**	**0**	4

OBJECTIVES
:

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I PROPERTIES OF MATTER 9

Elasticity – Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment - I-shaped girders - stress due to bending in beams.

UNIT II WAVES AND FIBER OPTICS 9

Oscillatory motion – forced and damped oscillations: differential equation and its solution – plane progressive waves – wave equation. Lasers : population of energy levels, Einstein's A and B coefficients derivation – resonant cavity, optical amplification (qualitative) – Semiconductor lasers: homojunction and heterojunction – Fiber optics: principle, numerical aperture and acceptance angle -types of optical fibres (material, refractive index, mode) – losses associated with optical fibers - fibre optic sensors: pressure and displacement.

UNIT III THERMAL PHYSICS 9

Transfer of heat energy – thermal expansion of solids and liquids – expansion joints - bimetallic strips - thermal conduction, convection and radiation – heat conductions in solids – thermal conductivity - Forbe's and Lee's disc method: theory and experiment - conduction through compound media (series and parallel) – thermal insulation – applications: heat exchangers, refrigerators, ovens and solar water heaters.

UNIT IV QUANTUM PHYSICS 9

Black body radiation – Planck's theory (derivation) – Compton effect: theory and experimental verification – wave particle duality – electron diffraction – concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box – tunnelling (qualitative) - scanning tunnelling microscope.

UNIT V CRYSTAL PHYSICS 9

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - crystal imperfections: point defects, line defects – Burger vectors, stacking faults – role of imperfections in plastic deformation - growth of single crystals: solution and melt growth techniques.

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course,

- the students will gain knowledge on the basics of properties of matter and its applications,
- the students will acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics,
- the students will have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers,
- the students will get knowledge on advanced physics concepts of quantum theory and its applications in tunneling microscopes, and
- the students will understand the basics of crystals, their structures and different crystal growth techniques.

TEXT BOOKS:

1. Bhattacharya, D.K. & Poonam, T. “Engineering Physics”. Oxford University Press, 2015.
2. Gaur, R.K. & Gupta, S.L. “Engineering Physics”. Dhanpat Rai Publishers, 2012.
3. Pandey, B.K. & Chaturvedi, S. “Engineering Physics”. Cengage Learning India, 2012.

REFERENCES:

1. Halliday, D., Resnick, R. & Walker, J. “Principles of Physics”. Wiley, 2015.
2. Serway, R.A. & Jewett, J.W. “Physics for Scientists and Engineers”. Cengage Learning, 2010.
3. Tipler, P.A. & Mosca, G. “Physics for Scientists and Engineers with Modern Physics’. W.H.Freeman, 2007.

19149S14 **ENGINEERING CHEMISTRY** **L T P C**
4 1 0 4

OBJECTIVES:

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.

UNIT I WATER AND ITS TREATMENT **9**

Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA – numerical problems – boiler troubles (scale and sludge) – treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) external treatment
– Ion exchange process, zeolite process – desalination of brackish water - Reverse Osmosis.

UNIT II SURFACE CHEMISTRY AND CATALYSIS **9**

Adsorption: Types of adsorption – adsorption of gases on solids – adsorption of solute from solutions
– adsorption isotherms – Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – contact theory – kinetics of surface reactions, unimolecular reactions, Langmuir - applications of adsorption on pollution abatement.

Catalysis: Catalyst – types of catalysis – criteria – autocatalysis – catalytic poisoning and catalytic promoters - acid base catalysis – applications (catalytic convertor) – enzyme catalysis– Michaelis –
Menten equation.

UNIT III ALLOYS AND PHASE RULE **9**

Alloys: Introduction- Definition- properties of alloys- significance of alloying, functions and effect of alloying elements- Nichrome and stainless steel (18/8) – heat treatment of steel. Phase rule: Introduction, definition of terms with examples, one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system - Pattinson process.

UNIT IV FUELS AND COMBUSTION **9**

Fuels: Introduction - classification of fuels - coal - analysis of coal (proximate and ultimate) - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum - manufacture of synthetic petrol (Bergius process) - knocking - octane number - diesel oil - cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) - power alcohol and biodiesel. Combustion of fuels: Introduction - calorific value - higher and lower calorific values- theoretical calculation of calorific value - ignition temperature - spontaneous ignition temperature - explosive range - flue gas analysis (ORSAT Method).

UNIT V ENERGY SOURCES AND STORAGE DEVICES **9**

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells
– H_2-O_2 fuel cell.

TOTAL: 45 PERIODS

OUTCOMES:

- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

TEXT BOOKS:

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015
2. P. C. Jain and Monika Jain, "Engineering Chemistry" Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.

REFERENCES:

1. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
2. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
3. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.

19154S15	ENGINEERING GRAPHICS	L	T	P	C
		4	1	0	4

OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (Not for Examination) 1

Importance of graphics in engineering applications – Use of draftinginstruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREEHAND SKETCHING 7+12

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 5+12

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 5+12

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+12

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

TOTAL: 90 PERIODS

OUTCOMES:

On successful completion of this course, the student will be able to

- familiarize with the fundamentals and standards of Engineering graphics
- perform freehand sketching of basic geometrical constructions and multiple views of objects.
- project orthographic projections of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- visualize and to project isometric and perspective sections of simple solids.

TEXT BOOK:

1. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.

REFERENCES:

1. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
2. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.
3. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
4. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
5. N S Parthasarathy And Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
6. S[illegible]M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

19150S16 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C
4 1 0 4

COURSE OBJECTIVES:

- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures –- lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT I ALGORITHMIC PROBLEM SOLVING 9

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS 9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

UNIT V FILES, MODULES, PACKAGES 9

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

- Develop algorithmic solutions to simple computational problems
- Read, write, execute by hand simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python Programs.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)

2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

REFERENCES:

1. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem- Solving Focus, Wiley India Edition, 2013.
2. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press , 2013
3. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
4. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013.
5. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
6. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd.,, 2015.

19150L17	**PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY**	**LT P C**
		0 0 3 2

COURSE OBJECTIVES:

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

LIST OF PROGRAMS

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

PLATFORM NEEDED
Python 3 interpreter for Windows/Linux

COURSE OUTCOMES:
Upon completion of the course, students will be able to

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

TOTAL :60 PERIODS

19149L18	**PHYSICS AND CHEMISTRY LABORATORY** **(Common to all branches of B.E. / B.Tech Programmes)**	**L T P C** **0 0 3 2**

OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young's modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser
   (b) Determination of acceptance angle in an optical fiber.
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method

OUTCOMES:

Upon completion of the course, the students will be able to **TOTAL: 30 PERIODS**

- apply principles of elasticity, optics and thermal properties for engineering applications.

CHEMISTRY LABORATORY: (Any seven experiments to be conducted) OBJECTIVES:

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a pol ymer by viscometery.

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10- Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
11. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
12. Pseudo first order kinetics-ester hydrolysis.
13. Corrosion experiment-weight loss method.
14. Determination of CMC.
15. Phase change in a solid.
16. Conductometric titration of strong acid vs strong base.

OUTCOMES:

- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

TOTAL: 30

PERIODS TEXTBOOKS:

1. Vogel's Textbook of Quantitative Chemical Analysis (8^{TH} edition, 2014)

19147S21 **TECHNICAL ENGLISH**

L	T	P	C
4	1	0	4

OBJECTIVES: The Course prepares second semester engineering and Technology students to:

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations , participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialisation.

UNIT I INTRODUCTION TECHNICAL ENGLISH 12

Listening- Listening to talks mostly of a scientific/technical nature and completing information-gap exercises- **Speaking** –Asking for and giving directions- **Reading** – reading short technical texts from journals- newsapapers- **Writing-** purpose statements – extended definitions – issue- writing instructions – checklists-recommendations-**Vocabulary Development-** technical vocabulary **Language Development** –subject verb agreement **-** compound words.

UNIT II READING AND STUDY SKILLS 12

Listening- Listening to longer technical talks and completing exercises based on them-**Speaking** – describing a process-**Reading** – reading longer technical texts- identifying the various transitions in a text- paragraphing- **Writing-** interpreting cgarts, graphs- **Vocabulary Development-**vocabularyused in formal letters/emails and reports **Language Development-** impersonal passive voice, numerical adjectives.

UNIT III TECHNICAL WRITING AND GRAMMAR 12

Listening- Listening to classroom lectures/ talkls on engineering/technology **-Speaking** – introduction to technical presentations- **Reading** – longer texts both general and technical, practice in speed reading; **Writing**-Describing a process, use of sequence words- **Vocabulary Development-** sequence words- Misspelled words. **Language Development-** embedded sentences

UNIT IV REPORT WRITING 12

Listening- Listening to documentaries and making notes. **Speaking** – mechanics of presentations- **Reading** – reading for detailed comprehension- **Writing-** email etiquette- job application – cover letter – Résumé preparation(via email and hard copy)- analytical essays and issue based essays**-- Vocabulary Development-** finding suitable synonyms-paraphrasing-. **Language Development-** clauses- if conditionals.

UNIT V GROUP DISCUSSION AND JOB APPLICATIONS 12

Listening- TED/Ink talks; **Speaking** –participating in a group discussion **-Reading**– reading and understanding technical articles **Writing**– Writing reports- minutes of a meeting- accident and survey- **Vocabulary Development- verbal analogies Language Development-** reported speech

TOTAL : 60 PERIODS

OUTCOMES: At the end of the course learners will be able to:

- Read technical texts and write area- specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialisation successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write reports and winning job applications.

TEXT BOOKS:

1. Board of editors. **Fluency in English A Course book for Engineering and Technology.** Orient Blackswan, Hyderabad: 2016
2. Sudharshana.N.P and Saveetha. C. **English for Technical Communication**. Cambridge University Press: New Delhi, 2016.

REFERENCES

1. Booth-L. Diana**, Project Work,** Oxford University Press**,** Oxford: 2014.
2. Grussendorf, Marion, **English for Presentations,** Oxford University Press, Oxford: 2007
3. Kumar, Suresh. E. **Engineering English**. Orient Blackswan: Hyderabad,2015
4. Means, L. Thomas and Elaine Langlois, **English & Communication For Colleges.** Cengage Learning, USA: 2007
5. Raman, Meenakshi and Sharma, Sangeetha- **Technical Communication Principles and Practice.**Oxford University Press: New Delhi,2014.

Students can be asked to read Tagore, Chetan Bhagat and for suplementary reading.

19148S22A	ENGINEERING MATHEMATICS – II	L	T	P	C
		4	1	0	4

OBJECTIVES :

- This course is designed to cover topics such as Matrix Algebra, Vector Calculus, Complex Analysis and Laplace Transform. Matrix Algebra is one of the powerful tools to handle practical problems arising in the field of engineering. Vector calculus can be widely used for modelling the various laws of physics. The various methods of complex analysis and Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

UNIT I MATRICES **12**

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II VECTOR CALCULUS **12**

Gradient and directional derivative – Divergence and curl - Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green’s, Gauss divergence and Stoke’s theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III ANALYTIC FUNCTIONS **12**

Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions $w = z + c, cz, \frac{1}{z}, z^2$ - Bilinear transformation.

UNIT IV COMPLEX INTEGRATION **12**

Line integral - Cauchy’s integral theorem – Cauchy’s integral formula – Taylor’s and Laurent’s series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour.

UNIT V LAPLACE TRANSFORMS **12**

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear second order ordinary differential equations with constant coefficients.

OUTCOMES : **TOTAL: 60 PERIODS**

After successfully completing the course, the student will have a good understanding of the following topics and their applications:

- Eigenvalues and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.
- Gradient, divergence and curl of a vector point function and related identities.
- Evaluation of line, surface and volume integrals using Gauss, Stokes and Green’s theorems and their verification.
- Analytic functions, conformal mapping and complex integration.
- Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.

TEXT BOOKS :

1. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.

REFERENCES :

1. Bali N., Goyal M. and Watkins C., “Advanced Engineering Mathematics”, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
2. Jain R.K. and Iyengar S.R.K., “ Advanced Engineering Mathematics ”, Narosa Publications, New Delhi , 3rd Edition, 2007.
3. O’Neil, P.V. “Advanced Engineering Mathematics”, Cengage Learning India Pvt., Ltd, New Delhi, 2007.
4. Sastry, S.S, “Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi, 2014.
5. Wylie, R.C. and Barrett, L.C., “Advanced Engineering Mathematics “Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

19149S23B	PHYSICS FOR ELECTRONICS ENGINEERING	L	T	P	C
		4	1	0	3

(Common to BME, ME, CC, ECE, EEE, E&I, ICE)

OBJECTIVES:

- To understand the essential principles of Physics of semiconductor device and Electron transport properties. Become proficient in magnetic, dielectric and optical properties of materials and nano devices.

UNIT I ELECTRICAL PROPERTIES OF MATERIALS 9

Classical free electron theory - Expression for electrical conductivity – Thermal conductivity, expression - Wiedemann-Franz law – Success and failures - electrons in metals – Particle in a three dimensional box – degenerate states – Fermi- Dirac statistics – Density of energy states – Electron in periodic potential: Bloch thorem – metals and insulators - Energy bands in solids– tight binding approximation - Electron effective mass – concept of hole.

UNIT II SEMICONDUCTOR PHYSICS 9

Intrinsic Semiconductors – Energy band diagram – direct and indirect semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Carrier transport: Velocity-electric field relations – drift and diffusion transport - Einstein's relation – Hall effect and devices – Zener and avalanche breakdown in p-n junctions - Ohmic contacts – tunnel diode - Schottky diode – MOS capacitor - power transistor.

UNIT III MAGNETIC AND DIELECTRIC PROPERTIES OF MATERIALS 9

Magnetism in materials – magnetic field and induction – magnetization - magnetic permeability and susceptibility–types of magnetic materials – microscopic classification of magnetic materials - Ferromagnetism: origin and exchange interaction- saturation magnetization and Curie temperature – Domain Theory. Dielectric materials: Polarization processes – dielectric loss – internal field – Clausius-Mosotti relation- dielectric breakdown – high-k dielectrics.

UNIT IV OPTICAL PROPERTIES OF MATERIALS 9

Classification of optical materials – carrier generation and recombination processes - Absorption emission and scattering of light in metals, insulators and Semiconductors (concepts only) - photo current in a P- N diode – solar cell –photo detectors - LED – Organic LED – Laser diodes – excitons - quantum confined Stark effect – quantum dot laser.

UNIT V NANOELECTRONIC DEVICES 9

Introduction - electron density in bulk material – Size dependence of Fermi energy– quantum confinement – quantum structures - Density of states in quantum well, quantum wire and quantum dot structures –Zener-Bloch oscillations – resonant tunneling – quantum interference effects – mesoscopic structures: conductance fluctuations and coherent transport – Coulomb blockade effects - Single electron phenomena and Single electron Transistor – magnetic semiconductors– spintronics - Carbon nanotubes: Properties and applications.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the students will able to

- gain knowledge on classical and quantum electron theories, and energy band structuues,
- acquire knowledge on basics of semiconductor physics and its applications in various devices,
- get knowledge on magnetic and dielectric properties of materials,
- have the necessary understanding on the functioning of optical materials for optoelectronics,
- understand the basics of quantum structures and their applications in spintronics and carbon electronics.

TEXT BOOKS:
1. Kasap, S.O. "Principles of Electronic Materials and Devices", McGraw-Hill Education, 2007.
2. Umesh K Mishra & Jasprit Singh, "Semiconductor Device Physics and Design", Springer, 2008.
3. Wahab, M.A. "Solid State Physics: Structure and Properties of Materials". Narosa Publishing House, 2009.

REFERENCES
1. Garcia, N. & Damask, A. "Physics for Computer Science Students". Springer-Verlag, 2012.
2. Hanson, G.W. "Fundamentals of Nanoelectronics". Pearson Education, 2009
3. Rogers, B., Adams, J. & Pennathur, S. "Nanotechnology: Understanding Small Systems". CRC Press, 2014

19149S24A ENVIRONMENTAL SCIENCE AND ENGINEERING **L T P C**
4 1 0 4

OBJECTIVES:
- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth‟s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14
Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 8
Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization-environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL: 45 PERIODS

OUTCOMES:

- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXTBOOKS:

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.

REFERENCES :

1. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD,New Delhi, 2007.
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) PVT, LTD, Hydrabad, 2015.
3. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.

19153S25C **CIRCUIT THEORY**

L	T	P	C
4	1	0	4

OBJECTIVES:

- To introduce electric circuits and its analysis
- To impart knowledge on solving circuit equations using network theorems
- To introduce the phenomenon of resonance in coupled circuits.
- To educate on obtaining the transient response of circuits.
- To introduce Phasor diagrams and analysis of three phase circuits

UNIT I BASIC CIRCUITS ANALYSIS 6+6

Resistive elements - Ohm's Law Resistors in series and parallel circuits – Kirchoffs laws – Mesh current and node voltage - methods of analysis.

UNIT II NETWORK REDUCTION AND THEOREMS FOR DC AND AC IRCUITS 6+6

Network reduction: voltage and current division, source transformation – star delta conversion. Thevenins and Norton Theorems – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem – Millman's theorem.

UNIT III TRANSIENT RESPONSE ANALYSIS 6+6

L and C elements -Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. sinusoidal input.

UNIT IV THREE PHASE CIRCUITS 6+6

A.C. circuits – Average and RMS value - Phasor Diagram – Power, Power Factor and Energy.- Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents – power measurement in three phase circuits.

UNIT V RESONANCE AND COUPLED CIRCUITS 6+6

Series and parallel resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

OUTCOMES: **TOTAL : 60 PERIODS**

- Ability to analyse electrical circuits
- Ability to apply circuit theorems
- Ability to analyse transients

TEXT BOOKS:

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", McGraw Hill publishers, edition, New Delhi, 2013.
2. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, 2013.
3. Allan H. Robbins, Wilhelm C. Miller, "Circuit Analysis Theory and Practice", Cengage Learning India, 2013.

REFERENCES

1. Chakrabarti A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, 1999.
2. Jegatheesan, R., "Analysis of Electric Circuits," McGraw Hill, 2015.
3. Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, McGraw- Hill, New Delhi, 2010.
4. M.E Van Valkenburg, "Network Analysis", Prentice-Hall of India Pvt Ltd, New Delhi,

2015.
5. Mahadevan, K., Chitra, C., “Electric Circuits Analysis,” Prentice-Hall of India Pvt Ltd., New Delhi, 2015.
6. Richard C. Dorf and James A. Svoboda, “Introduction to Electric Circuits”, 7th Edition, John Wiley & Sons, Inc. 2015.
7. Sudhakar A and Shyam Mohan SP, “Circuits and Network Analysis and Synthesis”, McGraw Hill, 2015.

19154S26C	BASIC CIVIL AND MECHANICAL ENGINEERING	L	T	P	C
		4	1	0	4

OBJECTIVES:

- To impart basic knowledge on Civil and Mechanical Engineering.
- To familiarize the materials and measurements used in Civil Engineering.
- To provide the exposure on the fundamental elements of civil engineering structures.
- To enable the students to distinguish the components and working principle of power plant units, IC engines, and R & AC system.

A – OVER VIEW

UNIT I SCOPE OF CIVIL AND MECHANICAL ENGINEERING 10

Overview of Civil Engineering - Civil Engineering contributions to the welfare of Society – Specialized sub disciplines in Civil Engineering – Structural, Construction, Geotechnical, Environmental, Transportation and Water Resources Engineering

Overview of Mechanical Engineering - Mechanical Engineering contributions to the welfare of Society – Specialized sub disciplines in Mechanical Engineering - Production, Automobile, Energy Engineering - Interdisciplinary concepts in Civil and Mechanical Engineering.

B – CIVIL ENGINEERING

UNIT II SURVEYING AND CIVIL ENGINEERING MATERIALS 10

Surveying: Objects – classification – principles – measurements of distances – angles – leveling – determination of areas– contours - examples.

Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel - timber - modern materials

UNIT III BUILDING COMPONENTS AND STRUCTURES 15

Foundations: Types of foundations - Bearing capacity and settlement – Requirement of good foundations.

Civil Engineering Structures: Brickmasonry – stonemasonry – beams – columns – lintels – roofing – flooring – plastering – floor area, carpet area and floor space index - Types of Bridges and Dams – water supply - sources and quality of water - Rain water harvesting - introduction to high way and rail way.

C – MECHANICAL ENGINEERING

UNIT IV INTERNAL COMBUSTION ENGINES AND POWER PLANTS 15

Classification of Power Plants - Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Working principle of steam, Gas, Diesel, Hydro - electric and Nuclear Power plants –- working principle of Boilers, Turbines, Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps

UNIT V REFRIGERATION AND AIR CONDITIONING SYSTEM 10

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system– Layout of typical domestic refrigerator–Window and Split type room Air conditioner.

OUTCOMES: **TOTAL: 60 PERIODS**

On successful completion of this course, the student will be able to

- appreciate the Civil and Mechanical Engineering components of Projects.
- explain the usage of construction material and proper selection of construction materials.
- measure distances and area by surveying
- identify the components used in power plant cycle.
- demonstrate working principles of petrol and diesel engine.
- elaborate the components of refrigeration and Air conditioning cycle.

TEXTBOOKS:

1. Shanmugam Gand Palanichamy MS,"Basic Civil and Mechanical Engineering",Tata McGraw Hill PublishingCo.,NewDelhi,1996.

REFERENCES:

1. Palanikumar, K. Basic Mechanical Engineering, ARS Publications, 2010.
2. Ramamrutham S.,"Basic Civil Engineering", Dhanpat Rai Publishing Co.(P) Ltd.1999.
3. Seetharaman S.,"BasicCivil Engineering",AnuradhaAgencies,2005.
4. ShanthaKumar SRJ.,"Basic Mechanical Engineering", Hi-tech Publications, Mayiladuthurai, 2000.
5. Venugopal K. and Prahu Raja V., "Basic Mechanical Engineering", Anuradha Publishers, Kumbakonam,2000.

19154L27 ENGINEERING PRACTICES LABORATORY L T P C
0 0 3 2

OBJECTIVES:

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE 13

Buildings:

(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.

(b) Study of pipe connections requirements for pumps and turbines.

(c) Preparation of plumbing line sketches for water supply and sewage works. (d) Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

(a) Study of the joints in roofs, doors, windows and furniture. (b) Hands-on-exercise:

Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE 18

Welding:

(a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding. (b) Gas welding practice

Basic Machining:

(a) Simple Turning and Taper turning

(b) Drilling Practice

Sheet Metal Work:

(a) Forming & Bending:

(b) Model making – Trays and funnels. (c) Different type of joints.

Machine assembly practice:

(a) Study of centrifugal pump

(b) Study of air conditioner

Demonstration on:

(a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.

(b) Foundry operations like mould preparation for gear and step cone pulley.

(c) Fitting – Exercises – Preparation of square fitting and V – fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE 13

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of an electrical equipment.

IV ELECTRONICS ENGINEERING PRACTICE **16**

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

OUTCOMES:

On successful completion of this course, the student will be able to

TOTAL: 60 PERIODS

- fabricate carpentry components and pipe connections including plumbing works.
- use welding equipments to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metal works
- Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundary and fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, soldering practices.

CIVIL

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.	15 Sets.
2. Carpentry vice (fitted to work bench)	15 Nos.
3. Standard woodworking tools	15 Sets.
4. Models of industrial trusses, door joints, furniture joints	5 each
5. Power Tools: (a) Rotary Hammer	2 Nos
(b) Demolition Hammer	2 Nos (c)
Circular Saw	2 Nos (d)
Planer	2 Nos (e)
Hand Drilling Machine	2 Nos (f)
Jigsaw	2 Nos

MECHANICAL

1. Arc welding transformer with cables and holders	5 Nos.
2. Welding booth with exhaust facility	5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 Nos.
5. Centre lathe	2 Nos.
6. Hearth furnace, anvil and smithy tools	2 Sets.
7. Moulding table, foundry tools	2 Sets.
8. Power Tool: Angle Grinder	2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner	One each.

ELECTRICAL

1. Assorted electrical components for house wiring	15 Sets
2. Electrical measuring instruments	10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp	1 each
4. Megger (250V/500V)	1 No.
5. Power Tools: (a) Range Finder	2 Nos
(b) Digital Live-wire detector	2 Nos

ELECTRONICS

1. Soldering guns	10 Nos.
2. Assorted electronic components for making circuits	50 Nos.
3. Small PCBs	10 Nos.
4. Multimeters	10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply	

19153L28C	ELECTRIC CIRCUITS LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES:

- To simulate various electric circuits using Pspice/ Matlab/e-Sim / Scilab
- To gain practical experience on electric circuits and verification of theorems.

LIST OF EXPERIMENTS

1. Simulation and experimental verification of electrical circuit problems using Kirchhoff's voltage and current laws.
2. Simulation and experimental verification of electrical circuit problems using Thevenin's theorem.
3. Simulation and experimental verification of electrical circuit problems using Norton's theorem.
4. Simulation and experimental verification of electrical circuit problems using Superposition theorem.
5. Simulation and experimental verification of Maximum Power transfer Theorem.
6. Study of Analog and digital oscilloscopes and measurement of sinusoidal voltage, frequency and power factor.
7. Simulation and Experimental validation of R-C electric circuit transients.
8. Simulation and Experimental validation of frequency response of RLC electric circuit.
9. Design and Simulation of series resonance circuit.
10. Design and Simulation of parallel resonant circuits.
11. Simulation of three phase balanced and unbalanced star, delta networks circuits.

OUTCOMES: **TOTAL: 60 PERIODS**

- Understand and apply circuit theorems and concepts in engineering applications.
- Simulate electric circuits.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Regulated Power Supply: 0 – 15 V D.C - 10 Nos / Distributed Power Source.
2. Function Generator (1 MHz) - 10 Nos.
3. Single Phase Energy Meter - 1 No.
4. Oscilloscope (20 MHz) - 10 Nos.
5. Digital Storage Oscilloscope (20 MHz) – 1 No.
6. 10 Nos. of PC with Circuit Simulation Software (min 10 Users) (e-Sim / Scilab/ Pspice / MATLAB /other Equivalent software Package) and Printer (1 No.)
7. AC/DC - Voltmeters (10 Nos.), Ammeters (10 Nos.) and Multi-meters (10 Nos.)
8. Single Phase Wattmeter – 3 Nos.
9. Decade Resistance Box, Decade Inductance Box, Decade Capacitance Box - 6 Nos each.
10. Circuit Connection Boards - 10 Nos.Necessary Quantities of Resistors,Inductors, Capacitors of various capacities (Quarter Watt to 10Watt

19149S31C TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

L	T	P	C
3	1	0	4

OBJECTIVES :

- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations – Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II FOURIER SERIES 12

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12

Classification of PDE – Method of separation of variables - Fourier Series Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

UNIT IV FOURIER TRANSFORMS 12

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS 12

Z-transforms - Elementary properties – Inverse Z-transform (using partial fraction and residues) – Initial and final value theorems - Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

TOTAL : 60 PERIODS

OUTCOMES :

Upon successful completion of the course, students should be able to:

- Understand how to solve the given standard partial differential equations.
- Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
- Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
- Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

TEXT BOOKS :

1. Grewal B.S., “Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, New Delhi, 2014.
2. Narayanan S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.

REFERENCES :

1. Andrews, L.C and Shivamoggi, B, "Integral Transforms for Engineers" SPIE Press, 1999.
2. Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 9th Edition, Laxmi Publications Pvt. Ltd, 2014.
3. Erwin Kreyszig, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, India, 2016.
4. James, G., "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.
5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
6. Wylie, R.C. and Barrett, L.C., “Advanced Engineering Mathematics “Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

19153C32	DIGITAL LOGIC CIRCUITS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To study various number systems and simplify the logical expressions using Boolean functions
- To study combinational circuits
- To design various synchronous and asynchronous circuits.
- To introduce asynchronous sequential circuits and PLDs
- To introduce digital simulation for development of application oriented logic circuits.

UNIT I NUMBER SYSTEMS AND DIGITAL LOGIC FAMILIES 6+6

Review of number systems, binary codes, error detection and correction codes (Parity and Hamming code) - Digital Logic Families -comparison of RTL, DTL, TTL, ECL and MOS families -operation, characteristics of digital logic family.

UNIT II COMBINATIONAL CIRCUITS 6+6

Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps - simplification and implementation of combinational logic – multiplexers and de multiplexers - code converters, adders, subtractors, Encoders and Decoders.

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS 6+6

Sequential logic- SR, JK, D and T flip flops - level triggering and edge triggering - counters - asynchronous and synchronous type - Modulo counters - Shift registers - design of synchronous sequential circuits – Moore and Melay models- Counters, state diagram; state reduction; state assignment.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS AND PROGRAMMABILITY LOGIC DEVICES 6+6

Asynchronous sequential logic circuits-Transition tability, flow tability-race conditions, hazards &errors in digital circuits; analysis of asynchronous sequential logic circuits- introduction to Programmability Logic Devices: PROM – PLA –PAL, CPLD-FPGA.

UNIT V VHDL 6+6

RTL Design – combinational logic – Sequential circuit – Operators – Introduction to Packages – Subprograms – Test bench. (Simulation /Tutorial Examples: adders, counters, flip flops, Multiplexers & De multiplexers).

OUTCOMES: **TOTAL : 60PERIODS**

- Ability to design combinational and sequential Circuits.
- Ability to simulate using software package.
- Ability to study various number systems and simplify the logical expressions using Boolean functions
- Ability to design various synchronous and asynchronous circuits.
- Ability to introduce asynchronous sequential circuits and PLDs
- Ability to introduce digital simulation for development of application oriented logic circuits.

TEXT BOOKS:

1. James W. Bignel, Digital Electronics, Cengage learning, 5th Edition, 2007.
2. M. Morris Mano, 'Digital Design with an introduction to the VHDL', Pearson Education, 2013.
3. Comer "Digital Logic & State Machine Design, Oxford, 2012.

REFERENCES

1. Mandal, "Digital Electronics Principles & Application, McGraw Hill Edu, 2013.
2. William Keitz, Digital Electronics-A Practical Approach with VHDL, Pearson, 2013.
3. Thomas L.Floyd, 'Digital Fundamentals', 11th edition, Pearson Education, 2015.
4. Charles H.Roth, Jr, Lizy Lizy Kurian John, 'Digital System Design using VHDL, Cengage, 2013.
5. D.P.Kothari,J.S.Dhillon, 'Digital circuits and Design',Pearson Education, 2016.

19153C33	**ELECTROMAGNETIC THEORY**	**L**	**T**	**P**	**C**
		2	**2**	**0**	**4**

OBJECTIVES:

- To introduce the basic mathematical concepts related to electromagnetic vector fields
- To impart knowledge on the concepts of
  - Electrostatic fields, electrical potential, energy density and their applications.
  - Magneto static fields, magnetic flux density, vector potential and its applications. Different methods of emf generation and Maxwell's equations
  - Electromagnetic waves and characterizing parameters

UNIT I ELECTROSTATICS – I 6+6

Sources and effects of electromagnetic fields – Coordinate Systems – Vector fields –Gradient, Divergence, Curl – theorems and applications - Coulomb's Law – Electric field intensity – Field due to discrete and continuous charges – Gauss's law and applications.

UNIT II ELECTROSTATICS – II 6+6

Electric potential – Electric field and equipotential plots, Uniform and Non-Uniform field, Utilization factor – Electric field in free space, conductors, dielectrics - Dielectric polarization – Dielectric strength - Electric field in multiple dielectrics – Boundary conditions, Poisson's and Laplace's equations, Capacitance, Energy density, Applications.

UNIT III MAGNETOSTATICS 6+6

Lorentz force, magnetic field intensity (H) – Biot–Savart's Law - Ampere's Circuit Law – H due to straight conductors, circular loop, infinite sheet of current, Magnetic flux density (B) – B in free space, conductor, magnetic materials – Magnetization, Magnetic field in multiple media – Boundary conditions, scalar and vector potential, Poisson's Equation, Magnetic force, Torque, Inductance, Energy density, Applications.

UNIT IV ELECTRODYNAMIC FIELDS 6+6

Magnetic Circuits - Faraday's law – Transformer and motional EMF – Displacement current - Maxwell's equations (differential and integral form) – Relation between field theory and circuit theory – Applications.

UNIT V ELECTROMAGNETIC WAVES 6+6

Electromagnetic wave generation and equations – Wave parameters; velocity, intrinsic impedance, propagation constant – Waves in free space, lossy and lossless dielectrics, conductors- skin depth - Poynting vector – Plane wave reflection and refraction.

TOTAL : 60 PERIODS

OUTCOMES:

- Ability to understand the basic mathematical concepts related to electromagnetic vector fields.
- Ability to understand the basic concepts about electrostatic fields, electrical potential, energy density and their applications.
- Ability to acquire the knowledge in magneto static fields, magnetic flux density, vector potential and its applications.
- Ability to understand the different methods of emf generation and Maxwell's equations
- Ability to understand the basic concepts electromagnetic waves and characterizing parameters
- Ability to understand and compute Electromagnetic fields and apply them for design and analysis of electrical equipment and systems

TEXT BOOKS:

1. Mathew N. O. Sadiku, 'Principles of Electromagnetics', 6th Edition, Oxford University Press Inc. Asian edition, 2015.
2. William H. Hayt and John A. Buck, 'Engineering Electromagnetics', McGraw Hill Special Indian edition, 2014.
3. Kraus and Fleish, 'Electromagnetics with Applications', McGraw Hill International Editions, Fifth Edition, 2010

REFERENCES

1. V.V.Sarwate, 'Electromagnetic fields and waves', First Edition, Newage Publishers, 1993.
2. J.P.Tewari, 'Engineering Electromagnetics - Theory, Problems and Applications', Second Edition, Khanna Publishers.
3. Joseph. A.Edminister, 'Schaum's Outline of Electromagnetics, Third Edition (Schaum's Outline Series), McGraw Hill, 2010.
4. S.P.Ghosh, Lipika Datta, 'Electromagnetic Field Theory', First Edition, McGraw Hill Education(India) Private Limited, 2012.
5. K A Gangadhar, 'Electromagnetic Field Theory', Khanna Publishers; Eighth Reprint : 2015
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19153C34	**ELECTRICAL MACHINES – I**	**L**	**T**	**P**	**C**
		2	**2**	**0**	**4**

OBJECTIVES:

To impart knowledge on the following Topics

- Magnetic-circuit analysis and introduce magnetic materials
- Constructional details, the principle of operation, prediction of performance, the methods of testing the transformers and three phase transformer connections.
- Working principles of electrical machines using the concepts of electromechanical energy conversion principles and derive expressions for generated voltage and torque developed in all Electrical Machines.
- Working principles of DC machines as Generator types, determination of their no-load/load characteristics, starting and methods of speed control of motors.
- Various losses taking place in D.C. Motor and to study the different testing methods to arrive at their performance.

UNIT I MAGNETIC CIRCUITS AND MAGNETIC MATERIALS 6+6

Magnetic circuits –Laws governing magnetic circuits - Flux linkage, Inductance and energy – Statically and Dynamically induced EMF - Torque – Properties of magnetic materials, Hysteresis and Eddy Current losses - AC excitation, introduction to permanent magnets- Transformer as a magnetically coupled circuit.

UNIT II TRANSFORMERS 6+6

Construction – principle of operation – equivalent circuit parameters – phasor diagrams, losses – testing – efficiency and voltage regulation-all day efficiency-Sumpner's test, per unit representation – inrush current - three phase transformers-connections – Scott Connection – Phasing of transformer– parallel operation of three phase transformers-auto transformer – tap changing transformers- tertiary winding.

UNIT III ELECTROMECHANICAL ENERGY CONVERSION AND CONCEPTS IN ROTATING MACHINES 6+6

Energy in magnetic system – Field energy and co energy-force and torque equations – singly and multiply excited magnetic field systems-mmf of distributed windings – Winding Inductances-, magnetic fields in rotating machines – rotating mmf waves – magnetic saturation and leakage fluxes.

UNIT IV DC GENERATORS 6+6

Construction and components of DC Machine – Principle of operation - Lap and wave windings-EMF equations– circuit model – armature reaction –methods of excitation-commutation - interpoles compensating winding –characteristics of DC generators.

UNIT V DC MOTORS 6+6

Principle and operations - types of DC Motors – Speed Torque Characteristics of DC Motors- starting and speed control of DC motors –Plugging, dynamic and regenerative braking- testing and efficiency – Retardation test- Swinburne's test and Hopkinson's test - Permanent Magnet DC (PMDC)motors-applications of DC Motor

OUTCOMES: **TOTAL : 60 PERIODS**

- Ability to analyze the magnetic-circuits.

- Ability to acquire the knowledge in constructional details of transformers.
- Ability to understand the concepts of electromechanical energy conversion.
- Ability to acquire the knowledge in working principles of DC Generator.
- Ability to acquire the knowledge in working principles of DC Motor
- Ability to acquire the knowledge in various losses taking place in D.C. Machines

TEXT BOOKS:

1. Stephen J. Chapman, 'Electric Machinery Fundamentals'4th edition, McGraw Hill Education Pvt. Ltd, 2010.
2. P.C. Sen'Principles of Electric Machines and Power Electronics' John Wiley & Sons; 3rd Edition 2013.
3. Nagrath, I.J. and Kothari.D.P., Electric Machines', McGraw-Hill Education, 2004

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1. Theodore Wildi, "Electrical Machines, Drives, and Power Systems", Pearson Education., (5th Edition), 2002.
2. B.R. Gupta ,'Fundamental of Electric Machines' New age International Publishers,3rd Edition ,Reprint 2015.
3. S.K. Bhattacharya, 'Electrical Machines' McGraw - Hill Education, New Delhi, 3rd Edition,2009.
4. Vincent Del Toro, 'Basic Electric Machines' Pearson India Education, 2016.
5. Surinder Pal Bali, 'Electrical Technology Machines & Measurements, Vol.II, Pearson, 2013.
6. Fitzgerald. A.E., Charles Kingsely Jr, Stephen D.Umans, 'Electric Machinery', Sixth edition, McGraw Hill Books Company, 2003.

19153C35	ELECTRON DEVICES AND CIRCUITS	L T P C
		3 0 0 4

OBJECTIVES:

The student should be made to:

- Understand the structure of basic electronic devices.
- Be exposed to active and passive circuit elements.
- Familiarize the operation and applications of transistor like BJT and FET.
- Explore the characteristics of amplifier gain and frequency response.
- Learn the required functionality of positive and negative feedback systems.

UNIT I PN JUNCTION DEVICES 9

PN junction diode –structure, operation and V-I characteristics, diffusion and transition capacitance - Rectifiers – Half Wave and Full Wave Rectifier,– Display devices- LED, Laser diodes, Zener diodecharacteristics- Zener Reverse characteristics – Zener as regulator

UNIT II TRANSISTORS AND THYRISTORS 9

BJT, JFET, MOSFET- structure, operation, characteristics and Biasing UJT, Thyristors and IGBT - Structure and characteristics.

UNIT III AMPLIFIERS 9

BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response –MOSFET small signal model– Analysis of CS and Source follower – Gain and frequency response- High frequency analysis.

UNIT IV MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER 9

BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis – FET input stages – Single tuned amplifiers – Gain and frequency response – Neutralization methods, power amplifiers – Types (Qualitative analysis).

UNIT V FEEDBACK AMPLIFIERS AND OSCILLATORS 9

Advantages of negative feedback – voltage / current, series , Shunt feedback –positive feedback – Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.

OUTCOMES: TOTAL : 45 PERIODS

Upon Completion of the course, the students will be ability to:

- Explain the structure and working operation of basic electronic devices.
- Able to identify and differentiate both active and passive elements
- Analyze the characteristics of different electronic devices such as diodes and transistors
- Choose and adapt the required components to construct an amplifier circuit.
- Employ the acquired knowledge in design and analysis of oscillators

TEXT BOOKS:

1. . David A. Bell ,"Electronic devices and circuits", Oxford University higher education, 5th edition 2008.
2. Sedra and smith, "Microelectronic circuits",7th Ed., Oxford University Press

REFERENCES:

1. Balbir Kumar, Shail.B.Jain, "Electronic devices and circuits" PHI learning private limited, 2nd edition 2014.
2. Thomas L.Floyd, "Electronic devices" Conventional current version, Pearson prentice hall, 10th Edition, 2017.
3. Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGraw Hill, 3rd Edition, 2003.
4. Robert L.Boylestad, "Electronic devices and circuit theory", 2002.
5. Robert B. Northrop, "Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation", CRC Press, 2004.

19153C36 **POWER PLANT ENGINEERING**

L	T	P	C
3	0	0	4

OBJECTIVE:

- Providing an overview of Power Plants and detailing the role of Mechanical Engineers in their operation and maintenance.

UNIT I COAL BASED THERMAL POWER PLANTS 9

Rankine cycle - improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.

UNIT II DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS 9

Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimisation. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.

UNIT III NUCLEAR POWER PLANTS 9

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : Boil*ing Water Reactor* (BWR), P*ressurized Water Reactor* (PW R), CANada Deuterium-Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

UNIT IV POWER FROM RENEWABLE ENERGY 9

Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, *Solar* Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.

UNIT V ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS 9

Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

OUTCOMES: **TOTAL : 45 PERIODS**

Upon the completion of this course the students will be able to

CO1 Explain the layout, construction and working of the components inside a thermal power plant.
CO2 Explain the layout, construction and working of the components inside a Diesel, Gas and Combined cycle power plants.
CO3 Explain the layout, construction and working of the components inside nuclear power plants.
CO4 Explain the layout, construction and working of the components inside Renewable energy power plants.
CO5 Explain the applications of power plants while extend their knowledge to power plant economics and environmental hazards and estimate the costs of electrical energy production.

TEXT BOOK:

1. Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008.

REFERENCES:

1. El-Wakil. M.M., "Power Plant Technology", Tata McGraw – Hill Publishing Company Ltd., 2010.
2. Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.
3. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, "Power Plant Engineering", Second Edition, Standard Handbook of McGraw – Hill, 1998

19153L37	ELECTRONICS LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES:

- To enability the students to understand the behavior of semiconductor device based on experimentation.

LIST OF EXPERIMENTS

1. Characteristics of Semiconductor diode and Zener diode
2. Characteristics of a NPN Transistor under common emitter , common collector and common base configurations
3. Characteristics of JFET and draw the equivalent circuit
4. Characteristics of UJT and generation of saw tooth waveforms
5. Design and Frequency response characteristics of a Common Emitter amplifier
6. Characteristics of photo diode & photo transistor, Study of light activated relay circuit
7. Design and testing of RC phase shift and LC oscillators
8. Single Phase half-wave and full wave rectifiers with inductive and capacitive filters
9. Differential amplifiers using FET
10. Study of CRO for frequency and phase measurements
11. Realization of passive filters

OUTCOMES:

- Ability to understand and analyse electronic circuits**.**

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Semiconductor devices like Diode, Zener Diode, NPN Transistors, JFET, UJT, Photo diode, Photo Transistor
2. Resistors, Capacitors and inductors
3. Necessary digital IC 8
4. Function Generators 10
5. Regulated 3 output Power Supply 5, ± 15V 10
6. CRO 10
7. Storage Oscilloscope 1
8. Bread boards
9. Atleast one demo module each for the listed equipments.
10. Component data sheets to be provided

19153L38	ELECTRICAL MACHINES LABORATORY-I	L	T	P	C
		0	0	3	2

OBJECTIVES:

- To expose the students to the operation of D.C. machines and transformers and give them experimental skill.

LIST OF EXPERIMENTS

1. Open circuit and load characteristics of DC shunt generator- critical resistance and critical speed.
2. Load characteristics of DC compound generator with differential and cumulative connections.
3. Load test on DC shunt motor.
4. Load test on DC compound motor.
5. Load test on DC series motor.
6. Swinburne's test and speed control of DC shunt motor.
7. Hopkinson's test on DC motor – generator set.
8. Load test on single-phase transformer and three phase transformers.
9. Open circuit and short circuit tests on single phase transformer.
10. Sumpner's test on single phase transformers.
11. Separation of no-load losses in single phase transformer.
12. Study of starters and 3-phase transformers connections.

OUTCOMES: **TOTAL: 60 PERIODS**

- Ability to understand and analyze DC Generator
- Ability to understand and analyze DC Motor
- Ability to understand and analyse Transformers.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. DC Shunt Motor with Loading Arrangement – 3 nos
2. DC Shunt Motor Coupled with Three phase Alternator – 1 No.
3. Single Phase Transformer – 4 nos
4. DC Series Motor with Loading Arrangement – 1 No.
5. DC compound Motor with Loading Arrangement – 1 No.
6. Three Phase Induction Motor with Loading Arrangement – 2 nos
7. Single Phase Induction Motor with Loading Arrangement – 1 No.
8. DC Shunt Motor Coupled With DC Compound Generator – 2 nos
9. DC Shunt Motor Coupled With DC Shunt Motor – 1 No.
10. Tachometer -Digital/Analog – 8 nos
11. Single Phase Auto Transformer – 2 nos
12. Three Phase Auto Transformer – 1 No.
13. Single Phase Resistive Loading Bank – 2 nos
14. Three Phase Resistive Loading Bank. – 2 nos

19149S41C	**NUMERICAL METHODS**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

OBJECTIVES :

- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals in real life situations.
- To acquaint the student with understanding of numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.
- To understand the knowledge of various techniques and methods of solving various types of partial differential equations.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 12

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

UNIT II INTERPOLATION AND APPROXIMATION 12

Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Difference operators and relations - Interpolation with equal intervals - Newton's forward and backward difference formulae.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 12

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's Method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 12

Single step methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge - Kutta method for solving first order equations - Multi step methods - Milne's and Adams - Bash forth predictor corrector methods for solving first order equations.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 12

Finite difference methods for solving second order two - point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

TOTAL : 60 PERIODS

OUTCOMES :

Upon successful completion of the course, students should be able to:

- Understand the basic concepts and techniques of solving algebraic and transcendental equations.
- Appreciate the numerical techniques of interpolation and error approximations in various intervals in real life situations.
- Apply the numerical techniques of differentiation and integration for engineering problems.
- Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
- Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

TEXTBOOKS :

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.

REFERENCES :

1. Brian Bradie, "A Friendly Introduction to Numerical Analysis", Pearson Education, Asia, New Delhi, 2007.
2. Gerald. C. F. and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6th Edition, New Delhi, 2006.
3. Mathews, J.H. "Numerical Methods for Mathematics, Science and Engineering", 2nd Edition, Prentice Hall, 1992.
4. Sankara Rao. K., "Numerical Methods for Scientists and Engineers", Prentice Hall of India Pvt. Ltd, 3rd Edition, New Delhi, 2007.
5. Sastry, S.S, "Introductory Methods of Numerical Analysis", PHI Learning Pvt. Ltd, 5th Edition, 2015.

19153C42	ELECTRICAL MACHINES – II	L	T	P	C
		2	2	0	4

OBJECTIVES:

To impart knowledge on the following Topics

- Construction and performance of salient and non – salient type synchronous generators.
- Principle of operation and performance of synchronous motor.
- Construction, principle of operation and performance of induction machines.
- Starting and speed control of three-phase induction motors.
- Construction, principle of operation and performance of single phase induction motors and special machines.

UNIT I SYNCHRONOUS GENERATOR 6+6

Constructional details – Types of rotors –winding factors- emf equation – Synchronous reactance – Armature reaction – Phasor diagrams of non salient pole synchronous generator connected to infinite bus--Synchronizing and parallel operation – Synchronizing torque -Change of excitation and mechanical input- Voltage regulation – EMF, MMF, ZPF and A.S.A methods – steady state power- angle characteristics– Two reaction theory –slip test -short circuit transients - Capability Curves

UNIT II SYNCHRONOUS MOTOR 6+6

Principle of operation – Torque equation – Operation on infinite bus bars - V and Inverted V curves – Power input and power developed equations – Starting methods – Current loci for constant power input, constant excitation and constant power developed-Hunting – natural frequency of oscillations – damper windings- synchronous condenser.

UNIT III THREE PHASE INDUCTION MOTOR 6+6

Constructional details – Types of rotors –- Principle of operation – Slip –cogging and crawling- Equivalent circuit – Torque-Slip characteristics - Condition for maximum torque – Losses and efficiency – Load test - No load and blocked rotor tests - Circle diagram – Separation of losses – Double cage induction motors –Induction generators – Synchronous induction motor.

UNIT IV STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR 6+6

Need for starting – Types of starters – DOL, Rotor resistance, Autotransformer and Star- delta starters – Speed control – Voltage control, Frequency control and pole changing – Cascaded connection-V/f control – Slip power recovery scheme-Braking of three phase induction motor: Plugging, dynamic braking and regenerative braking.

UNIT V SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES 6+6

Constructional details of single phase induction motor – Double field revolving theory and operation – Equivalent circuit – No load and blocked rotor test – Performance analysis – Starting methods of single-phase induction motors – Capacitor-start capacitor run Induction motor- Shaded pole induction motor - Linear induction motor – Repulsion motor - Hysteresis motor - AC series motor- Servo motors- Stepper motors - introduction to magnetic levitation systems.

TOTAL : 60 PERIODS

OUTCOMES:

- Ability to understand the construction and working principle of Synchronous Generator
- Ability to understand MMF curves and armature windings.
- Ability to acquire knowledge on Synchronous motor.
- Ability to understand the construction and working principle of Three phase Induction Motor
- Ability to understand the construction and working principle of Special Machines
- Ability to predetermine the performance characteristics of Synchronous Machines.

TEXT BOOKS:

1. A.E. Fitzgerald, Charles Kingsley, Stephen. D. Umans, 'Electric Machinery', Mc Graw Hill publishing Company Ltd, 2003.
2. Vincent Del Toro, 'Basic Electric Machines' Pearson India Education, 2016.
3. Stephen J. Chapman, 'Electric Machinery Fundamentals' 4^{th} edition, McGraw Hill Education Pvt. Ltd, 2010.

REFERENCES

1. D.P. Kothari and I.J. Nagrath, 'Electric Machines', McGraw Hill Publishing Company Ltd, 2002.
2. P.S. Bhimbhra, 'Electrical Machinery', Khanna Publishers, 2003.
3. M.N. Bandyopadhyay, Electrical Machines Theory and Practice, PHI Learning PVT LTD., New Delhi, 2009.
4. B.R.Gupta, 'Fundamental of Electric Machines' New age International Publishers, 3^{rd} Edition ,Reprint 2015.
5. Murugesh Kumar, 'Electric Machines', Vikas Publishing House Pvt. Ltd, 2002.
6. Alexander S. Langsdorf, 'Theory of Alternating-Current Machinery', McGraw Hill Publications, 2001.

19153C43	TRANSMISSION AND DISTRIBUTION	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To study the structure of electric power system and to develop expressions for the computation of transmission line parameters.
- To obtain the equivalent circuits for the transmission lines based on distance and to determine voltage regulation and efficiency.
- To understand the mechanical design of transmission lines and to analyze the voltage distribution in insulator strings to improve the efficiency.
- To study the types, construction of cabilitys and methods to improve the efficiency.
- To study about distribution systems, types of substations, methods of grounding, EHVAC, HVDC and FACTS.

UNIT I TRANSMISSION LINE PARAMETERS 9

Structure of Power System - Parameters of single and three phase transmission lines with single and double circuits -Resistance, inductance and capacitance of solid, stranded and bundled conductors, Symmetrical and unsymmetrical spacing and transposition - application of self and mutual GMD; skin and proximity effects -Typical configurations, conductor types and electrical parameters of EHV lines.

UNIT II MODELLING AND PERFORMANCE OF TRANSMISSION LINES 9

Performance of Transmission lines - short line, medium line and long line - equivalent circuits, phasor diagram, attenuation constant, phase constant, surge impedance - transmission efficiency and voltage regulation, real and reactive power flow in lines - Power Circle diagrams - Formation of Corona – Critical Voltages – Effect on Line Performance.

UNIT III MECHANICAL DESIGN OF LINES 9

Mechanical design of OH lines – Line Supports –Types of towers – Stress and Sag Calculation – Effects of Wind and Ice loading. Insulators: Types, voltage distribution in insulator string, improvement of string efficiency, testing of insulators.

UNIT IV UNDER GROUND CABILITYS 9

Underground cabilitys - Types of cabilitys – Construction of single core and 3 core Cabilitys - Insulation Resistance – Potential Gradient - Capacitance of Single-core and 3 core cabilitys - Grading of cabilitys - Power factor and heating of cabilitys– DC cabilitys.

UNIT V DISTRIBUTION SYSTEMS 9

Distribution Systems – General Aspects – Kelvin’s Law – AC and DC distributions - Techniques of Voltage Control and Power factor improvement – Distribution Loss –Types of Substations -Methods of Grounding – Trends in Transmission and Distribution: EHVAC, HVDC and FACTS (Qualitative treatment only).

TOTAL : 45 PERIODS

OUTCOMES:

- To understand the importance and the functioning of transmission line parameters.
- To understand the concepts of Lines and Insulators.
- To acquire knowledge on the performance of Transmission lines.
- To acquire knowledge on Underground Cabilitys
- To become familiar with the function of different components used in Transmission and Distribution levels of power system and modelling of these components.

TEXT BOOKS:

1. D.P.Kothari, I.J. Nagarath, ‘Power System Engineering’, Mc Graw-Hill Publishing Company limited, New Delhi, Second Edition, 2008.
2. C.L.Wadhwa, ‘Electrical Power Systems’, New Academic Science Ltd, 2009.
3. S.N. Singh, ‘Electric Power Generation, Transmission and Distribution’, Prentice Hall of India Pvt. Ltd, New Delhi, Second Edition, 2011.

REFERENCES

1. B.R.Gupta, ‘Power System Analysis and Design’ S. Chand, New Delhi, Fifth Edition, 2008.
2. Luces M.Fualken berry, Walter Coffer, ‘Electrical Power Distribution and Transmission’, Pearson Education, 2007.
3. Arun Ingole, "power transmission and distribution" Pearson Education, 2017
4. J.Brian, Hardy and Colin R.Bayliss ‘Transmission and Distribution in Electrical Engineering’, Newnes; Fourth Edition, 2012.
5. G.Ramamurthy, “Handbook of Electrical power Distribution,” Universities Press, 2013.
6. V.K.Mehta, Rohit Mehta, ‘Principles of power system’, S. Chand & Company Ltd, New Delhi, 2013

19153C44	MEASUREMENTS AND INSTRUMENTATION	L	T	P	C
		3	1	0	4

OBJECTIVES:

To impart knowledge on the following Topics

- Basic functional elements of instrumentation
- Fundamentals of electrical and electronic instruments
- Comparison between various measurement techniques
- Various storage and display devices
- Various transducers and the data acquisition systems

UNIT I INTRODUCTION 9

Functional elements of an instrument – Static and dynamic characteristics – Errors in measurement – Statistical evaluation of measurement data – Standards and calibration- Principle and types of analog and digital voltmeters, ammeters.

UNIT II ELECTRICAL AND ELECTRONIC INSTRUMENTS 9

Principle and types of multi meters – Single and three phase watt meters and energy meters – Magnetic measurements – Determination of B-H curve and measurements of iron loss – Instrument transformers – Instruments for measurement of frequency and phase.

UNIT III COMPARATIVE METHODS OF MEASUREMENTS 9

D.C potentiometers, D.C (Wheat stone, Kelvin and Kelvin Double bridge) & A.C bridges (Maxwell, Anderson and Schering bridges), transformer ratio bridges, self-balancing bridges. Interference & screening – Multiple earth and earth loops - Electrostatic and electromagnetic Interference – Grounding techniques.

UNIT IV STORAGE AND DISPLAY DEVICES 9

Magnetic disk and tape – Recorders, digital plotters and printers, CRT display, digital CRO, LED, LCD & Dot matrix display – Data Loggers.

UNIT V TRANSDUCERS AND DATA ACQUISITION SYSTEMS 9

Classification of transducers – Selection of transducers – Resistive, capacitive & inductive Transducers – Piezoelectric, Hall effect, optical and digital transducers – Elements of data acquisition system – Smart sensors-Thermal Imagers.

TOTAL : 45 PERIODS

OUTCOMES:

- To acquire knowledge on Basic functional elements of instrumentation
- To understand the concepts of Fundamentals of electrical and electronic instruments
- Ability to compare between various measurement techniques
- To acquire knowledge on Various storage and display devices
- To understand the concepts Various transducers and the data acquisition systems
- Ability to model and analyze electrical and electronic Instruments and understand the operational features of display Devices and Data Acquisition System.

TEXT BOOKS:

1. A.K. Sawhney, ‘A Course in Electrical & Electronic Measurements & Instrumentation’, Dhanpat Rai and Co, 2010.
2. J. B. Gupta, ‘A Course in Electronic and Electrical Measurements’, S. K. Kataria & Sons, Delhi, 2013.
3. Doebelin E.O. and Manik D.N., Measurement Systems – Applications and Design, Special Indian Edition, McGraw Hill Education Pvt. Ltd., 2007.

REFERENCES

1. H.S. Kalsi, ‘Electronic Instrumentation’, McGraw Hill, III Edition 2010.
2. D.V.S. Murthy, ‘Transducers and Instrumentation’, Prentice Hall of India Pvt Ltd, 2015.
3. David Bell, ‘ Electronic Instrumentation & Measurements’, Oxford University Press,2013.
4. Martin Reissland, ‘Electrical Measurements’, New Age International (P) Ltd., Delhi, 2001.
5. Alan. S. Morris, Principles of Measurements and Instrumentation, 2nd Edition, Prentice Hall of India, 2003.

19153C45	LINEAR INTEGRATED CIRCUITS AND APPLICATIONS	L	T	P	C
		3	1	0	4

OBJECTIVES:

To impart knowledge on the following topics

- Signal analysis using Op-amp based circuits.
- Applications of Op-amp.
- Functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits.
- IC fabrication procedure.

UNIT I IC FABRICATION 9

IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realisation of monolithic ICs and packaging. Fabrication of diodes, capacitance, resistance, FETs and PV Cell.

UNIT II CHARACTERISTICS OF OPAMP 9

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – Inverting and Non-inverting Amplifiers, summer, differentiator and integrator-V/I & I/V converters.

UNIT III APPLICATIONS OF OPAMP 9

Instrumentation amplifier and its applications for transducer Bridge, Log and Antilog Amplifiers- Analog multiplier & Divider, first and second order active filters, comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R- 2R ladder and weighted resistor types), A/D converters using opamps.

UNIT IV SPECIAL ICs 9

Functional block, characteristics of 555 Timer and its PWM application - IC-566 voltage controlled oscillator IC; 565-phase locked loop IC, AD633 Analog multiplier ICs.

UNIT V APPLICATION ICs 9

AD623 Instrumentation Amplifier and its application as load cell weight measurement - IC voltage regulators –LM78XX, LM79XX; Fixed voltage regulators its application as Linear power supply - LM317, 723 Variability voltage regulators, switching regulator- SMPS - ICL 8038 function generator IC.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to acquire knowledge in IC fabrication procedure
- Ability to analyze the characteristics of Op-Amp
- To understand the importance of Signal analysis using Op-amp based circuits.
- Functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits.
- To understand and acquire knowledge on the Applications of Op-amp
- Ability to understand and analyse, linear integrated circuits their Fabrication and Application.

TEXT BOOKS:

1. David A. Bell, ‘Op-amp & Linear ICs’, Oxford, 2013.

2. D. Roy Choudhary, Sheil B. Jani, ‘Linear Integrated Circuits’, II edition, New Age, 2003.

3. Ramakant A.Gayakward, ‘Op-amps and Linear Integrated Circuits’, IV edition, Pearson Education, 2003 / PHI. 2000.

REFERENCES

1. Fiore,”Opamps & Linear Integrated Circuits Concepts & applications”, Cengage, 2010.

2. Floyd ,Buchla,”Fundamentals of Analog Circuits, Pearson, 2013.

3. Jacob Millman, Christos C.Halkias, ‘Integrated Electronics - Analog and Digital circuits system’, McGraw Hill, 2003.

4. Robert F.Coughlin, Fredrick F. Driscoll, ‘Op-amp and Linear ICs’, Pearson, 6th edition,2012.

5. Sergio Franco, ‘Design with Operational Amplifiers and Analog Integrated Circuits’, Mc Graw Hill, 2016.

6. Muhammad H. Rashid,’ Microelectronic Circuits Analysis and Design’ Cengage Learning, 2011.

19153C46 CONTROL SYSTEMS L T P C

2 2 0 4

COURSE OBJECTIVES

- To understand the use of transfer function models for analysis physical systems and introduce the control system components.
- To provide adequate knowledge in the time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of systems.
- To introduce stability analysis and design of compensators

UNIT I SYSTEMS AND REPRESENTATION 9

Basic elements in control systems: – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs.

UNIT II TIME RESPONSE 9

Time response: – Time domain specifications – Types of test input – I and II order system response – Error coefficients – Generalized error series – Steady state error – Root locus construction- Effects of P, PI, PID modes of feedback control –Time response analysis.

UNIT III FREQUENCY RESPONSE 9

Frequency response: – Bode plot – Polar plot – Determination of closed loop response from open loop response - Correlation between frequency domain and time domain specifications

UNIT IV STABILITY AND COMPENSATOR DESIGN 9

Characteristics equation – Routh Hurwitz criterion – Nyquist stability criterion- Performance criteria – Effect of Lag, lead and lag-lead compensation on frequency response-Design of Lag, lead and lag- lead compensator using bode plots.

UNIT V STATE VARIABLE ANALYSIS 9

Concept of state variables – State models for linear and time invariant Systems – Solution of state and output equation in controllable canonical form – Concepts of controllability and observability.

TOTAL (L: 45+T:30): 75 PERIODS

COURSE OUTCOMES

At the end of the course, the student should have the :

- Ability to develop various representations of system based on the knowledge of
- Mathematics, Science and Engineering fundamentals.
- Ability to do time domain and frequency domain analysis of various models of linear system.
- Ability to interpret characteristics of the system to develop mathematical model.
- Ability to design appropriate compensator for the given specifications.
- Ability to come out with solution for complex control problem.
- Ability to understand use of PID controller in closed loop system.

TEXT BOOKS

1. Nagarath, I.J. and Gopal, M., “Control Systems Engineering”, New Age International Publishers, 2017.
2. Benjamin C. Kuo, “Automatic Control Systems”, Wiley, 2014.

REFERENCES

1. Katsuhiko Ogata, “Modern Control Engineering”, Pearson, 2015.
2. Richard C.Dorf and Bishop, R.H., “Modern Control Systems”, Pearson Education,2009.
3. John J.D., Azzo Constantine, H. and Houpis Sttuart, N Sheldon, “Linear Control System Analysis and Design with MATLAB”, CRC Taylor& Francis Reprint 2009.
4. Rames C.Panda and T. Thyagarajan, “An Introduction to Process Modelling Identification and Control of Engineers”, Narosa Publishing House, 2017.
5. M.Gopal, “Control System: Principle and design”, McGraw Hill Education, 2012.
6. NPTEL Video Lecture Notes on “Control Engineering “by Prof. S. D. Agashe, IIT Bombay.

19153L47	ELECTRICAL MACHINES LABORATORY - II	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To expose the students to the operation of synchronous machines and induction motors and give them experimental skill.

LIST OF EXPERIMENTS

1. Regulation of three phase alternator by EMF and MMF methods.
2. Regulation of three phase alternator by ZPF and ASA methods.
3. Regulation of three phase salient pole alternator by slip test.
4. Measurements of negative sequence and zero sequence impedance of alternators.
5. V and Inverted V curves of Three Phase Synchronous Motor.
6. Load test on three-phase induction motor.
7. No load and blocked rotor tests on three-phase induction motor (Determination of equivalent circuit parameters).
8. Separation of No-load losses of three-phase induction motor.
9. Load test on single-phase induction motor.
10. No load and blocked rotor test on single-phase induction motor.
11. Study of Induction motor Starters

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course, the student should have the :

- Ability to understand and analyze EMF and MMF methods
- Ability to analyze the characteristics of V and Inverted V curves
- Ability to understand the importance of Synchronous machines
- Ability to understand the importance of Induction Machines
- Ability to acquire knowledge on separation of losses

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Synchronous Induction motor 3HP – 1 No.
2. DC Shunt Motor Coupled With Three phase Alternator – 4 nos
3. DC Shunt Motor Coupled With Three phase Slip ring Induction motor – 1 No.
4. Three Phase Induction Motor with Loading Arrangement – 2 nos
5. Single Phase Induction Motor with Loading Arrangement – 2 nos
6. Tachometer -Digital/Analog – 8 nos
7. Single Phase Auto Transformer – 2 nos
8. Three Phase Auto Transformer – 3 nos
9. Single Phase Resistive Loading Bank – 2 nos
10. Three Phase Resistive Loading Bank – 2 nos
11. Capacitor Bank – 1 No.

19153L48 **LINEAR AND DIGITAL INTEGRATED CIRCUITS LABORATORY**

L	T	P	C
0	0	4	2

OBJECTIVES:

- To learn design, testing and characterizing of circuit behavior with digital and analog ICs.

LIST OF EXPERIMENTS

1. Implementation of Boolean Functions, Adder and Subtractor circuits.
2. Code converters: Excess-3 to BCD and Binary to Gray code converter and vice-versa
3. Parity generator and parity checking
4. Encoders and Decoders
5. Counters: Design and implementation of 3-bit modulo counters as synchronous and Asynchronous types using FF IC's and specific counter IC.
6. Shift Registers: Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitability IC's.
7. Study of multiplexer and de multiplexer
8. Timer IC application: Study of NE/SE 555 timer in Astability, Monostability operation.
9. Application of Op-Amp: inverting and non-inverting amplifier, Adder, comparator, Integrator and Differentiator.
10. Voltage to frequency characteristics of NE/ SE 566 IC.
11. Variability Voltage Regulator using IC LM317.

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course, the student should have the :

- Ability to understand and implement Boolean Functions.
- Ability to understand the importance of code conversion
- Ability to Design and implement 4-bit shift registers
- Ability to acquire knowledge on Application of Op-Amp
- Ability to Design and implement counters using specific counter IC.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS: (3 per Batch)

S.No	Name of the equipments / Components	Quantity Required	Remarks
1	Dual ,(0-30V) variability Power Supply	10	-
2	CRO	9	30MHz
3	Digital Multimeter	10	Digital
4	Function Generator	8	1 MHz
5	IC Tester (Analog)	2	
6	Bread board	10	

7	Computer (PSPICE installed)	1	
Consumabilitys (sufficient quantity)			
1	IC 741/ IC NE555/566/565		
2	Digital IC types		
3	LED		
4	LM317		
5	LM723		
6	ICSG3524 / SG3525		
7	Transistor – 2N3391		
8	Diodes, IN4001,BY126		
9	Zener diodes		
10	Potentiometer		
11	Step-down transformer 230V/12-0-12V		
12	Capacitor		
13	Resistors 1/4 Watt Assorted		
14	Single Strand Wire		

19153C51 **POWER SYSTEM ANALYSIS**

L	T	P	C
3	1	0	4

OBJECTIVES:

- To model the power system under steady state operating condition
- To understand and apply iterative techniques for power flow analysis
- To model and carry out short circuit studies on power system
- To model and analyze stability problems in power system

UNIT I POWER SYSTEM 9

Need for system planning and operational studies - Power scenario in India - Power system components – Representation - Single line diagram - per unit quantities - p.u. impedance diagram - p.u. reactance diagram - Network graph, Bus incidence matrix, Primitive parameters, Bus admittance matrix from primitive parameters - Representation of off- nominal transformer - Formation of bus admittance matrix of large power network.

UNIT II POWER FLOW ANALYSIS 9

Bus classification - Formulation of Power Flow problem in polar coordinates - Power flow solution using Gauss Seidel method - Handling of Voltage controlled buses - Power Flow Solution by Newton Raphson method.

UNIT III SYMMETRICAL FAULT ANALYSIS 9

Assumptions in short circuit analysis - Symmetrical short circuit analysis using Thevenin's theorem - Bus Impedance matrix building algorithm (without mutual coupling) - Symmetrical fault analysis through bus impedance matrix - Post fault bus voltages - Fault level - Current limiting reactors.

UNIT IV UNSYMMETRICAL FAULT ANALYSIS 9

Symmetrical components - Sequence impedances - Sequence networks - Analysis of unsymmetrical faults at generator terminals: LG, LL and LLG - unsymmetrical fault occurring at any point in a power system - computation of post fault currents in symmetrical component and phasor domains.

UNIT V STABILITY ANALYSIS 9

Classification of power system stability – Rotor angle stability - Swing equation - Swing curve - Power-Angle equation - Equal area criterion - Critical clearing angle and time - Classical step-by-step solution of the swing equation – modified Euler method.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to model the power system under steady state operating condition
- Ability to understand and apply iterative techniques for power flow analysis
- Ability to model and carry out short circuit studies on power system
- Ability to model and analyze stability problems in power system
- Ability to acquire knowledge on Fault analysis.
- Ability to model and understand various power system components and carry out power flow, short circuit and stability studies.

TEXT BOOKS:

1. John J. Grainger, William D. Stevenson, Jr, ‘Power System Analysis’, Mc Graw Hill Education (India) Private Limited, New Delhi, 2015.
2. Kothari D.P. and Nagrath I.J., ‘Power System Engineering’, Tata McGraw-Hill Education, Second Edition, 2008.
3. Hadi Saadat, ‘Power System Analysis’, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.

REFERENCES

1. Pai M A, ‘Computer Techniques in Power System Analysis’, Tata Mc Graw-Hill Publishing Company Ltd., New Delhi, Second Edition, 2007.
2. J. Duncan Glover, Mulukutla S.Sarma, Thomas J. Overbye, ‘Power System Analysis & Design’, Cengage Learning, Fifth Edition, 2012.
3. Gupta B.R., ‘Power System - Analysis and Design’, S. Chand Publishing, 2001.
4. Kundur P., ‘Power System Stability and Control’, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.

19153C52	MICROPROCESSORS AND MICROCONTROLLERS	L	T	P	C
		4	0	0	4

OBJECTIVES:

To impart knowledge on the following Topics

- Architecture of µP8085 & µC 8051
- Addressing modes & instruction set of 8085 & 8051.
- Need & use of Interrupt structure 8085 & 8051.
- Simple applications development with programming 8085 & 8051

UNIT I 8085 PROCESSOR 9

Hardware Architecture, pinouts – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts.

UNIT II PROGRAMMING OF 8085 PROCESSOR 9

Instruction -format and addressing modes – Assembly language format – Data transfer, data manipulation& control instructions – Programming: Loop structure with counting & Indexing – Look up tability - Subroutine instructions - stack.

UNIT III 8051 MICRO CONTROLLER 9

Hardware Architecture, pinouts – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts- Data Transfer, Manipulation, Control Algorithms& I/O instructions, Comparison to Programming concepts with 8085.

UNIT IV PERIPHERAL INTERFACING 9

Study on need, Architecture, configuration and interfacing, with ICs: 8255, 8259, 8254, 8279, - A/D and D/A converters &Interfacing with 8085& 8051.

UNIT V MICRO CONTROLLER PROGRAMMING & APPLICATIONS 9

Simple programming exercises- key board and display interface –Control of servo motor- stepper motor control- Application to automation systems.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to acquire knowledge in Addressing modes & instruction set of 8085 & 8051.
- Ability to need & use of Interrupt structure 8085 & 8051.
- Ability to understand the importance of Interfacing
- Ability to explain the architecture of Microprocessor and Microcontroller.
- Ability to write the assembly language programme.
- Ability to develop the Microprocessor and Microcontroller based applications.

TEXT BOOKS:

1. Sunil Mathur &Jeebananda Panda, "Microprocessor and Microcontrollers", PHI Learning Pvt. Ltd, 2016.
2. R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', with 8085, Wiley Eastern Ltd., New Delhi, 2013.
3. Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely 'The 8051 Micro Controller and Embedded Systems', PHI Pearson Education, 5th Indian reprint, 2003.

REFERENCES

1. Krishna Kant, "Microprocessor and Microcontrollers", Eastern Company Edition, Prentice Hall of India, New Delhi, 2007.
2. B.RAM," Computer Fundamentals Architecture and Organization" New age International Private Limited, Fifth edition, 2017.
3. Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051,McGraw Hill Edu,2013.
4. Ajay V.Deshmukh, 'Microcontroller Theory &Applications', McGraw Hill Edu,2016
5. Douglas V.Hall, 'Microprocessor and Interfacing', McGraw Hill Edu,2016.

19153C53	POWER ELECTRONICS	L	T	P	C
		4	0	0	4

OBJECTIVES:

To impart knowledge on the following Topics

- Different types of power semiconductor devices and their switching
- Operation, characteristics and performance parameters of controlled rectifiers
- Operation, switching techniques and basics topologies of DC-DC switching regulators.
- Different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
- Operation of AC voltage controller and various configurations.

UNIT I POWER SEMI-CONDUCTOR DEVICES 9

Study of switching devices, SCR, TRIAC, GTO, BJT, MOSFET, IGBT and IGCT- Static characteristics: SCR, MOSFET and IGBT - Triggering and commutation circuit for SCR- Introduction to Driver and snubber circuits.

UNIT II PHASE-CONTROLLED CONVERTERS 9

2-pulse, 3-pulse and 6-pulseconverters– performance parameters –Effect of source inductance–– Firing Schemes for converter–Dual converters, Applications-light dimmer, Excitation system, Solar PV systems.

UNIT III DC TO DC CONVERTERS 9

Step-down and step-up chopper-control strategy– Introduction to types of choppers-A, B, C, D and E -Switched mode regulators- Buck, Boost, Buck- Boost regulator, Introduction to Resonant Converters, Applications-Battery operated vehicles.

UNIT IV INVERTERS 9

Single phase and three phase voltage source inverters (both120^0 mode and 180^0 mode)– Voltage& harmonic control--PWM techniques: Multiple PWM, Sinusoidal PWM, modified sinusoidal PWM – Introduction to space vector modulation –Current source inverter, Applications-Induction heating, UPS.

UNIT V AC TO AC CONVERTERS 9

Single phase and Three phase AC voltage controllers–Control strategy- Power Factor Control – Multistage sequence control -single phase and three phase cyclo converters – Introduction to Matrix converters, Applications –welding .

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to analyse AC-AC and DC-DC and DC-AC converters.
- Ability to choose the converters for real time applications.

TEXT BOOKS:

1. M.H. Rashid, 'Power Electronics: Circuits, Devices and Applications', Pearson Education, Third Edition, New Delhi, 2004.
2. P.S.Bimbra "Power Electronics" Khanna Publishers, third Edition, 2003.
3. Ashfaq Ahmed 'Power Electronics for Technology', Pearson Education, Indian reprint, 2003.

REFERENCES

1. Joseph Vithayathil,' Power Electronics, Principles and Applications', McGraw Hill Series, 6^{th} Reprint, 2013.
2. Philip T. Krein, "Elements of Power Electronics" Oxford University Press, 2004 Edition.
3. L. Umanand, "Power Electronics Essentials and Applications", Wiley, 2010.
4. Ned Mohan Tore. M. Undel and, William. P. Robbins, 'Power Electronics: Converters, Applications and Design', John Wiley and sons, third edition, 2003.
5. S.Rama Reddy, 'Fundamentals of Power Electronics', Narosa Publications, 2014.
6. M.D. Singh and K.B. Khanchandani, "Power Electronics," Mc Graw Hill India, 2013.
7. JP Agarwal," Power Electronic Systems: Theory and Design" 1e, Pearson Education, 2002.

19153C55	DIGITAL SIGNAL PROCESSING	L	T	P	C
		2	2	0	4

OBJECTIVES: To impart knowledge about the following topics:

- Signals and systems & their mathematical representation.
- Discrete time systems.
- Transformation techniques & their computation. Filters and
- their design for digital implementation. Programmability digital
- signal processor & quantization effects.

UNIT I INTRODUCTION 6+6

Classification of systems: Continuous, discrete, linear, causal, stability, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect.

UNIT II DISCRETE TIME SYSTEM ANALYSIS 6+6

Z-transform and its properties, inverse z-transforms; difference equation – Solution by z-transform, application to discrete systems - Stability analysis, frequency response – Convolution – Discrete Time Fourier transform , magnitude and phase representation.

UNIT III DISCRETE FOURIER TRANSFORM & COMPUTATION 6+6

Discrete Fourier Transform- properties, magnitude and phase representation - Computation of DFT using FFT algorithm – DIT &DIF using radix 2 FFT – Butterfly structure.

UNIT IV DESIGN OF DIGITAL FILTERS 6+6

FIR & IIR filter realization – Parallel & cascade forms. FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics. Analog filter design – Butterworth and Chebyshev approximations; IIR Filters, digital design using impulse invariant and bilinear transformation Warping, pre warping.

UNIT V DIGITAL SIGNAL PROCESSORS 6+6

Introduction – Architecture – Features – Addressing Formats – Functional modes - Introduction to Commercial DS Processors.

TOTAL : 60 PERIODS

OUTCOMES:

1. Ability to understand the importance of Fourier transform, digital filters and DS Processors.
2. Ability to acquire knowledge on Signals and systems & their mathematical representation.
3. Ability to understand and analyze the discrete time systems.
4. Ability to analyze the transformation techniques & their computation.
5. Ability to understand the types of filters and their design for digital implementation.
6. Ability to acquire knowledge on programmability digital signal processor & quantization effects.

TEXT BOOKS:

1. J.G. Proakis and D.G. Manolakis, ‘Digital Signal Processing Principles, Algorithms and Applications’, Pearson Education, New Delhi, PHI. 2003.

2. S.K. Mitra, ‘Digital Signal Processing – A Computer Based Approach’, McGraw Hill Edu, 2013.
3. Lonnie C.Ludeman ,”Fundamentals of Digital Signal Processing”,Wiley,2013

REFERENCES

1. Poorna Chandra S, Sasikala. B ,Digital Signal Processing, Vijay Nicole/TMH,2013.
2. Robert Schilling & Sandra L.Harris, Introduction to Digital Signal Processing using Matlab”, Cengage Learning,2014.
3. B.P.Lathi, ‘Principles of Signal Processing and Linear Systems’, Oxford University Press, 2010 3. Taan S. ElAli, ‘Discrete Systems and Digital Signal Processing with Mat Lab’, CRC Press, 2009.
4. SenM.kuo, woonseng…s.gan, “Digital Signal Processors, Architecture, Implementations & Applications, Pearson,2013
5. DimitrisG.Manolakis, Vinay K. Ingle, applied Digital Signal Processing,Cambridge,2012

19153C56	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To understand Object Oriented Programming concepts and basic characteristics of Java
- To know the principles of packages, inheritance and interfaces
- To define exceptions and use I/O streams
- To develop a java application with threads and generics classes
- To design and build simple Graphical User Interfaces

UNIT I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 10

Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism- OOP in Java – Characteristics of Java – The Java Environment - Java Source File -Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers - static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays , Packages - JavaDoc comments.

UNIT II INHERITANCE AND INTERFACES 9

Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces - Object cloning -inner classes, Array Lists - Strings

UNIT III EXCEPTION HANDLING AND I/O 9

Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files

UNIT IV MULTITHREADING AND GENERIC PROGRAMMING 8

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations.

UNIT V EVENT DRIVEN PROGRAMMING 9

Graphics programming - Frame – Components - working with 2D shapes - Using color, fonts, and images - Basics of event handling - event handlers - adapter classes - actions - mouse events - AWT event hierarchy - Introduction to Swing – layout management - Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows –Menus – Dialog Boxes.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of the course, students will be able to:

- Develop Java programs using OOP principles
- Develop Java programs with the concepts inheritance and interfaces
- Build Java applications using exceptions and I/O streams
- Develop Java applications with threads and generics classes
- Develop interactive Java programs using swings

TEXT BOOKS

1. Herbert Schildt, “Java The complete reference”, 8th Edition, McGraw Hill Education, 2011.
2. Cay S. Horstmann, Gary cornell, “Core Java Volume –I Fundamentals”, 9th Edition, Prentice Hall, 2013.

REFERENCES

1. Paul Deitel, Harvey Deitel, “Java SE 8 for programmers”, 3rd Edition, Pearson, 2015.
2. Steven Holzner, “Java 2 Black book”, Dreamtech press, 2011.
3. Timothy Budd, “Understanding Object-oriented programming with Java”, Updated Edition, Pearson Education, 2000.

19153L57	CONTROL AND INSTRUMENTATION LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES:

- To provide knowledge on analysis and design of control system along with basics of instrumentation.

LIST OF EXPERIMENTS

CONTROLSYSTEMS:

1. P, PI and PID controllers
2. Stability Analysis
3. Modeling of Systems – Machines, Sensors and Transducers
4. Design of Lag, Lead and Lag-Lead Compensators
5. Position Control Systems
6. Synchro-Transmitter- Receiver and Characteristics
7. Simulation of Control Systems by Mathematical development tools.

INSTRUMENTATION:

8. Bridge Networks –AC and DC Bridges
9. Dynamics of Sensors/Transducers

   (a) Temperature (b) pressure (c) Displacement (d) Optical (e) Strain (f) Flow

10 Power and Energy Measurement

11 Signal Conditioning

   (a) Instrumentation Amplifier

   (b) Analog – Digital and Digital –Analog converters (ADC and DACs)

12 Process Simulation

TOTAL: 60 PERIODS

OUTCOMES:

- Ability to understand control theory and apply them to electrical engineering problems.
- Ability to analyze the various types of converters.
- Ability to design compensators
- Ability to understand the basic concepts of bridge networks.
- Ability to the basics of signal conditioning circuits.
- Ability to study the simulation packages.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CONTROLSYSTEMS:

1. PID controller simulation and learner kit – 1 No.
2. Digital storage Oscilloscope for capturing transience- 1 No

   2 Personal Computer with control system

   simulation packages - 10 Nos

3. DC motor –Generator test set-up for evaluation of motor parameters
4. CRO 30MHz – 1 No.
5. 2MHz Function Generator – 1No.
6. Position Control Systems Kit (with manual) – 1 No., Tacho Generator Coupling set
7. AC Synchro transmitter& receiver – 1No.
8. Sufficient number of Digital multi meters, speed and torque sensors

INSTRUMENTATION:

9. R, L, C Bridge kit (with manual)
10. a) Electric heater – 1No.
    Thermometer – 1No.Thermistor (silicon type) RTD nickel type – 1No.

    b) 30 psi Pressure chamber (complete set) – 1No. Current generator (0 – 20mA) Air foot pump – 1 No. (with necessary connecting tubes)

    c) LVDT20mm core length movability type – 1No. CRO 30MHz – 1No. d)

    Optical sensor – 1 No. Light source

    e) Strain Gauge Kit with Handy lever beam – 1No.

100gm weights – 10 nos
f) Flow measurement Trainer kit – 1 No.
(1/2 HP Motor, Water tank, Digital Milliammeter, complete set)

11. Single phase Auto transformer – 1No. Watt-hour meter (energy meter) – 1No. Ammeter Voltmeter Rheostat Stop watch
    Connecting wires (3/20)
12. IC Transistor kit – 1No.
13. Instrumentation Amplifier kit-1 No
14. Analog – Digital and Digital –Analog converters (ADC and DACs)- 1 No

19153L58 OBJECT ORIENTED PROGRAMMING LABORATORY

L T P C
0 0 3 2

COURSE OBJECTIVES

- To build software development skills using java programming for real-world applications.
- To understand and apply the concepts of classes, packages, interfaces, arraylist, exception handling and file processing.
- To develop applications using generic programming and event handling.

List of experiments

1. Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection(i.e domestic or commercial). Compute the bill amount using the following tariff. If the type of the EB connection is domestic, calculate the amount to be paid as follows:
   - First 100 units - Rs. 1 per unit
   - 101-200 units - Rs. 2.50 per unit
   - 201 -500 units - Rs. 4 per unit
   - > 501 units - Rs. 6 per unit

If the type of the EB connection is commercial, calculate the amount to be paid as follows:
   - First 100 units - Rs. 2 per unit
   - 101-200 units - Rs. 4.50 per unit
   - 201 -500 units - Rs. 6 per unit
   - > 501 units - Rs. 7 per unit

2. Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa) , time converter (hours to minutes, seconds and vice versa) using packages.
3. Develop a java application with Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
4. Design a Java interface for ADT Stack. Implement this interface using array. Provide necessary exception handling in both the implementations.
5. Write a program to perform string operations using ArrayList. Write functions for the following

   a. Append - add at end
   b. Insert – add at particular index c.
   Search
   d. List all string starts with given letter

6. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.
7. Write a Java program to implement user defined exception handling.
8. Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes.
9. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
10. Write a java program to find the maximum value from the given type of elements using a generic function.
11. Design a calculator using event-driven programming paradigm of Java with the following options.

    a) Decimal manipulations b)
    Scientific manipulations
12. Develop a mini project for any application using Java concepts.

COURSE OUTCOMES **TOTAL : 60 PERIODS**

Upon completion of the course, the students will be able to
- Develop and implement Java programs for simple applications that make use of classes, packages and interfaces.
- Develop and implement Java programs with arraylist, exception handling and multithreading .
- Design applications using file processing, generic programming and event handling.

19153L59 PROFESSIONAL COMMUNICATION

L	T	P	C
0	0	2	1

OBJECTIVES: The course aims to:

- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employability Graduates
- Develop their confidence and help them attend interviews successfully.

UNIT I

Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs

UNIT II

Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations

UNIT III

Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic -— questioning and clarifying –GD strategies- activities to improve GD skills

UNIT IV

Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews

UNIT V

Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long- term career plan-making career changes.

TOTAL : 30 PERIODS

OUTCOMES: At the end of the course Learners will be ability to:

- Make effective presentations
- Participate confidently in Group Discussions.
- Attend job interviews and be successful in them.
- Develop adequate Soft Skills required for the workplace

Recommended Software

1. **Globearena**
2. **Win English**

REFERENCES:

1. Butterfield, Jeff **Soft Skills for Everyone.** Cengage Learning: New Delhi, 2015
2. **Interact** English Lab Manual for Undergraduate Students,. OrientBalckSwan: Hyderabad, 2016.
3. E. Suresh Kumar et al. **Communication for Professional Success.** Orient Blackswan: Hyderabad, 2015
4. Raman, Meenakshi and Sangeeta Sharma. **Professional Communication**. Oxford University Press: Oxford, 2014
5. S. Hariharanetal. **Soft Skills**. MJP Publishers: Chennai, 2010.

SOLID STATE DRIVES

19153C61

L	T	P	C
4	0	0	4

OBJECTIVES:

To impart knowledge on the following Topics

- Steady state operation and transient dynamics of a motor load system.
- Analyze the operation of the converter/chopper fed dc drive, both qualitatively and quantitatively.
- Operation and performance of AC motor drives.
- Analyze and design the current and speed controllers for a closed loop solid state DC motor drive.

UNIT I DRIVE CHARACTERISTICS 9

Electric drive – Equations governing motor load dynamics – steady state stability – multi quadrant Dynamics: acceleration, deceleration, starting & stopping – typical load torque characteristics – Selection of motor.

UNIT II CONVERTER / CHOPPER FED DC MOTOR DRIVE 9

Steady state analysis of the single and three phase converter fed separately excited DC motor drive– continuous conduction – Time ratio and current limit control – 4 quadrant operation of converter / chopper fed drive- Applications.

UNIT III INDUCTION MOTOR DRIVES 9

Stator voltage control–V/f control– Rotor Resistance control-qualitative treatment of slip power recovery drives-closed loop control–– vector control- Applications.

UNIT IV SYNCHRONOUS MOTOR DRIVES 9

V/f control and self-control of synchronous motor: Margin angle control and power factor control- Three phase voltage/current source fed synchronous motor- Applications.

UNIT V DESIGN OF CONTROLLERS FOR DRIVES 9

Transfer function for DC motor / load and converter – closed loop control with Current and speed feedback–armature voltage control and field weakening mode – Design of controllers; current controller and speed controller- converter selection and characteristics.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and suggest a converter for solid state drive.
- Ability to select suitability drive for the given application.
- Ability to study about the steady state operation and transient dynamics of a motor load system.
- Ability to analyze the operation of the converter/chopper fed dc drive.
- Ability to analyze the operation and performance of AC motor drives.
- Ability to analyze and design the current and speed controllers for a closed loop solid state DC motor drive.

TEXT BOOKS:

1. Gopal K.Dubey, Fundamentals of Electrical Drives, Narosa Publishing House, 1992.
2. Bimal K.Bose. Modern Power Electronics and AC Drives, Pearson Education, 2002.
3. R.Krishnan, Electric Motor & Drives: Modeling, Analysis and Control, Pearson, 2001.

REFERENCES

1. Vedam Subramanyam, “ Electric Drives Concepts and Applications ”, 2e, McGraw Hill, 2016

2. Shaahin Felizadeh, “Electric Machines and Drives”, CRC Press (Taylor and Francis Group), 2013.
3. John Hindmarsh and Alasdain Renfrew, “Electrical Machines and Drives System,” Elsevier 2012.
4. Theodore Wildi, “ Electrical Machines ,Drives and power systems ,6th edition, Pearson Education ,2015
5. N.K. De., P.K. SEN” Electric drives” PHI, 2012.

19153C62	PROTECTION AND SWITCHGEAR	L	T	P	C
		4	0	0	4

OBJECTIVES:

To impart knowledge on the following Topics

- Causes of abnormal operating conditions (faults, lightning and switching surges) of the apparatus and system.
- Characteristics and functions of relays and protection schemes.
- Apparatus protection, static and numerical relays
- Functioning of circuit breaker

UNIT I PROTECTION SCHEMES 9

Principles and need for protective schemes – nature and causes of faults – types of faults – Methods of Grounding - Zones of protection and essential qualities of protection – Protection scheme

UNIT II ELECTROMAGNETIC RELAYS 9

Operating principles of relays - the Universal relay – Torque equation – R-X diagram – Electromagnetic Relays – Over current, Directional, Distance, Differential, Negative sequence and Under frequency relays.

UNIT III APPARATUS PROTECTION 9

Current transformers and Potential transformers and their applications in protection schemes - Protection of transformer, generator, motor, bus bars and transmission line.

UNIT IV STATIC RELAYS AND NUMERICAL PROTECTION 9

Static relays – Phase, Amplitude Comparators – Synthesis of various relays using Static comparators – Block diagram of Numerical relays – Over current protection, transformer differential protection, distant protection of transmission lines.

UNIT V CIRCUIT BREAKERS 9

Physics of arcing phenomenon and arc interruption - DC and AC circuit breaking – re-striking voltage and recovery voltage - rate of rise of recovery voltage - resistance switching - current chopping - interruption of capacitive current - Types of circuit breakers – air blast, air break, oil, SF6, MCBs, MCCBs and vacuum circuit breakers – comparison of different circuit breakers – Rating and selection of Circuit breakers.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze Electromagnetic and Static Relays.
- Ability to suggest suitability circuit breaker.
- Ability to find the causes of abnormal operating conditions of the apparatus and system.

- Ability to analyze the characteristics and functions of relays and protection schemes.
- Ability to study about the apparatus protection, static and numerical relays.
- Ability to acquire knowledge on functioning of circuit breaker.

TEXT BOOKS:

1. Sunil S.Rao, ‘Switchgear and Protection’, Khanna Publishers, New Delhi, 2008.
2. B.Rabindranath and N.Chander, ‘Power System Protection and Switchgear’, New Age International (P) Ltd., First Edition 2011.
3. Arun Ingole, ‘Switch Gear and Protection’ Pearson Education, 2017.

REFERENCES

1. BadriRam ,B.H. Vishwakarma, ‘Power System Protection and Switchgear’, New Age InternationalPvt Ltd Publishers, Second Edition 2011.
2. Y.G.Paithankar and S.R.Bhide, ‘Fundamentals of power system protection’, Second Edition,Prentice Hall of India Pvt. Ltd., New Delhi, 2010.
3. C.L.Wadhwa, ‘Electrical Power Systems’, 6th Edition, New Age International (P) Ltd., 2010
4. RavindraP.Singh, ‘Switchgear and Power System Protection’, PHI Learning Private Ltd., NewDelhi, 2009.
5. VK Metha,” Principles of Power Systems” S. Chand, 2005.
6. Bhavesh Bhalja, R.P. Maheshwari, Nilesh G. Chotani,’Protection and Switchgear’ Oxford University Press, 2011.

19153C63	EMBEDDED SYSTEMS	L	T	P	C
		4	0	0	4

OBJECTIVES
:

To impart knowledge on the following Topics

- Building Blocks of Embedded System
- Various Embedded Development Strategies
- Bus Communication in processors, Input/output interfacing.
- Various processor scheduling algorithms.
- Basics of Real time operating system and example tutorials to discuss on one real time operating system tool.

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS 9

Introduction to Embedded Systems –Structural units in Embedded processor , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging.

UNIT II EMBEDDED NETWORKING 9

Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols RS232 standard – RS422 – RS 485 - CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I^2C) –need for device drivers.

UNIT III EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT 9

Embedded Product Development Life Cycle- objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model.

UNIT IV RTOS BASED EMBEDDED SYSTEM DESIGN 9

Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication shared memory, message passing-, Inter process Communication– synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance.

UNIT V EMBEDDED SYSTEM APPLICATION AND DEVELOPMENT 9

Case Study of Washing Machine- Automotive Application- Smart card System Application-ATM machine –Digital camera

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze Embedded systems.
- Ability to suggest an embedded system for a given application.
- Ability to operate various Embedded Development Strategies
- Ability to study about the bus Communication in processors.
- Ability to acquire knowledge on various processor scheduling algorithms.
- Ability to understand basics of Real time operating system.

TEXT BOOKS:

1. Peckol, “Embedded system Design”, John Wiley & Sons,2010
2. Lyla B Das,” Embedded Systems-An Integrated Approach”, Pearson, 2013
3. Shibu. K.V, “Introduction to Embedded Systems”, 2e, Mc graw Hill, 2017.

REFERENCES

1. Raj Kamal, ‘Embedded System-Architecture, Programming, Design’, Mc Graw Hill, 2013.
2. C.R.Sarma, “Embedded Systems Engineering”, University Press (India) Pvt. Ltd, 2013.
3. Tammy Noergaard, “Embedded Systems Architecture”, Elsevier, 2006.
4. Han-Way Huang, “Embedded system Design Using C8051”, Cengage Learning, 2009.
5. Rajib Mall “Real-Time systems Theory and Practice” Pearson Education, 2007.

19153L66	POWER ELECTRONICS AND DRIVES LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES:

- To provide hands on experience with power electronic converters and testing.

LIST OF EXPERIMENTS

1 Gate Pulse Generation using R, RC and UJT.
2 Characteristics of SCR and TRIAC
3 Characteristics of MOSFET and IGBT
4 AC to DC half controlled converter
5 AC to DC fully controlled Converter
6 Step down and step up MOSFET based choppers
7 IGBT based single phase PWM inverter

8 IGBT based three phase PWM inverter
9 AC Voltage controller
10 Switched mode power converter.
11 Simulation of PE circuits (1Φ & 3Φ semi converters, 1Φ & 3Φ full converters, DC-DC converters, AC voltage controllers).
12 Characteristics of GTO & IGCT.
13 Characteristics of PMBLDC motor

TOTAL: 60 PERIODS

OUTCOMES:

- Ability to practice and understand converter and inverter circuits and apply software for engineering problems.
- Ability to experiment about switching characteristics various switches.
- Ability to analyze about AC to DC converter circuits.
- Ability to analyze about DC to AC circuits.
- Ability to acquire knowledge on AC to AC converters
- Ability to acquire knowledge on simulation software.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Device characteristics(for SCR, MOSFET, TRIAC,GTO,IGCT and IGBT kit with built-in / discrete power supply and meters) - 2 each
2. SinglephaseSCRbasedhalfcontrolledconverterandfullycontrolledconverteralong with built-in/separate/firing circuit/module and meter – 2 each
3. MOSFET based step up and step down choppers (Built in/ Discrete) – 1 each
4. IGBT based single phase PWM inverter module/Discrete Component – 2
5. IGBT based three phase PWM inverter module/Discrete Component – 2
6. Switched mode power converter module/Discrete Component – 2
7. SCR &TRIAC based 1 phase AC controller along with lamp or rheostat load - 2
8. Cyclo converter kit with firing module – 1
9. Dual regulated DC power supply with common ground
10. Cathode ray Oscilloscope –10
11. Isolation Transformer – 5
12. Single phase Auto transformer –3
13. Components (Inductance, Capacitance) 3 set for each
14. Multimeter – 5
15. LCR meter – 3
16. Rheostats of various ranges – 2 sets of 10 value
17. Work tabilitys – 10
18. DC and AC meters of required ranges – 20
19. Component data sheets to be provided

19153L67 MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:

- To provide training on programming of microprocessors and microcontrollers and understand the interface requirements.
- To simulate various microprocessors and microcontrollers using KEIL or Equivalent simulator.

LIST OF EXPERIMENTS

1 Simple arithmetic operations: addition / subtraction / multiplication / division.

2 Programming with control instructions:

(i) Ascending / Descending order, Maximum / Minimum of numbers. (ii) Programs using Rotate instructions.

(iii) Hex / ASCII / BCD code conversions.

3 Interface Experiments: with 8085

(i) A/D Interfacing. & D/A Interfacing.

4 Traffic light controller.

5 I/O Port / Serial communication

6 Programming Practices with Simulators/Emulators/open source

7 Read a key ,interface display

8 Demonstration of basic instructions with 8051 Micro controller execution, including: (i) Conditional jumps & looping

(ii) Calling subroutines.

9 Programming I/O Port and timer of 8051 (i) study on interface with A/D & D/A

(ii) Study on interface with DC & AC motors

10 Application hardware development using embedded processors.

TOTAL: 60 PERIODS

OUTCOMES:

- Ability to understand and apply computing platform and software for engineering problems.
- Ability to programming logics for code conversion.
- Ability to acquire knowledge on A/D and D/A.
- Ability to understand basics of serial communication.
- Ability to understand and impart knowledge in DC and AC motor interfacing.
- Ability to understand basics of software simulators.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Sl.No.	Description of Equipment	Quantity required
1.	8085 Microprocessor Trainer with Power Supply	15
2.	8051 Micro Controller Trainer Kit with power supply	15
3.	8255 Interface boards	5
4.	8251 Interface boards	5

5.	8259 Interface boards	5
6.	8279 Keyboard / Display Interface boards	5
7.	8254 timer/ counters	5
8.	ADC and DAC cards	5
9.	AC & DC motor with Controller s	5
10.	Traffic Light Control Systems	5

19153MP68 MINI PROJECT LT P C
0 0 4 2

OBJECTIVES:

- To develop their own innovative prototype of ideas.
- To train the students in preparing mini project reports and examination.

The students in a group of 5 to 6 works on a topic approved by the head of the department and prepares a comprehensive mini project report after completing the work to the satisfaction. The progress of the project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department. A mini project report is required at the end of the semester. The mini project work is evaluated based on oral presentation and the mini project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 60 PERIODS

OUTCOMES:

- On Completion of the mini project work students will be in a position to take up their final year project work and find solution by formulating proper methodology.

19153C71	HIGH VOLTAGE ENGINEERING	L	T	P	C
		4	0	0	4

OBJECTIVES:

To impart knowledge on the following Topics

- Various types of over voltages in power system and protection methods.
- Generation of over voltages in laboratories.
- Measurement of over voltages.
- Nature of Breakdown mechanism in solid, liquid and gaseous dielectrics.
- Testing of power apparatus and insulation coordination

UNIT I OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS 9

Causes of over voltages and its effects on power system – Lightning, switching surges and temporary over voltages, Corona and its effects – Bewley lattice diagram- Protection against over voltages.

UNIT II DIELECTRIC BREAKDOWN 9

Properties of Dielectric materials - Gaseous breakdown in uniform and non-uniform fields – Corona discharges – Vacuum breakdown – Conduction and breakdown in pure and commercial liquids, Maintenance of oil Quality – Breakdown mechanisms in solid and composite dielectrics- Applications of insulating materials in electrical equipments.

UNIT III GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS 9

Generation of High DC voltage: Rectifiers, voltage multipliers, vandigraff generator: generation of high impulse voltage: single and multistage Marx circuits – generation of high AC voltages: cascaded transformers, resonant transformer and tesla coil- generation of switching surges – generation of impulse currents - Triggering and control of impulse generators.

UNIT IV MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS 9

High Resistance with series ammeter – Dividers, Resistance, Capacitance and Mixed dividers - Peak Voltmeter, Generating Voltmeters - Capacitance Voltage Transformers, Electrostatic Voltmeters – Sphere Gaps - High current shunts- Digital techniques in high voltage measurement.

UNIT V HIGH VOLTAGE TESTING & INSULATION COORDINATION 9

High voltage testing of electrical power apparatus as per International and Indian standards – Power frequency, impulse voltage and DC testing of Insulators, circuit breakers, bushing, isolators and transformers- Insulation Coordination& testing of cabilitys.

OUTCOMES: **TOTAL : 45 PERIODS**

- Ability to understand Transients in power system.
- Ability to understand Generation and measurement of high voltage.
- Ability to understand High voltage testing.
- Ability to understand various types of over voltages in power system.
- Ability to measure over voltages.
- Ability to test power apparatus and insulation coordination

TEXT BOOKS:

1. S.Naidu and V. Kamaraju, ‘High Voltage Engineering’, Tata McGraw Hill, Fifth Edition, 2013.

2. E. Kuffel and W.S. Zaengl, J.Kuffel, 'High voltage Engineering fundamentals', Newnes Second Edition Elsevier , New Delhi, 2005.

3. C.L. Wadhwa, 'High voltage Engineering', New Age International Publishers, Third Edition, 2010.

REFERENCES

1. L.L. Alston, 'High Voltage Technology', Oxford University Press, First Indian Edition, 2011.

2. Mazen Abdel – Salam, Hussein Anis, Ahdab A-Morshedy, Roshday Radwan, High Voltage Engineering – Theory &Practice, Second Edition Marcel Dekker, Inc., 2010.

3. Subir Ray,' An Introduction to High Voltage Engineering' PHI Learning Private Limited, New Delhi, Second Edition, 2013.

19153C72	**POWER SYSTEM OPERATION AND CONTROL**	**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**

OBJECTIVES:

To impart knowledge on the following topics

- Significance of power system operation and control.
- Real power-frequency interaction and design of power-frequency controller.
- Reactive power-voltage interaction and the control actions to be implemented for maintaining the voltage profile against varying system load.
- Economic operation of power system.
- SCADA and its application for real time operation and control of power systems

UNIT I PRELIMINARIES ON POWER SYSTEM OPERATION AND CONTROL 9

Power scenario in Indian grid – National and Regional load dispatching centers – requirements of good power system - necessity of voltage and frequency regulation - real power vs frequency and reactive power vs voltage control loops - system load variation, load curves and basic concepts of load dispatching - load forecasting - Basics of speed governing mechanisms and modeling - speed load characteristics - regulation of two generators in parallel.

UNIT II REAL POWER - FREQUENCY CONTROL 9

Load Frequency Control (LFC) of single area system-static and dynamic analysis of uncontrolled and controlled cases - LFC of two area system - tie line modeling - block diagram representation of two area system - static and dynamic analysis - tie line with frequency bias control – state variability model - integration of economic dispatch control with LFC.

UNIT III REACTIVE POWER – VOLTAGE CONTROL 9

Generation and absorption of reactive power - basics of reactive power control – Automatic Voltage Regulator (AVR) – brushless AC excitation system – block diagram representation of AVR loop - static and dynamic analysis – stability compensation – voltage drop in transmission line - methods of reactive power injection - tap changing transformer, SVC (TCR + TSC) and STATCOM for voltage control.

UNIT IV ECONOMIC OPERATION OF POWER SYSTEM 9

Statement of economic dispatch problem - input and output characteristics of thermal plant - incremental cost curve - optimal operation of thermal units without and with transmission losses (no derivation of transmission loss coefficients) - base point and participation factors method - statement of unit commitment (UC) problem - constraints on UC problem - solution of UC problem using priority list – special aspects of short term and long term hydrothermal problems.

UNIT V COMPUTER CONTROL OF POWER SYSTEMS 9

Need of computer control of power systems-concept of energy control centers and functions – PMU - system monitoring, data acquisition and controls - System hardware configurations - SCADA and EMS functions - state estimation problem – measurements and errors - weighted least square estimation - various operating states - state transition diagram.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand the day-to-day operation of electric power system.
- Ability to analyze the control actions to be implemented on the system to meet the minute-to-minute variation of system demand.
- Ability to understand the significance of power system operation and control.
- Ability to acquire knowledge on real power-frequency interaction.
- Ability to understand the reactive power-voltage interaction.
- Ability to design SCADA and its application for real time operation

TEXT BOOKS:

1. Olle.I.Elgerd, ‘Electric Energy Systems theory - An introduction’, McGraw Hill Education Pvt. Ltd., New Delhi, 34th reprint, 2010.

2. Allen. J. Wood and Bruce F. Wollen berg, ‘Power Generation, Operation and Control’, John Wiley & Sons, Inc., 2016.

3. Abhijit Chakrabarti and Sunita Halder, ‘Power System Analysis Operation and Control’, PHI learning Pvt. Ltd., New Delhi, Third Edition, 2010.

REFERENCES

1. Kothari D.P. and Nagrath I.J., ‘Power System Engineering’, Tata McGraw-Hill Education, Second Edition, 2008.

2. Hadi Saadat, ‘Power System Analysis’, McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.

3. Kundur P., ‘Power System Stability and Control, McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.

.19153C73 **RENEWABLE ENERGY SYSTEMS**

L	T	P	C
4	0	0	4

OBJECTIVES:

To impart knowledge on the following Topics

- Awareness about renewable Energy Sources and technologies. Adequate
- inputs on a variety of issues in harnessing renewable Energy. Recognize
- current and possible future role of renewable energy sources.

UNIT I RENEWABLE ENERGY (RE) SOURCES 9

Environmental consequences of fossil fuel use, Importance of renewable sources of energy, Sustainable Design and development, Types of RE sources, Limitations of RE sources, Present Indian and international energy scenario of conventional and RE sources.

UNIT II WIND ENERGY 9

Power in the Wind – Types of Wind Power Plants(WPPs)–Components of WPPs-Working of WPPs-Siting of WPPs-Grid integration issues of WPPs.

UNIT III SOLAR PV AND THERMAL SYSTEMS 9

Solar Radiation, Radiation Measurement, Solar Thermal Power Plant, Central Receiver Power Plants, Solar Ponds.- Thermal Energy storage system with PCM- Solar Photovoltaic systems : Basic Principle of SPV conversion – Types of PV Systems- Types of Solar Cells, Photovoltaic cell concepts: Cell, module, array ,PV Module I-V Characteristics, Efficiency & Quality of the Cell, series and parallel connections, maximum power point tracking, Applications.

UNIT IV BIOMASS ENERGY 9

Introduction-Bio mass resources –Energy from Bio mass: conversion processes-Biomass Cogeneration-Environmental Benefits. Geothermal Energy: Basics, Direct Use, Geothermal Electricity. Mini/micro hydro power: Classification of hydropower schemes, Classification of water turbine, Turbine theory, Essential components of hydroelectric system.

UNIT V OTHER ENERGY SOURCES 9

Tidal Energy: Energy from the tides, Barrage and Non Barrage Tidal power systems. Wave Energy: Energy from waves, wave power devices. Ocean Thermal Energy Conversion (OTEC)- Hydrogen Production and Storage- Fuel cell : Principle of working- various types - construction and applications. Energy Storage System- Hybrid Energy Systems.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to create awareness about renewable Energy Sources and technologies.
- Ability to get adequate inputs on a variety of issues in harnessing renewable Energy.
- Ability to recognize current and possible future role of renewable energy sources.
- Ability to explain the various renewable energy resources and technologies and their applications.
- Ability to understand basics about biomass energy.
- Ability to acquire knowledge about solar energy.

TEXT BOOKS:

1. Joshua Earnest, Tore Wizeliu, 'Wind Power Plants and Project Development', PHI Learning Pvt.Ltd, New Delhi, 2011.

2. D.P.Kothari, K.C Singal, Rakesh Ranjan "Renewable Energy Sources and Emerging Technologies", PHI Learning Pvt.Ltd, New Delhi, 2013.

3. Scott Grinnell, "Renewable Energy & Sustainable Design", CENGAGE Learning, USA, 2016.

REFERENCES

1. A.K.Mukerjee and Nivedita Thakur," Photovoltaic Systems: Analysis and Design", PHI Learning Private Limited, New Delhi, 2011

2. Richard A. Dunlap," Sustainable Energy" Cengage Learning India Private Limited, Delhi, 2015.

3. Chetan Singh Solanki, " Solar Photovoltaics : Fundamentals, Technologies and Applications", PHI Learning Private Limited, New Delhi, 2011

4. Bradley A. Striebig,Adebayo A.Ogundipe and Maria Papadakis," Engineering Applications in Sustainable Design and Development", Cengage Learning India Private Limited, Delhi, 2016.

5. Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.

6. Shobh Nath Singh, 'Non-conventional Energy resources' Pearson Education ,2015.

		L	T	P	C
19153L77	**POWER SYSTEM SIMULATION LABORATORY**	**0**	**0**	**3**	**2**

OBJECTIVES:

- To provide better understanding of power system analysis through digital simulation.

LIST OF EXPERIMENTS

1 Computation of Transmission Line Parameters
2 Formation of Bus Admittance and Impedance Matrices and Solution of Networks
3 Power Flow Analysis using Gauss-Seidel Method
4 Power Flow Analysis using Newton Raphson Method
5 Symmetric and unsymmetrical fault analysis
6 Transient stability analysis of SMIB System
7 Economic Dispatch in Power Systems
8 Load – Frequency Dynamics of Single- Area and Two-Area Power Systems
9 State estimation: Weighted least square estimation
10 Electromagnetic Transients in Power Systems : Transmission Line Energization

OUTCOMES: **TOTAL: 60 PERIODS**

- Ability to understand power system planning and operational studies.
- Ability to acquire knowledge on Formation of Bus Admittance and Impedance Matrices and Solution of Networks.
- Ability to analyze the power flow using GS and NR method
- Ability to find Symmetric and Unsymmetrical fault
- Ability to understand the economic dispatch.
- Ability to analyze the electromagnetic transients.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Personal computers (Intel i3, 80GB, 2GBRAM) – 30 nos
2. Printer laser- 1 No.
3. Dot matrix- 1 No.
4. Server (Intel i5, 80GB, 2GBRAM) (High Speed Processor) – 1 No.
5. Software: any power system simulation software with 5 user license
6. Compliers: C, C++, VB, VC++ - 30 users

RENEWABLE ENERGY SYSTEMS LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:

- To train the students in Renewable Energy Sources and technologies.
- To provide adequate inputs on a variety of issues in harnessing Renewable Energy.
- To recognize current and possible future role of Renewable energy sources.

LIST OF EXPERIMENTS

1 Simulation study on Solar PV Energy System.

2 Experiment on "VI-Characteristics and Efficiency of 1kWp Solar PV System".

3 Experiment on "Shadowing effect & diode based solution in 1kWp Solar PV System".

4 Experiment on Performance assessment of Grid connected and Standalone 1kWp Solar Power System.

5 Simulation study on Wind Energy Generator.

6 Experiment on Performance assessment of micro Wind Energy Generator.

7 Simulation study on Hybrid (Solar-Wind) Power System.

8 Experiment on Performance Assessment of Hybrid (Solar-Wind) Power System.

9 Simulation study on Hydel Power.

10 Experiment on Performance Assessment of 100W Fuel Cell.

11 Simulation study on Intelligent Controllers for Hybrid Systems.

OUTCOMES:

- Ability to understand and analyze Renewable energy systems.

TOTAL: 60 PERIODS

- Ability to train the students in Renewable Energy Sources and technologies.
- Ability to provide adequate inputs on a variety of issues in harnessing Renewable Energy.
- Ability to simulate the various Renewable energy sources.
- Ability to recognize current and possible future role of Renewable energy sources.
- Ability to understand basics of Intelligent Controllers.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S.No	Name of the equipments / Components	Quantity Required	Remarks
1.	Personal computers (Intel i3, 80GB, 2GBRAM)	15	-
2.	CRO	9	30MHz
3.	Digital Multimeter	10	Digital
4.	PV panels - 100W, 24V	1	
5.	Battery storage system with charge and discharge control 40Ah	1	
6.	PV Emulator	1	
7.	Micro Wind Energy Generator module	1	

Consumabilitys (Minimum of 5 Nos. each)			
8.	Potentiometer	5	-
9.	Step-down transformer	5	230V/12-0-12V
10	Component data sheets to be provided		

19153P83PW **PROJECT WORK** **L T P C**
0 0 0 15

OBJECTIVES:

To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

OUTCOMES: **TOTAL: 300 PERIODS**

On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

19153PEE - PROGRAMME EXIT EXAMINATION **L T P C**
0 0 0 2

Electric Circuits and Fields:

Network graph, KCL, KVL, node and mesh analysis, transient response of dc and ac networks; sinusoidal steady-state analysis, resonance, basic filter concepts; ideal current and voltage sources, Thevenin's, Norton's and Superposition and Maximum Power Transfer theorems, two-port networks, three phase circuits; Gauss Theorem, electric field and potential due to point, line, plane and spherical charge distributions; Ampere's and Biot-Savart's laws; inductance; dielectrics; capacitance.

Signals and Systems:

Representation of continuous and discrete-time signals; shifting and scaling operations; linear, time-invariant and causal systems; Fourier series representation of continuous periodic signals; sampling theorem; Fourier, Laplace and Z transforms.

Electrical Machines:

Single phase transformer – equivalent circuit, phasor diagram, tests, regulation and efficiency; three phase transformers – connections, parallel operation; auto-transformer; energy conversion principles; DC machines – types, windings, generator characteristics, armature reaction and commutation, starting and speed control of motors; three phase induction motors – principles, types, performance characteristics, starting and speed control; single phase induction motors; synchronous machines – performance, regulation and parallel operation of generators, motor starting, characteristics and applications; servo and stepper motors.

Power Systems:

Basic power generation concepts; transmission line models and performance; cable performance, insulation; corona and radio interference; distribution systems; per-unit quantities; bus impedance and admittance matrices; load flow; voltage control; power factor correction; economic operation; symmetrical components; fault analysis; principles of over-current, differential and distance protection; solid state relays and digital protection; circuit breakers; system stability concepts, swing curves and equal area criterion; HVDC transmission and FACTS concepts.

Control Systems:

Principles of feedback; transfer function; block diagrams; steady-state errors; Routh and Niquist techniques; Bode plots; root loci; lag, lead and lead-lag compensation; state space model; state transition matrix, controllability and observability.

Electrical and Electronic Measurements:

Bridges and potentiometers; PMMC, moving iron, dynamometer and induction type instruments; measurement of voltage, current, power, energy and power factor; instrument transformers; digital voltmeters and multimeters; phase, time and frequency measurement; Q-meters; oscilloscopes; potentiometric recorders; error analysis.

Analog and Digital Electronics:
Characteristics of diodes, BJT, FET; amplifiers – biasing, equivalent circuit and frequency response; oscillators and feedback amplifiers; operational amplifiers – characteristics and applications; simple active filters; VCOs and timers; combinational and sequential logic circuits; multiplexer; Schmitt trigger; multi-vibrators; sample and hold circuits; A/D and D/A converters; 8-bit microprocessor basics, architecture, programming and interfacing.

Power Electronics and Drives:
Semiconductor power diodes, transistors, thyristors, triacs, GTOs, MOSFETs and IGBTs – static characteristics and principles of operation; triggering circuits; phase control rectifiers; bridge converters – fully controlled and half controlled; principles of choppers and inverters; basis concepts of adjustable speed dc and ac drives.

19153E64A DESIGN OF ELECTRICAL APPARATUS

L	T	P	C
3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Magnetic circuit parameters and thermal rating of various types of electrical machines.
- Armature and field systems for D.C. machines.
- Core, yoke, windings and cooling systems of transformers.
- Design of stator and rotor of induction machines and synchronous machines.
- The importance of computer aided design method.

UNIT I DESIGN OF FIELD SYSTEM AND ARMATURE 9

Major considerations in Electrical Machine Design – Materials for Electrical apparatus – Design of Magnetic circuits – Magnetising current – Flux leakage – Leakage in Armature. Design of lap winding and wave winding.

UNIT II DESIGN OF TRANSFORMERS 9

Construction - KVA output for single and three phase transformers – Overall dimensions – design of yoke, core and winding for core and shell type transformers – Estimation of No load current – Temperature rise in Transformers – Design of Tank and cooling tubes of Transformers. Computer program: Complete Design of single phase core transformer

UNIT III DESIGN OF DC MACHINES 9

Construction - Output Equations – Main Dimensions – Choice of specific loadings – Selection of number of poles – Design of Armature – Design of commutator and brushes – design of field Computer program: Design of Armature main dimensions

UNIT IV DESIGN OF INDUCTION MOTORS 9

Construction - Output equation of Induction motor – Main dimensions – choice of specific loadings – Design of squirrel cage rotor and wound rotor –Magnetic leakage calculations – Operating characteristics : Magnetizing current - Short circuit current – Circle diagram - Computer program: Design of slip-ring rotor

UNIT V DESIGN OF SYNCHRONOUS MACHINES 9

Output equations – choice of specific loadings – Design of salient pole machines – Short circuit ratio – Armature design – Estimation of air gap length – Design of rotor –Design of damper winding – Determination of full load field MMF – Design of field winding – Design of turbo alternators -Computer program: Design of Stator main dimensions-Brushless DC Machines

OUTCOMES: TOTAL : 45 PERIODS

- Ability to understand basics of design considerations for rotating and static electrical machines
- Ability to design of field system for its application.
- Ability to design sing and three phase transformer.
- Ability to design armature and field of DC machines.
- Ability to design stator and rotor of induction motor.

TEXT BOOKS:

1. Sawhney, A.K., ‘A Course in Electrical Machine Design’, Dhanpat Rai& Sons, New Delhi, Fifth Edition, 1984.

2. M V Deshpande ‘Design and Testing of Electrical Machines’ PHI learning Pvt Lt, 2011.

3. Sen, S.K., ‘Principles of Electrical Machine Designs with Computer Programmes’, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, Second Edition, 2009.

REFERENCES

1. A.Shanmugasundaram, G.Gangadharan, R.Palani 'Electrical Machine Design Data Book', New Age International Pvt. Ltd., Reprint 2007.
2. 'Electrical Machine Design', Balbir Singh, Vikas Publishing House Private Limited, 1981.
3. V Rajini, V.S Nagarajan, 'Electrical Machine Design', Pearson, 2017.
4. K.M.Vishnumurthy 'Computer aided design of electrical machines' B S Publications,2008

19153E64B **POWER SYSTEM STABILITY**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the fundamental concepts of stability of power systems and its classification.
- To expose the students to dynamic behaviour of the power system for small and large disturbances.
- To understand and enhance the stability of power systems.

UNIT I INTRODUCTION TO STABILITY 9

Fundamental concepts - Stability and energy of a system - Power System Stability: Definition, Causes, Nature and Effects of disturbances, Classification of stability, Modelling of electrical components - Basic assumptions made in stability studies- Modelling of Synchronous machine for stability studies(classical model) - Rotor dynamics and the swing equation.

UNIT II SMALL-SIGNAL STABILITY 9

Basic concepts and definitions – State space representation, Physical Interpretation of small– signal stability, Eigen properties of the state matrix: Eigenvalues and eigenvectors, modal matrices, eigenvalue and stability, mode shape and participation factor. Small– signal stability analysis of a Single-Machine Infinite Bus (SMIB) Configuration with numerical example.

UNIT III TRANSIENT STABILITY 9

Review of numerical integration methods: modified Euler and Fourth Order Runge-Kutta methods, Numerical stability,. Interfacing of Synchronous machine (classical machine) model to the transient stability algorithm (TSA) with partitioned – explicit approaches- Application of TSA to SMIB system.

UNIT IV VOLTAGE STABILITY 9

Factors affecting voltage stability- Classification of Voltage stability-Transmission system characteristics- Generator characteristics- Load characteristics- Characteristics of reactive power compensating Devices- Voltage collapse.

UNIT V ENHANCEMENT OF SMALL-SIGNAL STABILITY AND TRANSIENT STABILITY 9

Power System Stabilizer –. Principle behind transient stability enhancement methods: high-speed fault clearing, regulated shunt compensation, dynamic braking, reactor switching, independent pole-operation of circuit-breakers, single-pole switching, fast- valving, high-speed excitation systems.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will attain knowledge about the stability of power system
- Learners will have knowledge on small-signal stability, transient stability and voltage stability.
- Learners will be able to understand the dynamic behaviour of synchronous generator for different disturbances.
- Learners will be able to understand the various methods to enhance the stability of a power system.

TEXT BOOKS:

1. Power system stability and control ,P. Kundur ; edited by Neal J. Balu, Mark G. Lauby, McGraw-Hill, 1994.
2. R.Ramnujam," Power System Dynamics Analysis and Simulation, PHI Learning Private Limited, New Delhi, 2009
3. T.V. Cutsem and C.Vournas, "Voltage Stability of Electric Power Systems", Kluwer publishers, 1998.

REFERENCES

1 Peter W., Saucer, Pai M.A., "Power System Dynamics and Stability, Pearson Education (Singapore), 9th Edition, 2007.
2 EW. Kimbark., "Power System Stability", John Wiley & Sons Limited, New Jersey, 2013.
3 SB. Crary., "Power System Stability", John Wiley & Sons Limited, New Jersey, 1955.
4 K.N. Shubhanga,"Power System Analysis" Pearson, 2017.
5 Power systems dynamics: Stability and control / K.R. Padiyar, BS Publications, 2008
6 Power system control and Stability P.M. Anderson, A.A. Foud, Iowa State University Press, 1977.

19153E64C	MODERN POWER CONVERTERS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:
- Switched mode power supplies
- Matrix Converter
- Soft switched converters

UNIT I SWITCHED MODE POWER SUPPLIES (SMPS) 9

DC Power supplies and Classification; Switched mode dc power supplies - with and without isolation, single and multiple outputs; Closed loop control and regulation; Design examples on converter and closed loop performance.

UNIT II AC-DC CONVERTERS 9

Switched mode AC-DC converters. synchronous rectification - single and three phase topologies - switching techniques - high input power factor . reduced input current harmonic distortion. improved efficiency. with and without input-output isolation. performance indices design examples

UNIT III DC-AC CONVERTERS 9

Multi-level Inversion - concept, classification of multilevel inverters, Principle of operation, main features and analysis of Diode clamped, Flying capacitor and cascaded multilevel inverters; Modulation schemes.

UNIT IV AC-AC CONVERTERS WITH AND WITHOUT DC LINK 9

Matrix converters. Basic topology of matrix converter; Commutation – current path; Modulation techniques - scalar modulation, indirect modulation; Matrix converter as only AC-DC converter; AC-AC converter with DC link - topologies and operation - with and without resonance link - converter with dc link converter; Performance comparison with matrix converter with DC link converters.

UNIT V SOFT-SWITCHING POWER CONVERTERS 9

Soft switching techniques. ZVS, ZCS, quasi resonance operation; Performance comparison hard switched and soft switched converters.AC-DC converter, DC-DC converter, DC-AC converter.; Resonant DC power supplies .

OUTCOMES: **TOTAL : 45 PERIODS**

- Ability to suggest converters for AC-DC conversion and SMPS

TEXT BOOKS:

1. Power Electronics Handbook, M.H.Rashid, Academic press, New york, 2000.
2. Advanced DC/DC Converters, Fang Lin Luo and Fang Lin Luo, CRC Press, NewYork, 2004.
3. Control in Power Electronics- Selected Problem, Marian P.Kazmierkowski, R.Krishnan and Frede Blaabjerg, Academic Press (Elsevier Science), 2002.

REFERENCES

1. Power Electronic Circuits, Issa Batarseh, John Wiley and Sons, Inc.2004
2. Power Electronics for Modern Wind Turbines, Frede Blaabjerg and Zhe Chen, Morgan & Claypool Publishers series, United States of America, 2006.
3. Krein Philip T, Elements of Power Electronics,Oxford University press, 2008
4. Agarwal ,Power Electronics: Converters, Applications, and Design, 3rd edition, Jai P, Prentice Hall,2000
5. L. Umanand, Power Electronics: Essentials & Applications, John Wiley and Sons, 2009.

19153E64D	**INTELLECTUAL PROPERTY RIGHTS**	**L T P C**
		3 0 0 3

OBJECTIVE:

- To give an idea about IPR, registration and its enforcement.

UNIT I INTRODUCTION 9

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II REGISTRATION OF IPRs 10

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III AGREEMENTS AND LEGISLATIONS 10

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV DIGITAL PRODUCTS AND LAW 9

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT V ENFORCEMENT OF IPRs 7

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL:45 PERIODS

OUTCOME:

- Ability to manage Intellectual Property portfolio to enhance the value of the firm.

TEXT BOOKS

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. S. V. Satakar, “Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002

REFERENCES:

1. Deborah E. Bouchoux, “Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets”, Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli,”Intellectual Property Rights: Unleashing the Knowledge Economy”, McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

19153E65A **PRINCIPLES OF ROBOTICS** **L T P C**
3 0 0 3

OBJ
ECTI
VES:

- To introduce the functional elements of Robotics
- To impart knowledge on the direct and inverse kinematics
- To introduce the manipulator differential motion and control
- To educate on various path planning techniques
- To introduce the dynamics and control of manipulators

UNIT I BASIC CONCEPTS **9**
Brief history-Types of Robot–Technology-Robot classifications and specifications-Design and controlissues- Various manipulators – Sensors - work cell - Programming languages.

UNIT II DIRECT AND INVERSE KINEMATICS **9**
Mathematical representation of Robots - Position and orientation – Homogeneous transformation- Various joints- Representation using the Denavit Hattenberg parameters -Degrees of freedom-Direct kinematics-Inverse kinematics- SCARA robots- Solvability – Solution methods-Closed form solution.

UNIT III MANIPULATOR DIFFERENTIAL MOTION AND STATICS **9**
Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints–Inverse -Wrist and arm singularity - Static analysis - Force and moment Balance.

UNIT IV PATH PLANNING **9**
Definition-Joint space technique-Use of p-degree polynomial-Cubic polynomial-Cartesian space technique - Parametric descriptions - Straight line and circular paths - Position and orientation planning.

UNIT V DYNAMICS AND CONTROL **9**
Lagrangian mechanics-2DOF Manipulator-Lagrange Euler formulation-Dynamic model – Manipulator control problem-Linear control schemes-PID control scheme-Force control of robotic manipulator.

TOTAL: 45 PERIOD

OUTCOMES:

- Ability to understand basic concept of robotics.
- To analyze Instrumentation systems and their applications to various
- To know about the differential motion add statics in robotics
- To know about the various path planning techniques.
- To know about the dynamics and control in robotics industrie.

TEXT BOOKS:

1. R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi,4th Reprint, 2005.
2. JohnJ.Craig ,Introduction to Robotics Mechanics and Control, Third edition, Pearson Education, 2009.
3. M.P.Groover, M.Weiss, R.N. Nageland N. G.Odrej, Industrial Robotics, McGraw-Hill Singapore, 1996.

REFERENCES:
1. Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis', Oxford University Press, Sixth impression, 2010.
2. K. K.Appu Kuttan, Robotics, I K International, 2007.
3. Edwin Wise, Applied Robotics, Cengage Learning, 2003.
4. R.D.Klafter,T.A.Chimielewski and M.Negin, Robotic Engineering–An Integrated Approach, Prentice Hall of India, New Delhi, 1994.
5. B.K.Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers,Chennai, 1998.
6. S.Ghoshal, " Embedded Systems & Robotics" – Projects using the 8051 Microcontroller", Cengage Learning, 2009.

19153E65B	**SPECIAL ELECTRICAL MACHINES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

To impart knowledge on the following Topics

- Construction, principle of operation, control and performance of stepping motors.
- Construction, principle of operation, control and performance of switched reluctance motors.
- Construction, principle of operation, control and performance of permanent magnet brushless D.C. motors.
- Construction, principle of operation and performance of permanent magnet synchronous motors.
- Construction, principle of operation and performance of other special Machines.

UNIT I STEPPER MOTORS 9

Constructional features –Principle of operation –Types – Torque predictions – Linear Analysis – Characteristics – Drive circuits – Closed loop control – Concept of lead angle - Applications.

UNIT II SWITCHED RELUCTANCE MOTORS (SRM) 9

Constructional features –Principle of operation- Torque prediction–Characteristics Steady state performance prediction – Analytical Method – Power controllers – Control of SRM drive- Sensor less operation of SRM – Applications.

UNIT III PERMANENT MAGNET BRUSHLESS D.C. MOTORS 9

Fundamentals of Permanent Magnets- Types- Principle of operation- Magnetic circuit analysis- EMF and Torque equations- Power Converter Circuits and their controllers - Characteristics and control- Applications.

UNIT IV PERMANENT MAGNET SYNCHRONOUS MOTORS (PMSM) 9

Constructional features -Principle of operation – EMF and Torque equations - Sine wave motor with practical windings - Phasor diagram - Power controllers – performance characteristics - Digital controllers – Applications.

UNIT V OTHER SPECIAL MACHINES 9

Constructional features – Principle of operation and Characteristics of Hysteresis motor- Synchronous Reluctance Motor–Linear Induction motor-Repulsion motor- Applications.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to analyze and design controllers for special Electrical Machines.
- Ability to acquire the knowledge on construction and operation of stepper motor.
- Ability to acquire the knowledge on construction and operation of stepper switched reluctance motors.
- Ability to construction, principle of operation, switched reluctance motors.
- Ability to acquire the knowledge on construction and operation of permanent magnet brushless D.C. motors.
- Ability to acquire the knowledge on construction and operation of permanent magnet synchronous motors.
- Ability to select a special Machine for a particular application.

TEXT BOOKS:

- K.Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.
- T. Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press London, 1984
- E.G. Janardanan, 'Special electrical machines', PHI learning Private Limited, Delhi, 2014.

REFERENCES

1. R.Krishnan, 'Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application', CRC Press, New York, 2001.
2. T. Kenjo and S. Nagamori, 'Permanent Magnet and Brushless DC Motors', Clarendon Press, London, 1988.
3. T.J.E.Miller,'Brushless Permanent-Magnet and Reluctance Motor Drives', Oxford University Press, 1989.
4. R.Srinivasan, 'Special Electrical Machines', Lakshmi Publications, 2013.

19153E65C	POWER QUALITY	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Causes & Mitigation techniques of various PQ events.
- Various Active & Passive power filters.

UNIT I INTRODUCTION TO POWER QUALITY 9

Terms and definitions & Sources – Overloading, under voltage, over voltage - Concepts of transients - Short duration variations such as interruption - Long duration variation such as sustained interruption - Sags and swells - Voltage sag - Voltage swell - Voltage imbalance – Voltage fluctuations - Power frequency variations - International standards of power quality – Computer Business Equipment Manufacturers Associations (CBEMA) curve

UNIT II VOLTAGE SAG AND SWELL 9

Estimating voltage sag performance - Thevenin's equivalent source - Analysis and calculation of various faulted condition - Estimation of the sag severity - Mitigation of voltage sag, Static transfer switches and fast transfer switches. - Capacitor switching – Lightning - Ferro resonance - Mitigation of voltage swell.

UNIT III HARMONICS 9

Harmonic sources from commercial and industrial loads - Locating harmonic sources – Power system response characteristics - Harmonics Vs transients. Effect of harmonics – Harmonic distortion - Voltage and current distortions - Harmonic indices - Inter harmonics – Resonance Harmonic distortion evaluation, IEEE and IEC standards.

UNIT IV PASSIVE POWER COMPENSATORS 9

Principle of Operation of Passive Shunt and Series Compensators, Analysis and Design of Passive Shunt Compensators Simulation and Performance of Passive Power Filters- Limitations of Passive Filters Parallel Resonance of Passive Filters with the Supply System and Its Mitigation. Fundamentals of load compensation – voltage regulation & power factor correction.

UNIT V POWER QUALITY MONITORING & CUSTOM POWER DEVICES 9

Monitoring considerations - Monitoring and diagnostic techniques for various power quality problems - Quality measurement equipment - Harmonic / spectrum analyzer - Flicker meters Disturbance analyzer - Applications of expert systems for power quality monitoring. Principle& Working of DSTATCOM – DSTATCOM in Voltage control mode, current control mode, DVR Structure – Rectifier supported DVR – DC Capacitor supported DVR -Unified power quality conditioner.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand various sources, causes and effects of power quality issues, electrical systems and their measures and mitigation.
- Ability to analyze the causes & Mitigation techniques of various PQ events.
- Ability to study about the various Active & Passive power filters.
- Ability to understand the concepts about Voltage and current distortions, harmonics.
- Ability to analyze and design the passive filters.
- Ability to acquire knowledge on compensation techniques.
- Ability to acquire knowledge on DVR.

TEXT BOOKS:

1. Roger. C. Dugan, Mark. F. Mc Granagham, Surya Santoso, H.WayneBeaty, “Electrical Power Systems Quality”, McGraw Hill,2003
2. J. Arrillaga, N.R. Watson, S. Chen, “Power System Quality Assessment”, (New York : Wiley),2000.
3. Bhim Singh, Ambrish Chandra, Kamal Al-Haddad,” Power Quality Problems & Mitigation Techniques” Wiley, 2015.

REFERENCES

1. G.T. Heydt, “Electric Power Quality”, 2nd Edition. (West Lafayette, IN, Stars in a Circle Publications, 1994.
2. M.H.J Bollen, “Understanding Power Quality Problems: Voltage Sags and Interruptions”, (New York: IEEE Press), 2000.

19153E65D	EHVAC TRANSMISSION	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- EHVAC Transmission lines
- Electrostatic field of AC lines
- Corona in E.H.V. lines

UNIT I INTRODUCTION 9

EHVAC Transmission line trends and preliminary aspect - standard transmission voltages – Estimation at line and ground parameters-Bundle conductors: Properties -Inductance and Capacitance of EHV lines – Positive, negative and zero sequence impedance – Line Parameters for Modes of Propagation.

UNIT II ELECTROSTATIC FIELDS 9

Electrostatic field and voltage gradients – Calculations of electrostatic field of AC lines – Effect of high electrostatic field on biological organisms and human beings - Surface voltage gradients and Maximum gradients of actual transmission lines – Voltage gradients on sub conductor.

UNIT III POWER CONTROL 9

Electrostatic induction in un energized lines – Measurement of field and voltage gradients for three phase single and double circuit lines – Un energized lines. Power Frequency Voltage control and overvoltage in EHV lines: No load voltage – Charging currents at power frequency-Voltage control – Shunt and Series compensation – Static VAR compensation.

UNIT IV CORONA EFFECTS AND RADIO INTERFERENCE 9

Corona in EHV lines – Corona loss formulae-Charge voltage diagram- Attenuation of traveling waves due to Corona – Audio noise due to Corona, its generation, characteristic and limits. Measurements of audio noise radio interference due to Corona - properties of radio noise – Frequency spectrum of RI fields – Measurements of RI and RIV.

UNIT V STEADY STATE AND TRANSIENT LIMITS 9

Design of EHV lines based on steady state and transient limits - EHV cabilitys and their characteristics-Introduction six phase transmission – UHV.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand the principles and types of EHVAC system.
- Ability to analyze the electrostatic field of AC lines
- Ability to study about the compensation.
- Ability to study about the corona in E.H.V. lines
- Ability to understand the EHV cabilitys.
- Ability to analyze the steady state and transient limits.

TEXT BOOKS:

1. Rokosh Das Begamudre, ”Extra High Voltage AC Transmission Engineering”– Wiley Eastern LTD., NEW DELHI 1990.
2. S. Rao, “HVAC and HVDC Transmission, Engineering and Practice” Khanna Publisher, Delhi, 1990.

REFERENCES

1. Subir Ray, “An Introduction to High Voltage Engineering”, Prentice Hall of India Private Limited, 2013.
2. RD Begamudre, “Extra High Voltage AC Transmission Engineering”– New Academic Science Ltd; 4 edition 2011.
3. Edison,” EHV Transmission line”- Electric Institution, GEC, 1968.

19153E75A DISASTER MANAGEMENT LT P C
3 0 0 3

OBJECTIVES:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA)
– Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:

The students will be ability to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.

- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.

TEXTBOOKS:

1. Singhal J.P. “Disaster Management”, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-**13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerability India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

19153E75B HUMAN RIGHTS LT P C

3 0 0 3

OBJECTIVES :

- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I 9

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II 9

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III 9

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV 9

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V 9

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabilityd persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO’s, Media, Educational Institutions, Social Movements.

TOTAL : 45 PERIODS

OUTCOME :

- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

19153E75C	**OPERATIONS RESEARCH**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

- To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

UNIT I LINEAR MODELS 15

The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.

UNIT II TRANSPORTATION MODELS AND NETWORK MODELS 8

Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route – Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks – Critical path scheduling – Sequencing models.

UNIT III INVENTORY MODELS 6

Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

UNIT IV QUEUEING MODELS 6

Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

UNIT V DECISION MODELS 10

Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life – Economic life– Single / Multi variability search technique – Dynamic Programming – Simple Problem.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can ability to use the optimization techniques for use engineering and Business problems

TEXT BOOK:

1. Hillier and Libeberman, "Operations Research", Holden Day, 2005
2. Taha H.A., "Operations Research", Sixth Edition, Prentice Hall of India, 2003.

REFERENCES:

1. Bazara M.J., Jarvis and Sherali H., "Linear Programming and Network Flows", John Wiley, 2009.

2. Budnick F.S., "Principles of Operations Research for Management", Richard D Irwin, 1990.
3. Philip D.T. and Ravindran A., "Operations Research", John Wiley, 1992.
4. Shennoy G.V. and Srivastava U.K., "Operation Research for Management", Wiley Eastern, 1994.
5. Tulsian and Pasdey V., "Quantitative Techniques", Pearson Asia, 2002.

19153E75D **PROBABILITY AND STATISTICS**

L	T	P	C
3	0	0	3

OBJECTIVES :

- This course aims at providing the required skill to apply the statistical tools in engineering problems.
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two dimensional random variables.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.

UNIT I PROBABILITY AND RANDOM VARIABLES 12

Probability – The axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT II TWO - DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTING OF HYPOTHESIS 12

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT IV DESIGN OF EXPERIMENTS 12

One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design - 2^2 factorial design.

UNIT V STATISTICAL QUALITY CONTROL `12

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL : 60 PERIODS

OUTCOMES :

Upon successful completion of the course, students will be able to:

- Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
- Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

TEXT BOOKS :

1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.

REFERENCES :

1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
2. Papoulis, A. and Unnikrishnapillai, S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2010.
3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
4. Spiegel. M.R., Schiller. J. and Srinivasan, R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.
5. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2007.

		L	T	P	C
19153E76A	**SYSTEM IDENTIFICATION AND ADAPTIVE CONTROL**	**3**	**0**	**0**	**3**

OBJECTIVES: To impart knowledge about the following topics:

- The concept of system identification and adaptive control
- Black-box approach based system identification
- Batch and recursive identification
- Computer Controlled Systems
- Design concept for adaptive control schemes

UNIT I NON-PARAMETRIC METHODS 9

Non-parametric methods - Transient analysis - frequency analysis - Correlation analysis - Spectral analysis - Input signal design for identification

UNIT II PARAMETRIC METHODS 9

Least squares estimation – Analysis of the least squares estimate - Best linear unbiased estimate – Model parameterizations - Prediction error methods.

UNIT III RECURSIVE IDENTIFICATION METHODS 9

The recursive least square method - Model validation –Model structure determination - Introduction to closed loop system identification.

UNIT IV ADAPTIVE CONTROL SCHEMES 9

Introduction – Auto-tuning of PID controller using relay feedback approach – Types of adaptive control, Gain scheduling, Model reference adaptive control, Self–tuning controller – Design of gain scheduled adaptive controller – Applications of gain scheduling.

UNIT V MODEL-REFERENCE ADAPTIVE SYSTEM (MRAS) and SELF-TUNING REGULATOR (STR) 9

STR – Pole placement design – Indirect STR and direct STR – MRAC - MIT rule – Lyapunov theory – Relationship between MRAC and STR.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand various system identification techniques and features of adaptive control like STR and MRAC.
- Ability to understand the concept of system identification and adaptive control
- Ability to understand about Black-box approach based system identification
- Ability to get knowledge about batch and recursive identification
- Ability to study about computer controlled systems
- Ability to design concept for adaptive control schemes

TEXT BOOKS:

1. T. Soderstrom and PetreStoica, System Identification, Prentice Hall International (UK) Ltd. 1989

2. Karl J. Astrom and Bjorn Witten mark, Adaptive Control, Pearson Education, Second edition, Fifth impression, 2009.

REFERENCES

1. L. Ljung, System Identification - Theory for the User, 2nd edition, PTR Prentice Hall, Upper Saddle River, N.J., 1999.
2. K. S. Narendra and A. M. Annaswamy, Stability Adaptive Systems, Prentice-Hall, 1989.
3. H. K. Khalil, Nonlinear Systems, Prentice Hall, 3rd edition, 2002.
4. William S.Levine, "Control Systems Advanced Methods, the Control Handbook, CRC Press 2011.
5. S. Sastry and M. Bodson, Adaptive Control, Prentice-Hall, 1989

19153E76B **CONTROL OF ELECTRICAL DRIVES**

L	T	P	C
3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- To understand the DC drive control.
- To study and analyze the Induction motor drive control.
- To study and understand the Synchronous motor drive control.
- To study and analyze the SRM and BLDC motor drive control.
- To analyze and design the Digital control for drives.

UNIT I CONTROL OF DC DRIVES 9

Losses in electrical drive system, Energy efficient operation of drives, block diagram/ transfer function of self, separately excited DC motors --closed loop control-speed control- current control - constant torque/power operation - P, PI and PID controllers–response comparison.

UNIT II CONTROL OF INDUCTION MOTORDRIVE 9

VSI and CSI fed induction motor drives-principles of V/f control-closed loop variable frequency PWM inverter with dynamic braking- static Scherbius drives- power factor considerations– modified Kramer drives-principle of vector control- implementation-block diagram, Design of closed loop operation of V/f control of Induction motor drive systems.

UNIT III CONTROL OF SYNCHRONOUS MOTOR DRIVES 9

Open loop VSI fed drive and its characteristics–Self control–Torque control –Torque angle control –Power factor control–Brushless excitation systems—Field oriented control – Design of closed loop operation of Self control of Synchronous motor drive systems.

UNIT IV CONTROL OF SRM AND BLDC MOTOR DRIVES 9

SRM construction - Principle of operation - SRM drive design factors-Torque controlled SRM-Block diagram of Instantaneous Torque control using current controllers and flux controllers. Construction and Principle of operation of BLDC Machine -Sensing and logic switching scheme,-Sinusoidal and trapezoidal type of Brushless dc motors – Block diagram of current controlled Brushless dc motor drive.

UNIT V DIGITAL CONTROL OF DC DRIVE 9

Phase Locked Loop and micro-computer control of DC drives–Program flow chart for constant constant torque and constant horse power operations Speed detection and current sensing circuits and feedback elements.

TOTAL : 45 PERIODS

OUTCOMES:

• Ability to understand various control strategies and controllers for AC and DC Motor Drive systems.

TEXT BOOKS:

1. Dubey, G.K, Power semiconductor controlled devices, Prentice Hall International New jersey, 1989.
2. R.Krishnan,, Electric Motor Drives - Modeling, Analysis and ControlPrentice- Hall of India Pvt. Ltd., New Delhi, 2003.
3. Murphy, J.M.D, Turnbull F.G, Thyristor control of AC motors,., Pergamon press, Oxford, 1988.

REFERENCES

1. Bin Wu, High-Power Converters and AC Drives, Wiley-IEEE Press
2. Buxbaum, A.Schierau, and K.Staughen, A design of control systems for DC drives, Springer-Verlag, Berlin, 1990.
3. Bimal K. Bose, Modern Power Electronics and AC Drives, Pearson Education (Singapore) Pte. Ltd., New Delhi, 2003.
4. R. Krishnan, Switched Reluctance Motor Drives: Modeling, Simulation, Analysis, Design, and Applications, CRC press, 2001.
5. Werner Leonhard, Control of Electrical Drives, 3rd Edition, Springer, Sept., 2001.
6. R. Krishnan, Permanent Magnet Synchronous and Brushless DC Motor Drives, CRC press, 2001.

19153E76C	POWER SYSTEMS TRANSIENTS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Generation of switching transients and their control using circuit – theoretical concept.
- Mechanism of lighting strokes and the production of lighting surges.
- Propagation, reflection and refraction of travelling waves.
- Voltage transients caused by faults, circuit breaker action, load rejection on integrated power system.

UNIT I INTRODUCTION AND SURVEY 9

Review and importance of the study of transients - causes for transients. RL circuit transient with sine wave excitation - double frequency transients - basic transforms of the RLC circuit transients. Different types of power system transients - effect of transients on power systems – role of the study of transients in system planning.

UNIT II SWITCHING TRANSIENTS 9

Over voltages due to switching transients - resistance switching and the equivalent circuit for interrupting the resistor current - load switching and equivalent circuit - waveforms for transient voltage across the load and the switch - normal and abnormal switching transients. Current suppression - current chopping - effective equivalent circuit. Capacitance switching - effect of source regulation - capacitance switching with a restrike, with multiple restrikes. Illustration for multiple restriking transients - ferro resonance.

UNIT III LIGHTNING TRANSIENTS 9

Review of the theories in the formation of clouds and charge formation - rate of charging of thunder clouds – mechanism of lightning discharges and characteristics of lightning strokes – model for lightning stroke - factors contributing to good line design - protection using ground wires - tower footing resistance - Interaction between lightning and power system.

UNIT IV TRAVELING WAVES ON TRANSMISSION LINE COMPUTATION OF TRANSIENTS 9

Computation of transients - transient response of systems with series and shunt lumped parameters and distributed lines. Traveling wave concept - step response - Bewely's lattice diagram - standing waves and natural frequencies - reflection and refraction of travelling waves.

UNIT V TRANSIENTS IN INTEGRATED POWER SYSTEM 9

The short line and kilometric fault - distribution of voltages in a power system - Line dropping and load rejection - voltage transients on closing and reclosing lines - over voltage induced by faults -switching surges on integrated system Qualitative application of EMTP for transient computation.

TOTAL : 45 PERIODS

OUTCOMES:

Ability to understand and analyze switching and lightning transients.

- Ability to acquire knowledge on generation of switching transients and their control.
- Ability to analyze the mechanism of lighting strokes.
- Ability to understand the importance of propagation, reflection and refraction of travelling waves.
- Ability to find the voltage transients caused by faults.
- Ability to understand the concept of circuit breaker action, load rejection on integrated power system.

TEXT BOOKS:

1. Allan Greenwood, 'Electrical Transients in Power Systems', Wiley Inter Science, New York, 2nd Edition, 1991.
2. Pritindra Chowdhari, "Electromagnetic transients in Power System", John Wiley and Sons Inc., Second Edition, 2009.
3. C.S. Indulkar, D.P.Kothari, K. Ramalingam, 'Power System Transients – A statistical approach', PHI Learning Private Limited, Second Edition, 2010.

REFERENCES

1. M.S.Naidu and V.Kamaraju, 'High Voltage Engineering', McGraw Hill, Fifth Edition, 2013.
2. R.D. Begamudre, 'Extra High Voltage AC Transmission Engineering', Wiley Eastern Limited, 1986.
3. Y.Hase, Handbook of Power System Engineering," Wiley India, 2012.
4. J.L.Kirtley, "Electric Power Principles, Sources, Conversion, Distribution and use," Wiley, 2012.
5. Akihiro ametani," Power System Transient theory and applications", CRC press, 2013.

19153E76D TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:

- To facilitate the understanding of Quality Management principles and process.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention.

UNIT II TQM PRINCIPLES 9

Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal – Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS AND TECHNIQUES I 9

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV TQM TOOLS AND TECHNIQUES II 9

Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V QUALITY MANAGEMENT SYSTEM 9

Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation— Documentation—Internal Audits—Registration—**ENVIRONMENTAL MANAGEMENT SYSTEM:** Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001— Benefits of EMS.

TOTAL: 45 PERIODS

OUTCOME:

- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

TEXT BOOK:

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Besterfield,Mary B.Sacre,Hemant Urdhwareshe and Rashmi Urdhwareshe, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.
2. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
3. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
4. ISO9001-2015 standards

19153E81A	FLEXIBLE AC TRANSMISSION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- The start-of-art of the power system
- Performance of power systems with FACTS controllers.
- FACTS controllers for load flow and dynamic analysis

UNIT I INTRODUCTION 9

Real and reactive power control in electrical power transmission lines–loads & system compensation-Uncompensated transmission line–shunt and series compensation.

UNIT II STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS 9

Voltage control by SVC–Advantages of slope in dynamic characteristics–Influence of SVC on system voltage–Design of SVC voltage regulator–TCR-FC-TCR-Modeling of SVC for power flow and fast transient stability– Applications: Enhancement of transient stability – Steady state power transfer –Enhancement of power system damping.

UNIT III THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) AND APPLICATIONS 9

Operation of the TCSC–Different modes of operation–Modelling of TCSC, Variability reactance model– Modelling for Power Flow and stability studies. Applications: Improvement of the system stability limit–Enhancement of system damping.

UNIT IV VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS 9

Static Synchronous Compensator (STATCOM)–Principle of operation–V-I Characteristics. Applications: Steady state power transfer-enhancement of transient stability-prevention of voltage instability. SSSC-operation of SSSC and the control of power flow–modelling of SSSC in load flow and transient stability studies- Dynamic voltage restorer(DVR).

UNIT V ADVANCED FACTS CONTROLLERS 9

Interline DVR(IDVR) - Unified Power flow controller (UPFC) - Interline power flow controller (IPFC) - Unified Power quality conditioner (UPQC).

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand, analyze and develop analytical model of FACTS controller for power system application.
- Ability to understand the concepts about load compensation techniques.
- Ability to acquire knowledge on facts devices.
- Ability to understand the start-of-art of the power system
- Ability to analyze the performance of steady state and transients of facts controllers.
- Ability to study about advanced FACTS controllers.

TEXT BOOKS:

1. R.Mohan Mathur, Rajiv K.Varma,"Thyristor–Based Facts Controllers for Electrical Transmission Systems", IEEE press andJohnWiley&Sons,Inc,2002.
2. NarainG. Hingorani, "Understanding FACTS-Concepts and Technology of Flexible AC Transmission Systems", Standard Publishers Distributors,Delhi-110006,2011.
3. T.J.E Miller, Power Electronics in power systems, John Wiley and sons.

REFERENCES

1. K.R. Padiyar, ”FACTS Controllers in Power Transmission and Distribution”, New Age International (P) Limited, Publishers, New Delhi, 2008
2. A.T.John,“FlexibleA.C.TransmissionSystems”,InstitutionofElectricalandElectronic Engineers(IEEE), 1999.
3. V.K.Sood, HVDC and FACTS controllers–Applications of Static Converters in Power System, APRIL2004,KluwerAcademic Publishers,2004.

19153E81B	SOFT COMPUTING TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Basics of artificial neural network.
- Concepts of modelling and control of neural and fuzzy control schemes.
- Features of hybrid control schemes.

UNIT I ARTIFICIAL NEURAL NETWORK 9

Review of fundamentals – Biological neuron, artificial neuron, activation function, single layer perceptron – Limitation – Multi layer perceptron – Back Propagation Algorithm (BPA) – Recurrent Neural Network (RNN) – Adaptive Resonance Theory (ART) based network – Radial basis function network – online learning algorithms, BP through time – RTRL algorithms – Reinforcement learning.

UNIT II NEURAL NETWORKS FOR MODELING AND CONTROL 9

Modelling of non-linear systems using ANN – Generation of training data – Optimal architecture– Model validation – Control of non-linear systems using ANN – Direct and indirect neuro control schemes – Adaptive neuro controller – Familiarization with neural network toolbox.

UNIT III FUZZY SET THEORY 9

Fuzzy set theory – Fuzzy sets – Operation on fuzzy sets – Scalar cardinality, fuzzy cardinality, union and intersection, complement (Yager and Sugeno), equilibrium points, aggregation, projection, composition, cylindrical extension, fuzzy relation – Fuzzy membership functions.

UNIT IV FUZZY LOGIC FOR MODELING AND CONTROL 9

Modelling of non-linear systems using fuzzy models – TSK model – Fuzzy logic controller – Fuzzification – Knowledge base – Decision making logic – Defuzzification – Adaptive fuzzy systems – Familiarization with fuzzy logic toolbox.

UNIT V HYBRID CONTROL SCHEMES 9

Fuzzification and rule base using ANN – Neuro fuzzy systems – ANFIS – Fuzzy neuron– GA – Optimization of membership function and rule base using Genetic Algorithm – Introduction to other evolutionary optimization techniques, support vector machine– Case study – Familiarization with ANFIS toolbox.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand the concepts of ANN, different features of fuzzy logic and their modelling, control aspects and different hybrid control schemes.
- Ability to understand the basics of artificial neural network.
- Ability to get knowledge on modelling and control of neural.
- Ability to get knowledge on modelling and control of fuzzy control schemes.
- Ability to acquire knowledge on hybrid control schemes.
- Ability to understand the concepts of Adaptive Resonance Theory

TEXT BOOKS:

1. Laurence Fausett, "Fundamentals of Neural Networks", Prentice Hall, Englewood Cliffs, N.J., 1992
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill Inc., 2000.

REFERENCES

1. Goldberg, "Genetic Algorithm in Search, Optimization and Machine learning", Addison Wesley Publishing Company Inc. 1989
2. Millon W.T., Sutton R.S. and Webrose P.J., "Neural Networks for Control", MIT press, 1992
3. Ethem Alpaydin, "Introduction to Machine learning (Adaptive Computation and Machine Learning series)', MIT Press, Second Edition, 2010.
4. Zhang Huaguang and Liu Derong, "Fuzzy Modeling and Fuzzy Control Series: Control Engineering", 2006

19153E81C	**SMPS AND UPS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES: To impart knowledge about the following topics:

- Modern power electronic converters and its applications in electric power utility.
- Resonant converters and UPS

UNIT I DC-DC CONVERTERS 9

Principles of step down and step up converters – Analysis and state space modeling of Buck, Boost, Buck- Boost and Cuk converters.

UNIT II SWITCHED MODE POWER CONVERTERS 9

Analysis and state space modeling of fly back, Forward, Push pull, Luo, Half bridge and full bridge converters- control circuits and PWM techniques.

UNIT III RESONANT CONVERTERS 9

Introduction- classification- basic concepts- Resonant switch- Load Resonant converters- ZVS , Clamped voltage topologies- DC link inverters with Zero Voltage Switching- Series and parallel Resonant inverters- Voltage control.

UNIT IV DC-AC CONVERTERS 9

Single phase and three phase inverters, control using various (sine PWM, SVPWM and PSPWM) techniques, various harmonic elimination techniques- Multilevel inverters- Concepts - Types: Diode clamped- Flying capacitor- Cascaded types- Applications.

UNIT V POWER CONDITIONERS, UPS & FILTERS 9

Introduction- Power line disturbances- Power conditioners –UPS: offline UPS, Online UPS, Applications – Filters: Voltage filters, Series-parallel resonant filters, filter without series capacitors, filter for PWM VSI, current filter, DC filters – Design of inductor and transformer for PE applications – Selection of capacitors.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to analyze the state space model for DC – DC converters
- Ability to acquire knowledge on switched mode power converters.
- Ability to understand the importance of Resonant Converters.
- Ability to analyze the PWM techniques for DC-AC converters
- Ability to acquire knowledge on modern power electronic converters and its applications in electric power utility.
- Ability to acquire knowledge on filters and UPS

TEXT BOOKS:

1. Simon Ang, Alejandro Oliva," Power-Switching Converters", Third Edition, CRC Press, 2010.
2. KjeldThorborg, "Power Electronics – In theory and Practice", Overseas Press, First Indian Edition 2005.
3. M.H. Rashid – Power Electronics handbook, Elsevier Publication, 2001.

REFERENCES

1. Philip T Krein, " Elements of Power Electronics", Oxford University Press
2. Ned Mohan, Tore.M.Undeland, William.P.Robbins, Power Electronics converters,

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Applications and design- Third Edition- John Wiley and Sons- 2006

3. M.H. Rashid – Power Electronics circuits, devices and applications- third edition Prentice Hall of India New Delhi, 2007.
4. Erickson, Robert W, "Fundamentals of Power Electronics", Springer, second edition, 2010.

19153E81D	ELECTRIC ENERGY GENERATION, UTILIZATION CONSERVATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- To study the generation, conservation of electrical power and energy efficient equipments.
- To understand the principle, design of illumination systems and energy efficiency lamps.
- To study the methods of industrial heating and welding.
- To understand the electric traction systems and their performance.

UNIT I ILLUMINATION 9

Importance of lighting – properties of good lighting scheme – laws of illumination – photometry - types of lamps – lighting calculations – basic design of illumination schemes for residential, commercial, street lighting, factory lighting and flood lighting – LED lighting and energy efficient lamps.

UNIT II REFRIGERATION AND AIR CONDITIONING 9

Refrigeration-Domestic refrigerator and water coolers - Air-Conditioning-Various types of air-conditioning system and their applications, smart air conditioning units - Energy Efficient motors: Standard motor efficiency, need for efficient motors, Motor life cycle, Direct Savings and payback analysis, efficiency evaluation factor.

UNIT III HEATING AND WELDING 9

Role of electric heating for industrial applications – resistance heating – induction heating – dielectric heating - electric arc furnaces. Brief introduction to electric welding – welding generator, welding transformer and the characteristics.

UNIT IV TRACTION 9

Merits of electric traction – requirements of electric traction system – supply systems – mechanics of train movement – traction motors and control – braking – recent trends in electric traction.

UNIT V DOMESTIC UTILIZATION OF ELECTRICAL ENERGY 9

Domestic utilization of electrical energy – House wiring. Induction based appliances, Online and OFF line UPS, Batteries - Power quality aspects – nonlinear and domestic loads – Earthing – Domestic, Industrial and Substation.

TOTAL : 45 PERIODS

OUTCOMES:

- To understand the main aspects of generation, utilization and conservation.
- To identify an appropriate method of heating for any particular industrial application.
- To evaluate domestic wiring connection and debug any faults occurred.
- To construct an electric connection for any domestic appliance like refrigerator as well as to design a battery charging circuit for a specific household application.
- To realize the appropriate type of electric supply system as well as to evaluate the performance of a traction unit.
- To understand the main aspects of Traction.

TEXT BOOKS:

1. Wadhwa, C.L. "Generation, Distribution and Utilization of Electrical Energy", New Age International Pvt. Ltd, 2003.
2. Dr. Uppal S.L. and Prof. S. Rao, 'Electrical Power Systems', Khanna Publishers, New Delhi, 15th Edition, 2014.
3. Energy Efficiency in Electric Utilities, BEE Guide Book, 2010

REFERENCES

1. Partab.H, "Art and Science of Utilisation of Electrical Energy", Dhanpat Rai and Co, New Delhi, 2004.
2. Openshaw Taylor.E, "Utilization of Electrical Energy in SI Units", Orient Longman Pvt. Ltd, 2003.
3. Gupta.J.B, "Utilization of Electric Power and Electric Traction", S.K.Kataria and Sons, 2002.
4. Cleaner Production – Energy Efficiency Manual for GERIAP, UNEP, Bangkok prepared by National Productivity Council.

19153E82A **ENERGY MANAGEMENT AND AUDITING**

L	T	P	C
3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- To impact concepts behind economic analysis and Load management.
- Energy management on various electrical equipments and metering.
- Concept of lighting systems and cogeneration.

UNIT I INTRODUCTION 9

Basics of Energy – Need for energy management – Energy accounting - Energy monitoring, targeting and reporting - Energy audit process.

UNIT II ENERGY MANAGEMENT FOR MOTORS AND COGENERATION 9

Energy management for electric motors – Transformer and reactors - Capacitors and synchronous machines, energy management by cogeneration – Forms of cogeneration – Feasibility of cogeneration – Electrical interconnection.

UNIT III LIGHTING SYSTEMS 9

Energy management in lighting systems – Task and the working space - Light sources – Ballasts – Lighting controls – Optimizing lighting energy – Power factor and effect of harmonics, lighting and energy standards.

UNIT IV METERING FOR ENERGY MANAGEMENT 9

Metering for energy management – Units of measure - Utility meters – Demand meters – Paralleling of current transformers – Instrument transformer burdens – Multi tasking solid state meters, metering location vs requirements, metering techniques and practical examples.

UNIT V ECONOMIC ANALYSIS AND MODELS 9

Economic analysis – Economic models - Time value of money - Utility rate structures – Cost of electricity – Loss evaluation, load management – Demand control techniques – Utility monitoring and control system – HVAC and energy management – Economic justification.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand the basics of Energy audit process.
- Ability to understand the basics of energy management by cogeneration
- Ability to acquire knowledge on Energy management in lighting systems
- Ability to impact concepts behind economic analysis and Load management.
- Ability to understand the importance of Energy management on various electrical equipment and metering.
- Ability to acquire knowledge on HVAC.

TEXT BOOKS:

1. Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, Guide to Energy Management, Fifth Edition, The Fairmont Press, Inc., 2006
2. Eastop T.D & Croft D.R, Energy Efficiency for Engineers and Technologists,.Logman Scientific & Technical, ISBN-0-582-03184 , 1990.

REFERENCES

1. Reay D.A, Industrial Energy Conservation, 1st edition, Pergamon Press, 1977.
2. IEEE Recommended Practice for Energy Management in Industrial and Commercial Facilities, IEEE, 196.
3. Amit K. Tyagi, Handbook on Energy Audits and Management, TERI, 2003.
4. Electricity in buildings good practice guide, McGraw-Hill Education, 2016.
5. National Productivity Council Guide Books

19153E82B	HIGH VOLTAGE DIRECT CURRENT TRANSMISSION	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Planning of DC power transmission and comparison with AC power transmission.
- HVDC converters.
- HVDC system control.
- Harmonics and design of filters.
- Power flow in HVDC system under steady state.

UNIT I INTRODUCTION 9

DC Power transmission technology–Comparison of AC and DC transmission–Application of DC transmission–Description of DC transmission system–Planning for HVDC transmission–Modern trends in HVDC technology–DC breakers–Operating problems–HVDC transmission based on VSC –Types and applications of MTDC systems.

UNIT II ANALYSIS OF HVDC CONVERTERS 9

Line commutated converter -Analysis of Graetz circuit with and without overlap -Pulse number– Choice of converter configuration – Converter bridge characteristics– Analysis of a 12 pulse converters– Analysis of VSC topologies and firing schemes.

UNIT III CONVERTER AND HVDC SYSTEM CONTROL 9

Principles of DC link control–Converter control characteristics–System control hierarchy–Firing angle control– Current and extinction angle control–Starting and stopping of DC link –Power control –Higher level controllers –Control of VSC based HVDC link.

UNIT IV REACTIVE POWER AND HARMONICS CONTROL 9

Reactive power requirements in steady state–Sources of reactive power–SVC and STATCOM– Generation of harmonics –Design of AC and DC filters– Active filters.

UNIT V POWER FLOW ANALYSIS IN AC/DC SYSTEMS 9

Per unit system for DC quantities–DC system model –Inclusion of constraints –Power flow analysis –case study

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand the principles and types of HVDC system.
- Ability to analyze and understand the concepts of HVDC converters.
- Ability to acquire knowledge on DC link control.
- Ability to understand the concepts of reactive power management, harmonics and power flow analysis.
- Ability to get knowledge about Planning of DC power transmission and comparison with AC power transmission.
- Ability to understand the importance of power flow in HVDC system under steady state.

TEXT BOOKS:

1. Padiyar,K.R.,"HVDC power transmission system", New Age International(P)Ltd. NewDelhi, Second Edition,2010.
2. Arrillaga,J.,"High Voltage Direct Current Transmission", Peter Pregrinus, London,1983.

REFERENCES

1. Kundur P.," Power System Stability and Control", McGraw-Hill,1993.
2. Colin Adamson and Hingorani NG," High Voltage Direct Current Power Transmission", Garraway Limited, London, 1960.
3. Edward Wilson Kimbark," Direct Current Transmission", Vol.I, Wiley inter science, New York, London, Sydney,1971.

19153E82C	SMART GRID	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Smart Grid technologies, different smart meters and advanced metering infrastructure.
- The power quality management issues in Smart Grid.
- The high performance computing for Smart Grid applications

UNIT I INTRODUCTION TO SMART GRID 9

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, National and International Initiatives in Smart Grid.

UNIT II SMART GRID TECHNOLOGIES 9

Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/VAR control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plugin Hybrid Electric Vehicles(PHEV).

UNIT III SMART METERS AND ADVANCED METERING INFRASTRUCTURE 9

IntroductiontoSmartMeters,AdvancedMeteringinfrastructure(AMI)driversandbenefits,AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU), Intelligent Electronic Devices(IED)&their application for monitoring & protection.

UNIT IV POWERQUALITYMANAGEMENTINSMARTGRID 9

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, W eb based Power Quality monitoring, Power Quality Audit.

UNIT V HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS 9

Local Area Network(LAN),House Area Network(HAN), W ide Area Network(W AN), Broad band over Power line(BPL),IP based Protocols, Basics of W eb Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will develop more understanding on the concepts of Smart Grid and its present developments.
- Learners will study about different Smart Grid technologies.
- Learners will acquire knowledge about different smart meters and advanced metering infrastructure.
- Learners will have knowledge on power quality management in Smart Grids
- Learners will develop more understanding on LAN, WAN and Cloud Computing for Smart Grid applications.

TEXT BOOKS:

1. Stuart Borlase “Smart Grid: Infrastructure, Technology and Solutions”,CRCPress2012.
2. JanakaEkanayake,NickJenkins,KithsiriLiyanage,JianzhongWu,AkihikoYokoyama, “Smart Grid: TechnologyandApplications”,Wiley2012.

REFERENCES

- VehbiC. Güngör ,Dilan Sahin, Taskin Kocak, Salih Ergüt, Concettina Buccella, Carlo Cecati, and Gerhard P. Hancke, “Smart Grid Technologies: Communication Technologies and Standards” IEEE Transactions On Industrial Informatics, Vol.7,No.4, November2011.
- Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang “SmartGrid –The New and Improved Power Grid: A Survey” ,IEEE Transaction on Smart Grids,vol.14,2012.
- James Momohe “Smart Grid: Fundamentals of Design and Analysis,”, Wiley-IEEE Press , 2012.

19153E82D BIOMEDICAL INSTRUMENTATION L T P C
3 0 0 3

OBJECTIVES:

- To Introduce Fundamentals of Biomedical Engineering
- To study the communication mechanics in a biomedical system with few examples
- To study measurement of certain important electrical and non-electrical parameters
- To understand the basic principles in imaging techniques
- To have a basic knowledge in life assisting and therapeutic devices

UNIT I FUNDAMENTALS OF BIOMEDICAL ENGINEERING 9

Cell and its structure – Resting and Action Potential – Nervous system and its fundamentals - Basic components of a biomedical system- Cardiovascular systems- Respiratory systems -Kidney and blood flow - Biomechanics of bone - Biomechanics of soft tissues -Physiological signals and transducers - Transducers – selection criteria – Piezo electric, ultrasonic transducers - Temperature measurements - Fibre optic temperature sensors

UNIT II NON ELECTRICAL PARAMETERS MEASUREMENT AND DIAGNOSTIC PROCEDURES 9

Measurement of blood pressure - Cardiac output - Heart rate - Heart sound - Pulmonary function measurements – spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analysers, pH of blood –measurement of blood pCO2, pO2, finger-tip oxymeter - ESR, GSR measurements.

UNIT III ELECTRICAL PARAMETERS ACQUISITION AND ANALYSIS 9

Electrodes – Limb electrodes –floating electrodes – pregelled disposability electrodes - Micro, needle and surface electrodes – Amplifiers, Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier - ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms - Electrical safety in medical environment, shock hazards – leakage current-Instruments for checking safety parameters of biomedical equipment.

UNIT IV IMAGING MODALITIES AND ANALYSIS 9

Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography –Different types of biotelemetry systems - Retinal Imaging - Imaging application in Biometric systems.

UNIT V LIFE ASSISTING, THERAPEUTIC AND ROBOTIC DEVICES 9

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialysers – Lithotripsy - ICCU patient monitoring system - Nano Robots - Robotic surgery –Orthopedic prostheses fixation.

OUTCOMES: TOTAL : 45 PERIODS

- Ability to understand the philosophy of the heart, lung, blood circulation and respiration system.
- Ability to provide latest ideas on devices of non-electrical devices.
- Ability to gain knowledge on various sensing and measurement devices of electrical origin.
- Ability to understand the analysis systems of various organ types.
- Ability to bring out the important and modern methods of imaging techniques and their analysis.
- Ability to explain the medical assistance/techniques, robotic and therapeutic equipments.

TEXT BOOKS:

1. Leslie Cromwell, “Biomedical Instrumentation and Measurement”, Prentice Hall of India, New Delhi, 2007.
2. Khandpur R.S, Handbook of Biomedical Instrumentation, Tata McGraw-Hill, New Delhi,2nd edition, 2003
3. Joseph J Carr and John M.Brown, Introduction to Biomedical Equipment Technology, JohnWiley and sons, New York, 4th edition, 2012

REFERENCES

1. John G. Webster, Medical Instrumentation Application and Design, John Wiley and sons, New York, 1998.
2. Duane Knudson, Fundamentals of Biomechanics, Springer, 2nd Edition, 2007.
3. Suh, Sang, Gurupur, Varadraj P., Tanik, Murat M., Health Care Systems, Technology and Techniques, Springer, 1st Edition, 2011.
4. Ed. Joseph D. Bronzino, The Biomedical Engineering Hand Book, Third Edition, Boca Raton, CRC Press LLC, 2006.
5. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.

PRIST

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UNIVERSITY

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THANJAVUR – 613 403 - TAMIL NADU

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

PROGRAM HANDBOOK

B.TECH FULLTIME

ELECTRICAL & ELECTRONICS ENGINEERING

[REGULATION 2020]
[for candidates admitted to B.Tech EEE program from June 2020 onwards]

COURSE STRUCTURE

B.TECH-EEE
R 2020

B.TECH (FT) EEE [REGULATION 2020]

SEMESTER I

S.No	Course Code	Course Name	L	T	P	C
1	20147S11	Communicative English	2	0	0	2
2	20148S12	Engineering Mathematics-I	3	1	0	4
3	20149S13	Engineering Physics	2	1	0	3
4	20149S14	Engineering Chemistry	2	1	0	3
5	20154S15	Engineering Graphics	1	0	4	3
6	20150S16	Problem Solving and Basics of Python programming	3	0	0	3
PRACTICAL						
7	20150L17	Problem Solving and Basics of Python programming Laboratory	0	0	4	2
8	20149L18	Physics and Chemistry Laboratory	0	0	4	2
			TOTAL CREDITS			**22**
AUDIT COURSE						
9	201AGIT	Induction Training Programme				2

SEMESTER II

S.No	Course Code	Course Name	L	T	P	C
1	20147S21	Technical English	2	0	0	2
2	20148S22	Engineering Mathematics –II	3	1	0	4
3	20149S23B	Physics for Electronics Engineering	3	0	0	3
4	20149S24A	Environmental Science and Engineering	3	0	0	3
5	20153S25C	Circuit Theory	2	1	0	3
6	20154S26C	Basic Civil and Mechanical Engineering	4	0	0	4
PRACTICAL						
7	20154L27	Engineering Practices Laboratory	1	0	4	3
8	20153L28C	Electric Circuits Laboratory	0	0	4	2
			TOTAL CREDITS			**24**
AUDIT COURSE						
1	201AGIC	Indian Constitution				2
SOFT SKILL COURSE						
2	201ASBE	Basic Behavioral Etiquette				2

SEMESTER III

S.No	Course Code	Course Name	L	T	P	C
1	20148S31C	Transforms and Partial Differential Equations	3	1	0	4
2	20153S32	Digital Logic Circuits	2	2	0	3
3	20153C33	Electromagnetic Theory	2	2	0	3
4	20153C34	Electrical Machines-I	2	2	0	3
5	20153C35	Electron Devices and Circuits	3	0	0	3
6	20153C36	Power Plant Engineering	3	0	0	3
PRACTICAL						
7	20153L37	Electronics Laboratory	0	0	4	2
8	20153L38	Electrical Machines Laboratory-I	0	0	4	2
9	201AGGS	Introduction to Gender studies				2
					TOTAL CREDITS	**23**

SEMESTER IV

S.No	Course Code	Course Name	L	T	P	C
1	20148S41C	Numerical Methods	3	1	0	4
2	20153C42	Electrical Machines –II	2	2	0	3
3	20153C43	Transmission and Distribution	3	0	0	3
4	20153C44	Measurements and Instrumentation	3	0	0	3
5	20153C45	Linear Integrated Circuits and Applications	3	0	0	3
6	20153C46	Control Systems	3	2	0	4
PRACTICAL						
7	20153L47	Electrical Machines Laboratory-II	0	0	4	2
8	20153L48	Linear and Digital Integrated Circuits Laboratory	0	0	4	2
9	20153L49	Technical Seminar	0	0	2	1
10	201AGCE	Community Engagement				2
11	201ASGS	Technical, General Aptitude and Skill set Development				2
					TOTAL CREDITS	**25**

SEMESTER V

S.No	Course Code	Course Name	L	T	P	C
1	20153C51	Power System Analysis	3	0	0	3
2	20153C52	Microprocessors and Microcontrollers	3	0	0	3
3	20153C53	Power Electronics	3	0	0	3
4	201__OE54_	OPEN Elective-I	3	0	0	3
5	20153S55	Digital Signal Processing	2	2	0	3
6	20153S56	Object Oriented Programming	3	0	0	3
PRACTICAL						
7	20153L57	Control and Instrumentation Laboratory	0	0	4	2
8	20153L58	Object Oriented Programming Laboratory	0	0	4	2
9	20153L59	Professional Communication	0	0	2	1
RESEARCH SKILL DEVELOPMENT(RSD)COURSE						
10	201AGIE	Innovation and Entrepreneurship				2
					TOTAL CREDITS	**23**

SEMESTER –VI

S.No	Course Code	Course Name	L	T	P	C
1	20153C61	Solid State Drives	3	0	0	3
2	20153C62	Protection and Switchgear	3	0	0	3
3	20153S63	Embedded Systems	3	0	0	3
4	20153E64_	Elective –I	3	0	0	3
5	20153E65_	Elective –II	3	0	0	3
PRACTICAL						
6	20153L66	Power Electronics and Drives Laboratory	0	0	4	2
7	20153L67	Microprocessors and Microcontrollers Laboratory	0	0	4	2
8	20153MP68	Mini Project	-	-	4	2
RESEARCH SKILL DEVELOPMENT (RSD) COURSE						
9	201ASTT	Technical Training				2
					TOTAL CREDITS	**21**

SEMESTER –VII

S.No	Course Code	Course Name	L	T	P	C
1	20153C71	High Voltage Engineering	3	0	0	3
2	20153C72	Power System Operation and Control	3	0	0	3
3	20153C73	Renewable Energy Systems	3	0	0	3
4	201__OE74_	OPEN Elective –II	3	0	0	3
5	20153E75_	Elective –III	3	0	0	3
6	20153E76_	Elective –IV	3	0	0	3
PRACTICAL						
7	20153L77	Power System Simulation Laboratory	0	0	4	2
8	20153L78	Renewable Energy Systems Laboratory	0	0	4	2
					TOTAL CREDITS	**22**

SEMESTER –VIII

S.No	Course Code	Course Name	L	T	P	C
1	20153E81_	Elective –V	3	0	0	3
2.	20153E82_	Elective –VI	3	0	0	3
PRACTICAL						
3.	20153P83	Project Work	0	0	12	6
4.	201AGPE	Professional Ethics and Human Values				2
5.	201ASIM	Interview Skills Training and Mock Test				2
					TOTAL CREDITS	**12**
TOTAL NO.OF CREDITS=172						

****Experiential based learning courses (Theory)**
##-Highly Significant Laboratory Courses (Practical)

HoD **Dean of Academic Affairs** **DEAN**

LIST OF ELECTIVES

ELECTIVE –I (VI SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1.	20153E64A	Advanced Control System	3	0	0	3
2.	20153E64B	Visual Languages and Applications	3	0	0	3
3.	20153E64C	Design of Electrical Apparatus	3	0	0	3
4.	20153E64D	Power Systems Stability	3	0	0	3
5.	20153E64E	Modern Power Converters	3	0	0	3
6..	20153E64F	Intellectual Property Rights	3	0	0	3

ELECTIVE–II (VI SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1.	20153E65A	Principles of Robotics	3	0	0	3
2.	20153E65B	Special Electrical Machines	3	0	0	3
3.	20153E65C	Power Quality	3	0	0	3
4.	20153E65D	EHVAC Transmission	3	0	0	3
5.	20153E65E	Communication Engineering	3	0	0	3

ELECTIVE –III (VII SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1	20153E75A	Disaster Management	3	0	0	3
2	20153E75B	Human Rights	3	0	0	3
3	20153E75C	Operations Research	3	0	0	3
4	20153E75D	Probability and Statistics	3	0	0	3
5.	20153E75E	Fiber Optics and Laser Instrumentation	3	0	0	3

ELECTIVE –IV (VII SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1.	20153E76A	System Identification and Adaptive Control	3	0	0	3
2.	20153E76B	Computer Architecture	3	0	0	3
3.	20153E76C	Control of Electrical Drives	3	0	0	3
4.	20153E76D	VLSI Design	3	0	0	3
5.	20153E76E	Power Systems Transients	3	0	0	3
6.	20153E76F	Total Quality Management	3	0	0	3

ELECTIVE –V (VIII SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1.	20153E81A	Flexible AC Transmission Systems	3	0	0	3
2.	20153E81B	Soft Computing Techniques	3	0	0	3
3.	20153E81C	Power Systems Dynamics	3	0	0	3
4.	20153E81D	SMPS and UPS	3	0	0	3
5.	20153E81E	Electric Energy Generation, Utilization and Conservation	3	0	0	3
6.	20153E81F	Professional Ethics in Engineering	3	0	0	3
7.	20153E81G	Principles of Management	3	0	0	3

ELECTIVE –VI (VIII SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1.	20153E82A	Energy Management and Auditing	3	0	0	3
2.	20153E82B	Data Structures	3	0	0	3
3.	20153E82C	High Voltage Direct Current Transmission	3	0	0	3
4.	20153E82D	Microcontroller Based System Design	3	0	0	3
5.	20153E82E	Smart Grid	3	0	0	3
6.	20153E82F	Biomedical Instrumentation	3	0	0	3
7.	20153E82G	Fundamentals of Nano Science	3	0	0	3

FREE ELECTIVE (V SEM)

S.No	Course Code	Course Name	L	T	P	C
1	20150FE54A	Database Management System	3	0	0	3
2	20152FE54A	Basics of Biomedical Instrumentation	3	0	0	3
3	20154FE54A	Renewable Energy Sources	3	0	0	3
4	20155FE54A	Air Pollution and Control Engineering	3	0	0	3
5	20150FE54B	Cloud computing	3	0	0	3
6	20152FE54B	Sensors and Transducers	3	0	0	3
7	20154FE54B	Automatic System	3	0	0	3
8	20155FE54B	Geographic Information System	3	0	0	3

FREE ELECTIVE (VII SEM)

S.No	Course Code	Course Name	L	T	P	C
1	20150FE74A	Introduction to C Programming	3	0	0	3
2	20152FE74A	Robotics	3	0	0	3
3	20154FE74A	Industrial safety	3	0	0	3
4	20155FE74A	Green Building Design	3	0	0	3
5	20150FE74B	Datastructures and Algorithms	3	0	0	3
6	20152FE74B	Electronic Devices	3	0	0	3
7	20154FE74B	Testing of Materials	3	0	0	3
8	20155FE74B	Waste water Treatment	3	0	0	3

HoD **DEAN E&T** **DEAN ACADEMICS** **VICE CHANCELLOR**

20147S11 **COMMUNICATIVE ENGLISH**

L	T	P	C
5	1	0	4

OBJECTIVES:

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills

UNIT I SHARING INFORMATION RELATED TO ONESELF/FAMILY& FRIENDS 12

Reading- short comprehension passages, practice in skimming-scanning and predicting- **Writing-** completing sentences- - developing hints. **Listening-** short texts- short formal and informal conversations. **Speaking-** introducing oneself - exchanging personal information- **Language development-** Wh- Questions- asking and answering-yes or no questions- parts of speech. **Vocabulary development--** prefixes- suffixes- articles.- count/ uncount nouns.

UNIT II GENERAL READING AND FREE WRITING 12

Reading - comprehension-pre-reading-post reading- comprehension questions (multiple choice questions and /or short questions/ open-ended questions)-inductive reading- short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts)- register- **Writing –** paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions using some suggested vocabulary and structures –**Listening-** telephonic conversations. **Speaking –** sharing information of a personal kind—greeting – taking leave**- Language development**
– prepositions, conjunctions **Vocabulary development-** guessing meanings of words in context.

UNIT III GRAMMAR AND LANGUAGE DEVELOPMENT 12

Reading- short texts and longer passages (close reading) **Writing-** understanding text structure- use of reference words and discourse markers-coherence-jumbled sentences **Listening** – listening to longer texts and filling up the table- product description- narratives from different sources. **Speaking-** asking about routine actions and expressing opinions. **Language development-** degrees of comparison- pronouns- direct vs indirect questions- **Vocabulary development –** single word substitutes- adverbs.

UNIT IV READING AND LANGUAGE DEVELOPMENT 12

Reading- comprehension-reading longer texts- reading different types of texts- magazines **Writing-** letter writing, informal or personal letters-e-mails-conventions of personal email**- Listening-** listening to dialogues or conversations and completing exercises based on them. **Speaking-** speaking about oneself- speaking about one's friend**- Language development-** Tenses- simple present-simple past- present continuous and past continuous- **Vocabulary development-** synonyms-antonyms- phrasal verbs

UNIT V EXTENDED WRITING 12

Reading- longer texts- close reading –**Writing-** brainstorming -writing short essays – developing an outline- identifying main and subordinate ideas- dialogue writing-**Listening** – listening to talks- conversations- **Speaking –** participating in conversations- short group conversations-**Language development**-modal verbs- present/ past perfect tense - **Vocabulary development**-collocations- fixed and semi-fixed expressions

REFERENCES

1. Bailey, Stephen. **Academic Writing: A practical guide for students**. New York: Rutledge,2011.
2. Comfort, Jeremy, et al. **Speaking Effectively : Developing Speaking Skillsfor BusinessEnglish.** Cambridge University Press, Cambridge: Reprint 2011
3. Dutt P. Kiranmai and RajeevanGeeta. **Basic Communication Skills,** Foundation Books: 2013
4. Means,L. Thomas and Elaine Langlois. **English & Communication For Colleges.** CengageLearning ,USA: 2007
5. Redston, Chris &Gillies Cunningham **Face2Face** (Pre-intermediate Student's Book& Workbook) Cambridge University Press, New Delhi: 2005

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20148S12	**ENGINEERING MATHEMATICS - I**	**L**	**T**	**P**	**C**
		5	**1**	**0**	**4**

OBJECTIVES :

- The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

UNIT I DIFFERENTIAL CALCULUS 12

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

UNIT II FUNCTIONS OF SEVERAL VARIABLES 12

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT III INTEGRAL CALCULUS 12

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT IV MULTIPLE INTEGRALS 12

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

UNIT V DIFFERENTIAL EQUATIONS 12

Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients - Method of undetermined coefficients.

TOTAL : 60 PERIODS

OUTCOMES :

After completing this course, students should demonstrate competency in the following skills:

- Use both the limit definition and rules of differentiation to differentiate functions.
- Apply differentiation to solve maxima and minima problems.
- Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
- Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
- Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
- Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
- Apply various techniques in solving differential equations.

TEXT BOOKS :

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015. [For Units I & III - Sections 1.1, 2.2, 2.3, 2.5, 2.7(Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1(Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCES :

1. Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10th Edition, 2016.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
3. Narayanan, S. and Manicavachagom Pillai, T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.
4. Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.
5. Weir, M.D and Joel Hass, "Thomas Calculus", 12th Edition, Pearson India, 2016.

20149S13 ENGINEERING PHYSICS

L	T	P	C
5	1	0	4

OBJECTIVES :

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I PROPERTIES OF MATTER 9

Elasticity – Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment - I-shaped girders - stress due to bending in beams.

UNIT II WAVES AND FIBER OPTICS 9

Oscillatory motion – forced and damped oscillations: differential equation and its solution – plane progressive waves – wave equation. Lasers : population of energy levels, Einstein's A and B coefficients derivation – resonant cavity, optical amplification (qualitative) – Semiconductor lasers: homojunction and heterojunction – Fiber optics: principle, numerical aperture and acceptance angle -types of optical fibres (material, refractive index, mode) – losses associated with optical fibers - fibre optic sensors: pressure and displacement.

UNIT III THERMAL PHYSICS 9

Transfer of heat energy – thermal expansion of solids and liquids – expansion joints - bimetallic strips - thermal conduction, convection and radiation – heat conductions in solids – thermal conductivity - Forbe's and Lee's disc method: theory and experiment - conduction through compound media (series and parallel) – thermal insulation – applications: heat exchangers, refrigerators, ovens and solar water heaters.

UNIT IV QUANTUM PHYSICS 9

Black body radiation – Planck's theory (derivation) – Compton effect: theory and experimental verification – wave particle duality – electron diffraction – concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box – tunnelling (qualitative) - scanning tunnelling microscope.

UNIT V CRYSTAL PHYSICS 9

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - crystal imperfections: point defects, line defects – Burger vectors, stacking faults – role of imperfections in plastic deformation - growth of single crystals: solution and melt growth techniques.

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course,

- the students will gain knowledge on the basics of properties of matter and its applications,
- the students will acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics,
- the students will have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers,
- the students will get knowledge on advanced physics concepts of quantum theory and its applications in tunneling microscopes, and
- the students will understand the basics of crystals, their structures and different crystal growth techniques.

TEXT BOOKS:

1. Bhattacharya, D.K. & Poonam, T. “Engineering Physics”. Oxford University Press, 2015.
2. Gaur, R.K. & Gupta, S.L. “Engineering Physics”. Dhanpat Rai Publishers, 2012.
3. Pandey, B.K. & Chaturvedi, S. “Engineering Physics”. Cengage Learning India, 2012.

REFERENCES:

1. Halliday, D., Resnick, R. & Walker, J. “Principles of Physics”. Wiley, 2015.
2. Serway, R.A. & Jewett, J.W. “Physics for Scientists and Engineers”. Cengage Learning, 2010.
3. Tipler, P.A. & Mosca, G. “Physics for Scientists and Engineers with Modern Physics’. W.H.Freeman, 2007.

20149S14	ENGINEERING CHEMISTRY	L T P C
		5 1 0 4

OBJECTIVES:

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.

UNIT I WATER AND ITS TREATMENT 9

Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA – numerical problems – boiler troubles (scale and sludge) – treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) external treatment – Ion exchange process, zeolite process – desalination of brackish water - Reverse Osmosis.

UNIT II SURFACE CHEMISTRY AND CATALYSIS 9

Adsorption: Types of adsorption – adsorption of gases on solids – adsorption of solute from solutions – adsorption isotherms – Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – contact theory – kinetics of surface reactions, unimolecular reactions, Langmuir - applications of adsorption on pollution abatement.

Catalysis: Catalyst – types of catalysis – criteria – autocatalysis – catalytic poisoning and catalytic promoters - acid base catalysis – applications (catalytic convertor) – enzyme catalysis– Michaelis – Menten equation.

UNIT III ALLOYS AND PHASE RULE 9

Alloys: Introduction- Definition- properties of alloys- significance of alloying, functions and effect of alloying elements- Nichrome and stainless steel (18/8) – heat treatment of steel. Phase rule: Introduction, definition of terms with examples, one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system - Pattinson process.

UNIT IV FUELS AND COMBUSTION 9

Fuels: Introduction - classification of fuels - coal - analysis of coal (proximate and ultimate) - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum - manufacture of synthetic petrol (Bergius process) - knocking - octane number - diesel oil - cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) - power alcohol and biodiesel. Combustion of fuels: Introduction - calorific value - higher and lower calorific values- theoretical calculation of calorific value - ignition temperature - spontaneous ignition temperature - explosive range - flue gas analysis (ORSAT Method).

UNIT V ENERGY SOURCES AND STORAGE DEVICES 9

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H_2-O_2 fuel cell.

TOTAL: 45 PERIODS

OUTCOMES:

- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

TEXT BOOKS:

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015
2. P. C. Jain and Monika Jain, "Engineering Chemistry" Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.

REFERENCES:

1. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
2. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
3. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.

20154S15	ENGINEERING GRAPHICS	L	T	P	C
		5	1	0	4

OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (Not for Examination) 1

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREEHAND SKETCHING 7+12

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and t r ue inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 5+12

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 5+12

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+12

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

TOTAL: 90 PERIODS

OUTCOMES:

On successful completion of this course, the student will be able to

- familiarize with the fundamentals and standards of Engineering graphics
- perform freehand sketching of basic geometrical constructions and multiple views of objects.
- project orthographic projections of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- visualize and to project isometric and perspective sections of simple solids.

TEXT BOOK:

1. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.

REFERENCES:

1. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
2. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.
3. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
4. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
5. N S Parthasarathy And Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
6. S[illegible] M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

20150S16 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C
5 1 0 4

COURSE OBJECTIVES:

- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures –- lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT I ALGORITHMIC PROBLEM SOLVING 9

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS 9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

UNIT V FILES, MODULES, PACKAGES 9

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

- Develop algorithmic solutions to simple computational problems
- Read, write, execute by hand simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python Programs.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)

2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

REFERENCES:

1. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem- Solving Focus, Wiley India Edition, 2013.
2. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press , 2013
3. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
4. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013.
5. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
6. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd.,, 2015.

20150L17	**PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY**	**L T P C**
		0 0 3 2

COURSE OBJECTIVES:

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

LIST OF PROGRAMS

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

PLATFORM NEEDED
Python 3 interpreter for Windows/Linux

COURSE OUTCOMES:
Upon completion of the course, students will be able to

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

TOTAL :60 PERIODS

20149L18	**PHYSICS AND CHEMISTRY LABORATORY** **(Common to all branches of B.E. / B.Tech Programmes)**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**2**

OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young's modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser
   (b) Determination of acceptance angle in an optical fiber.
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method

OUTCOMES:
Upon completion of the course, the students will be able to **TOTAL: 30 PERIODS**

- apply principles of elasticity, optics and thermal properties for engineering applications.

CHEMISTRY LABORATORY: (Any seven experiments to be conducted) OBJECTIVES:

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by viscometery.

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10- Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
11. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
12. Pseudo first order kinetics-ester hydrolysis.
13. Corrosion experiment-weight loss method.
14. Determination of CMC.
15. Phase change in a solid.
16. Conductometric titration of strong acid vs strong base.

OUTCOMES:

- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

TOTAL: 30

PERIODS TEXTBOOKS:

1. Vogel's Textbook of Quantitative Chemical Analysis (8^{TH} edition, 2014)

20147S21

TECHNICAL ENGLISH

L	T	P	C
3	1	0	4

OBJECTIVES: The Course prepares second semester engineering and Technology students to:

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations , participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialisation.

UNIT I INTRODUCTION TECHNICAL ENGLISH 12

Listening- Listening to talks mostly of a scientific/technical nature and completing information-gap exercises- **Speaking** –Asking for and giving directions- **Reading** – reading short technical texts from journals- newsapapers- **Writing-** purpose statements – extended definitions – issue- writing instructions – checklists-recommendations-**Vocabulary Development-** technical vocabulary **Language Development** –subject verb agreement - compound words.

UNIT II READING AND STUDY SKILLS 12

Listening- Listening to longer technical talks and completing exercises based on them-**Speaking** – describing a process-**Reading** – reading longer technical texts- identifying the various transitions in a text- paragraphing- **Writing-** interpreting cgarts, graphs- **Vocabulary Development-**vocabularyused in formal letters/emails and reports **Language Development-** impersonal passive voice, numerical adjectives.

UNIT III TECHNICAL WRITING AND GRAMMAR 12

Listening- Listening to classroom lectures/ talkls on engineering/technology **-Speaking** – introduction to technical presentations- **Reading** – longer texts both general and technical, practice in speed reading; **Writing**-Describing a process, use of sequence words- **Vocabulary Development-** sequence words- Misspelled words. **Language Development-** embedded sentences

UNIT IV REPORT WRITING 12

Listening- Listening to documentaries and making notes. **Speaking** – mechanics of presentations- **Reading** – reading for detailed comprehension- **Writing-** email etiquette- job application – cover letter – Résumé preparation(via email and hard copy)- analytical essays and issue based essays-- **Vocabulary Development-** finding suitable synonyms-paraphrasing-. **Language Development-** clauses- if conditionals.

UNIT V GROUP DISCUSSION AND JOB APPLICATIONS 12

Listening- TED/Ink talks; **Speaking** –participating in a group discussion **-Reading**– reading and understanding technical articles **Writing**– Writing reports- minutes of a meeting- accident and survey- **Vocabulary Development- verbal analogies Language Development-** reported speech

TOTAL : 60 PERIODS

OUTCOMES: At the end of the course learners will be able to:

- Read technical texts and write area- specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialisation successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write reports and winning job applications.

TEXT BOOKS:

1. Board of editors. **Fluency in English A Course book for Engineering and Technology.** Orient Blackswan, Hyderabad: 2016
2. Sudharshana.N.P and Saveetha. C. **English for Technical Communication**. Cambridge University Press: New Delhi, 2016.

REFERENCES

1. Booth-L. Diana**, Project Work,** Oxford University Press**,** Oxford: 2014.
2. Grussendorf, Marion, **English for Presentations,** Oxford University Press, Oxford: 2007
3. Kumar, Suresh. E. **Engineering English**. Orient Blackswan: Hyderabad,2015
4. Means, L. Thomas and Elaine Langlois, **English & Communication For Colleges.** Cengage Learning, USA: 2007
5. Raman, Meenakshi and Sharma, Sangeetha- **Technical Communication Principles and Practice.**Oxford University Press: New Delhi,2014.

Students can be asked to read Tagore, Chetan Bhagat and for suplementary reading.

20148S22A	**ENGINEERING MATHEMATICS – II**	**L**	**T**	**P**	**C**
		5	**1**	**0**	**4**

OBJECTIVES :

- This course is designed to cover topics such as Matrix Algebra, Vector Calculus, Complex Analysis and Laplace Transform. Matrix Algebra is one of the powerful tools to handle practical problems arising in the field of engineering. Vector calculus can be widely used for modelling the various laws of physics. The various methods of complex analysis and Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

UNIT I MATRICES **12**

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II VECTOR CALCULUS **12**

Gradient and directional derivative – Divergence and curl - Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III ANALYTIC FUNCTIONS **12**

Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions $w = z + c, cz, \frac{1}{z}, z^2$ - Bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour.

UNIT V LAPLACE TRANSFORMS 12

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear second order ordinary differential equations with constant coefficients.

OUTCOMES : TOTAL: 60 PERIODS

After successfully completing the course, the student will have a good understanding of the following topics and their applications:

- Eigenvalues and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.
- Gradient, divergence and curl of a vector point function and related identities.
- Evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems and their verification.
- Analytic functions, conformal mapping and complex integration.
- Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.

TEXT BOOKS :

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.

REFERENCES :

1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
2. Jain R.K. and Iyengar S.R.K., " Advanced Engineering Mathematics ", Narosa Publications, New Delhi , 3rd Edition, 2007.
3. O'Neil, P.V. "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.
4. Sastry, S.S, "Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi, 2014.
5. Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

20149S23B	PHYSICS FOR ELECTRONICS ENGINEERING	L	T	P	C
		5	1	0	3

(Common to BME, ME, CC, ECE, EEE, E&I, ICE)

OBJECTIVES:

- To understand the essential principles of Physics of semiconductor device and Electron transport properties. Become proficient in magnetic, dielectric and optical properties of materials and nano devices.

UNIT I ELECTRICAL PROPERTIES OF MATERIALS 9

Classical free electron theory - Expression for electrical conductivity – Thermal conductivity, expression - Wiedemann-Franz law – Success and failures - electrons in metals – Particle in a three dimensional box – degenerate states – Fermi- Dirac statistics – Density of energy states – Electron in periodic potential: Bloch thorem – metals and insulators - Energy bands in solids– tight binding approximation - Electron effective mass – concept of hole.

UNIT II SEMICONDUCTOR PHYSICS 9

Intrinsic Semiconductors – Energy band diagram – direct and indirect semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Carrier transport: Velocity-electric field relations – drift and diffusion transport - Einstein's relation – Hall effect and devices – Zener and avalanche breakdown in p-n junctions - Ohmic contacts – tunnel diode - Schottky diode – MOS capacitor - power transistor.

UNIT III MAGNETIC AND DIELECTRIC PROPERTIES OF MATERIALS 9

Magnetism in materials – magnetic field and induction – magnetization - magnetic permeability and susceptibility–types of magnetic materials – microscopic classification of magnetic materials - Ferromagnetism: origin and exchange interaction- saturation magnetization and Curie temperature – Domain Theory. Dielectric materials: Polarization processes – dielectric loss – internal field – Clausius-Mosotti relation- dielectric breakdown – high-k dielectrics.

UNIT IV OPTICAL PROPERTIES OF MATERIALS 9

Classification of optical materials – carrier generation and recombination processes - Absorption emission and scattering of light in metals, insulators and Semiconductors (concepts only) - photo current in a P- N diode – solar cell –photo detectors - LED – Organic LED – Laser diodes – excitons - quantum confined Stark effect – quantum dot laser.

UNIT V NANOELECTRONIC DEVICES 9

Introduction - electron density in bulk material – Size dependence of Fermi energy– quantum confinement – quantum structures - Density of states in quantum well, quantum wire and quantum dot structures –Zener-Bloch oscillations – resonant tunneling – quantum interference effects – mesoscopic structures: conductance fluctuations and coherent transport – Coulomb blockade effects - Single electron phenomena and Single electron Transistor – magnetic semiconductors– spintronics - Carbon nanotubes: Properties and applications.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the students will able to

- gain knowledge on classical and quantum electron theories, and energy band structuues,
- acquire knowledge on basics of semiconductor physics and its applications in various devices,
- get knowledge on magnetic and dielectric properties of materials,
- have the necessary understanding on the functioning of optical materials for optoelectronics,
- understand the basics of quantum structures and their applications in spintronics and carbon electronics.

TEXT BOOKS:

1. Kasap, S.O. "Principles of Electronic Materials and Devices", McGraw-Hill Education, 2007.
2. Umesh K Mishra & Jasprit Singh, "Semiconductor Device Physics and Design", Springer, 2008.
3. Wahab, M.A. "Solid State Physics: Structure and Properties of Materials". Narosa Publishing House, 2009.

REFERENCES

1. Garcia, N. & Damask, A. "Physics for Computer Science Students". Springer-Verlag, 2012.
2. Hanson, G.W. "Fundamentals of Nanoelectronics". Pearson Education, 2009
3. Rogers, B., Adams, J. & Pennathur, S. "Nanotechnology: Understanding Small Systems". CRC Press, 2014

20149S24A ENVIRONMENTAL SCIENCE AND ENGINEERING **L T P C**
5 1 0 4

OBJECTIVES:

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth‟s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL: 45 PERIODS

OUTCOMES:

- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXTBOOKS:

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.

REFERENCES :

1. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD,New Delhi, 2007.
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) PVT, LTD, Hydrabad, 2015.
3. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.

20153S25C **CIRCUIT THEORY**

L	T	P	C
5	1	0	4

OBJECTIVES:

- To introduce electric circuits and its analysis
- To impart knowledge on solving circuit equations using network theorems
- To introduce the phenomenon of resonance in coupled circuits.
- To educate on obtaining the transient response of circuits.
- To introduce Phasor diagrams and analysis of three phase circuits

UNIT I BASIC CIRCUITS ANALYSIS 6+6

Resistive elements - Ohm's Law Resistors in series and parallel circuits – Kirchoffs laws – Mesh current and node voltage - methods of analysis.

UNIT II NETWORK REDUCTION AND THEOREMS FOR DC AND AC IRCUITS 6+6

Network reduction: voltage and current division, source transformation – star delta conversion. Thevenins and Norton Theorems – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem – Millman's theorem.

UNIT III TRANSIENT RESPONSE ANALYSIS 6+6

L and C elements -Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. sinusoidal input.

UNIT IV THREE PHASE CIRCUITS 6+6

A.C. circuits – Average and RMS value - Phasor Diagram – Power, Power Factor and Energy.- Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents – power measurement in three phase circuits.

UNIT V RESONANCE AND COUPLED CIRCUITS 6+6

Series and parallel resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

OUTCOMES: **TOTAL : 60 PERIODS**

- Ability to analyse electrical circuits
- Ability to apply circuit theorems
- Ability to analyse transients

TEXT BOOKS:

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", McGraw Hill publishers, edition, New Delhi, 2013.
2. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, 2013.
3. Allan H. Robbins, Wilhelm C. Miller, "Circuit Analysis Theory and Practice", Cengage Learning India, 2013.

REFERENCES

1. Chakrabarti A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, 1999.
2. Jegatheesan, R., "Analysis of Electric Circuits," McGraw Hill, 2015.
3. Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, McGraw- Hill, New Delhi, 2010.
4. M E Van Valkenburg, "Network Analysis",Prentice-Hall of India Pvt Ltd, New Delhi,

2015.
5. Mahadevan, K., Chitra, C., "Electric Circuits Analysis," Prentice-Hall of India Pvt Ltd., New Delhi, 2015.
6. Richard C. Dorf and James A. Svoboda, "Introduction to Electric Circuits", 7th Edition, John Wiley & Sons, Inc. 2015.
7. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", McGraw Hill, 2015.

20154S26C BASIC CIVIL AND MECHANICAL ENGINEERING **L T P C**
5 1 0 4

OBJECTIVES:
- To impart basic knowledge on Civil and Mechanical Engineering.
- To familiarize the materials and measurements used in Civil Engineering.
- To provide the exposure on the fundamental elements of civil engineering structures.
- To enable the students to distinguish the components and working principle of power plant units, IC engines, and R & AC system.

A – OVER VIEW

UNIT I SCOPE OF CIVIL AND MECHANICAL ENGINEERING 10

Overview of Civil Engineering - Civil Engineering contributions to the welfare of Society – Specialized sub disciplines in Civil Engineering – Structural, Construction, Geotechnical, Environmental, Transportation and Water Resources Engineering

Overview of Mechanical Engineering - Mechanical Engineering contributions to the welfare of Society – Specialized sub disciplines in Mechanical Engineering - Production, Automobile, Energy Engineering - Interdisciplinary concepts in Civil and Mechanical Engineering.

B – CIVIL ENGINEERING

UNIT II SURVEYING AND CIVIL ENGINEERING MATERIALS 10

Surveying: Objects – classification – principles – measurements of distances – angles – leveling – determination of areas– contours - examples.

Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel - timber - modern materials

UNIT III BUILDING COMPONENTS AND STRUCTURES 15

Foundations: Types of foundations - Bearing capacity and settlement – Requirement of good foundations.

Civil Engineering Structures: Brickmasonry – stonemasonry – beams – columns – lintels – roofing – flooring – plastering – floor area, carpet area and floor space index - Types of Bridges and Dams – water supply - sources and quality of water - Rain water harvesting - introduction to high way and rail way.

C – MECHANICAL ENGINEERING

UNIT IV INTERNAL COMBUSTION ENGINES AND POWER PLANTS 15

Classification of Power Plants - Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Working principle of steam, Gas, Diesel, Hydro - electric and Nuclear Power plants –- working principle of Boilers, Turbines, Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps

UNIT V REFRIGERATION AND AIR CONDITIONING SYSTEM 10

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system– Layout of typical domestic refrigerator–Window and Split type room Air conditioner.

OUTCOMES: **TOTAL: 60 PERIODS**

On successful completion of this course, the student will be able to

- appreciate the Civil and Mechanical Engineering components of Projects.
- explain the usage of construction material and proper selection of construction materials.
- measure distances and area by surveying
- identify the components used in power plant cycle.
- demonstrate working principles of petrol and diesel engine.
- elaborate the components of refrigeration and Air conditioning cycle.

TEXTBOOKS:

1. Shanmugam Gand Palanichamy MS,“Basic Civil and Mechanical Engineering”,Tata McGraw Hill PublishingCo.,NewDelhi,1996.

REFERENCES:

1. Palanikumar, K. Basic Mechanical Engineering, ARS Publications, 2010.
2. Ramamrutham S.,“Basic Civil Engineering”, Dhanpat Rai Publishing Co.(P) Ltd.1999.
3. Seetharaman S.,“BasicCivil Engineering”,AnuradhaAgencies,2005.
4. ShanthaKumar SRJ.,“Basic Mechanical Engineering”, Hi-tech Publications, Mayiladuthurai, 2000.
5. Venugopal K. and Prahu Raja V., “Basic Mechanical Engineering”, Anuradha Publishers, Kumbakonam,2000.

20154L27 ENGINEERING PRACTICES LABORATORY L T P C
0 0 3 2

OBJECTIVES:

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE 13

Buildings:

(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works. (d) Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

(a) Study of the joints in roofs, doors, windows and furniture. (b) Hands-on-exercise:
Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE 18

Welding:

(a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding. (b) Gas welding practice

Basic Machining:

(a) Simple Turning and Taper turning
(b) Drilling Practice

Sheet Metal Work:

(a) Forming & Bending:
(b) Model making – Trays and funnels. (c) Different type of joints.

Machine assembly practice:

(a) Study of centrifugal pump
(b) Study of air conditioner

Demonstration on:

(a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.
(c) Fitting – Exercises – Preparation of square fitting and V – fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE 13

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of an electrical equipment.

IV ELECTRONICS ENGINEERING PRACTICE 16

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

OUTCOMES:

On successful completion of this course, the student will be able to

TOTAL: 60 PERIODS

- fabricate carpentry components and pipe connections including plumbing works.
- use welding equipments to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metal works
- Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundary and fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, soldering practices.

CIVIL

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.	15 Sets.	
2. Carpentry vice (fitted to work bench)	15 Nos.	
3. Standard woodworking tools	15 Sets.	
4. Models of industrial trusses, door joints, furniture joints	5 each	
5. Power Tools: (a) Rotary Hammer	2 Nos	
(b) Demolition Hammer	2 Nos	(c)
Circular Saw	2 Nos	(d)
Planer	2 Nos	(e)
Hand Drilling Machine	2 Nos	(f)
Jigsaw	2 Nos	

MECHANICAL

1. Arc welding transformer with cables and holders	5 Nos.
2. Welding booth with exhaust facility	5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 Nos.
5. Centre lathe	2 Nos.
6. Hearth furnace, anvil and smithy tools	2 Sets.
7. Moulding table, foundry tools	2 Sets.
8. Power Tool: Angle Grinder	2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner	One each.

ELECTRICAL

1. Assorted electrical components for house wiring	15 Sets
2. Electrical measuring instruments	10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp	1 each
4. Megger (250V/500V)	1 No.
5. Power Tools: (a) Range Finder	2 Nos
(b) Digital Live-wire detector	2 Nos

ELECTRONICS

1. Soldering guns	10 Nos.
2. Assorted electronic components for making circuits	50 Nos.
3. Small PCBs	10 Nos.
4. Multimeters	10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply	

20153L28C	ELECTRIC CIRCUITS LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES:

- To simulate various electric circuits using Pspice/ Matlab/e-Sim / Scilab
- To gain practical experience on electric circuits and verification of theorems.

LIST OF EXPERIMENTS

1. Simulation and experimental verification of electrical circuit problems using Kirchhoff's voltage and current laws.
2. Simulation and experimental verification of electrical circuit problems using Thevenin's theorem.
3. Simulation and experimental verification of electrical circuit problems using Norton's theorem.
4. Simulation and experimental verification of electrical circuit problems using Superposition theorem.
5. Simulation and experimental verification of Maximum Power transfer Theorem.
6. Study of Analog and digital oscilloscopes and measurement of sinusoidal voltage, frequency and power factor.
7. Simulation and Experimental validation of R-C electric circuit transients.
8. Simulation and Experimental validation of frequency response of RLC electric circuit.
9. Design and Simulation of series resonance circuit.
10. Design and Simulation of parallel resonant circuits.
11. Simulation of three phase balanced and unbalanced star, delta networks circuits.

OUTCOMES: **TOTAL: 60 PERIODS**

- Understand and apply circuit theorems and concepts in engineering applications.
- Simulate electric circuits.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Regulated Power Supply: 0 – 15 V D.C - 10 Nos / Distributed Power Source.
2. Function Generator (1 MHz) - 10 Nos.
3. Single Phase Energy Meter - 1 No.
4. Oscilloscope (20 MHz) - 10 Nos.
5. Digital Storage Oscilloscope (20 MHz) – 1 No.
6. 10 Nos. of PC with Circuit Simulation Software (min 10 Users) (e-Sim / Scilab/ Pspice / MATLAB /other Equivalent software Package) and Printer (1 No.)
7. AC/DC - Voltmeters (10 Nos.), Ammeters (10 Nos.) and Multi-meters (10 Nos.)
8. Single Phase Wattmeter – 3 Nos.
9. Decade Resistance Box, Decade Inductance Box, Decade Capacitance Box - 6 Nos each.
10. Circuit Connection Boards - 10 Nos.Necessary Quantities of Resistors,Inductors, Capacitors of various capacities (Quarter Watt to 10Watt

20149S31C TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

L	T	P	C
3	1	0	4

OBJECTIVES :

- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations – Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II FOURIER SERIES 12

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12

Classification of PDE – Method of separation of variables - Fourier Series Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

UNIT IV FOURIER TRANSFORMS 12

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS 12

Z-transforms - Elementary properties – Inverse Z-transform (using partial fraction and residues) – Initial and final value theorems - Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

TOTAL : 60 PERIODS

OUTCOMES :

Upon successful completion of the course, students should be able to:

- Understand how to solve the given standard partial differential equations.
- Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
- Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
- Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

TEXT BOOKS :

1. Grewal B.S., “Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, New Delhi, 2014.
2. Narayanan S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.

REFERENCES :

1. Andrews, L.C and Shivamoggi, B, "Integral Transforms for Engineers" SPIE Press, 1999.
2. Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 9th Edition, Laxmi Publications Pvt. Ltd, 2014.
3. Erwin Kreyszig, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, India, 2016.
4. James, G., "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.
5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
6. Wylie, R.C. and Barrett, L.C., “Advanced Engineering Mathematics “Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

20153C32	DIGITAL LOGIC CIRCUITS	L	T	P	C
		3	1	0	3

OBJECTIVES:

- To study various number systems and simplify the logical expressions using Boolean functions
- To study combinational circuits
- To design various synchronous and asynchronous circuits.
- To introduce asynchronous sequential circuits and PLDs
- To introduce digital simulation for development of application oriented logic circuits.

UNIT I NUMBER SYSTEMS AND DIGITAL LOGIC FAMILIES 6+6

Review of number systems, binary codes, error detection and correction codes (Parity and Hamming code) - Digital Logic Families -comparison of RTL, DTL, TTL, ECL and MOS families -operation, characteristics of digital logic family.

UNIT II COMBINATIONAL CIRCUITS 6+6

Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps - simplification and implementation of combinational logic – multiplexers and de multiplexers - code converters, adders, subtractors, Encoders and Decoders.

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS 6+6

Sequential logic- SR, JK, D and T flip flops - level triggering and edge triggering - counters - asynchronous and synchronous type - Modulo counters - Shift registers - design of synchronous sequential circuits – Moore and Melay models- Counters, state diagram; state reduction; state assignment.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS AND PROGRAMMABILITY LOGIC DEVICES 6+6

Asynchronous sequential logic circuits-Transition tability, flow tability-race conditions, hazards &errors in digital circuits; analysis of asynchronous sequential logic circuits- introduction to Programmability Logic Devices: PROM – PLA –PAL, CPLD-FPGA.

UNIT V VHDL 6+6

RTL Design – combinational logic – Sequential circuit – Operators – Introduction to Packages – Subprograms – Test bench. (Simulation /Tutorial Examples: adders, counters, flip flops, Multiplexers & De multiplexers).

OUTCOMES: TOTAL : 60PERIODS

- Ability to design combinational and sequential Circuits.
- Ability to simulate using software package.
- Ability to study various number systems and simplify the logical expressions using Boolean functions
- Ability to design various synchronous and asynchronous circuits.
- Ability to introduce asynchronous sequential circuits and PLDs
- Ability to introduce digital simulation for development of application oriented logic circuits.

TEXT BOOKS:

1. James W. Bignel, Digital Electronics, Cengage learning, 5th Edition, 2007.
2. M. Morris Mano, 'Digital Design with an introduction to the VHDL', Pearson Education, 2013.
3. Comer "Digital Logic & State Machine Design, Oxford, 2012.

REFERENCES

1. Mandal, "Digital Electronics Principles & Application, McGraw Hill Edu, 2013.
2. William Keitz, Digital Electronics-A Practical Approach with VHDL, Pearson, 2013.
3. Thomas L.Floyd, 'Digital Fundamentals', 11th edition, Pearson Education, 2015.
4. Charles H.Roth, Jr, Lizy Lizy Kurian John, 'Digital System Design using VHDL, Cengage, 2013.
5. D.P.Kothari,J.S.Dhillon, 'Digital circuits and Design',Pearson Education, 2016.

20153C33	ELECTROMAGNETIC THEORY	L	T	P	C
		2	2	0	3

OBJECTIVES:

- To introduce the basic mathematical concepts related to electromagnetic vector fields
- To impart knowledge on the concepts of
  - Electrostatic fields, electrical potential, energy density and their applications.
  - Magneto static fields, magnetic flux density, vector potential and its applications.
  - Different methods of emf generation and Maxwell's equations
  - Electromagnetic waves and characterizing parameters

UNIT I ELECTROSTATICS – I 6+6

Sources and effects of electromagnetic fields – Coordinate Systems – Vector fields –Gradient, Divergence, Curl – theorems and applications - Coulomb's Law – Electric field intensity – Field due to discrete and continuous charges – Gauss's law and applications.

UNIT II ELECTROSTATICS – II 6+6

Electric potential – Electric field and equipotential plots, Uniform and Non-Uniform field, Utilization factor – Electric field in free space, conductors, dielectrics - Dielectric polarization – Dielectric strength - Electric field in multiple dielectrics – Boundary conditions, Poisson's and Laplace's equations, Capacitance, Energy density, Applications.

UNIT III MAGNETOSTATICS 6+6

Lorentz force, magnetic field intensity (H) – Biot–Savart's Law - Ampere's Circuit Law – H due to straight conductors, circular loop, infinite sheet of current, Magnetic flux density (B) – B in free space, conductor, magnetic materials – Magnetization, Magnetic field in multiple media – Boundary conditions, scalar and vector potential, Poisson's Equation, Magnetic force, Torque, Inductance, Energy density, Applications.

UNIT IV ELECTRODYNAMIC FIELDS 6+6

Magnetic Circuits - Faraday's law – Transformer and motional EMF – Displacement current - Maxwell's equations (differential and integral form) – Relation between field theory and circuit theory – Applications.

UNIT V ELECTROMAGNETIC WAVES 6+6

Electromagnetic wave generation and equations – Wave parameters; velocity, intrinsic impedance, propagation constant – Waves in free space, lossy and lossless dielectrics, conductors- skin depth - Poynting vector – Plane wave reflection and refraction.

TOTAL : 60 PERIODS

OUTCOMES:

- Ability to understand the basic mathematical concepts related to electromagnetic vector fields.
- Ability to understand the basic concepts about electrostatic fields, electrical potential, energy density and their applications.
- Ability to acquire the knowledge in magneto static fields, magnetic flux density, vector potential and its applications.
- Ability to understand the different methods of emf generation and Maxwell's equations
- Ability to understand the basic concepts electromagnetic waves and characterizing parameters
- Ability to understand and compute Electromagnetic fields and apply them for design and analysis of electrical equipment and systems

TEXT BOOKS:

1. Mathew N. O. Sadiku, 'Principles of Electromagnetics', 6th Edition, Oxford University Press Inc. Asian edition, 2015.
2. William H. Hayt and John A. Buck, 'Engineering Electromagnetics', McGraw Hill Special Indian edition, 2014.
3. Kraus and Fleish, 'Electromagnetics with Applications', McGraw Hill International Editions, Fifth Edition, 2010

REFERENCES

1. V.V.Sarwate, 'Electromagnetic fields and waves', First Edition, Newage Publishers, 1993.
2. J.P.Tewari, 'Engineering Electromagnetics - Theory, Problems and Applications', Second Edition, Khanna Publishers.
3. Joseph. A.Edminister, 'Schaum's Outline of Electromagnetics, Third Edition (Schaum's Outline Series), McGraw Hill, 2010.
4. S.P.Ghosh, Lipika Datta, 'Electromagnetic Field Theory', First Edition, McGraw Hill Education(India) Private Limited, 2012.
5. K A Gangadhar, 'Electromagnetic Field Theory', Khanna Publishers; Eighth Reprint : 2015

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20153C34	ELECTRICAL MACHINES – I	L	T	P	C
		2	2	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Magnetic-circuit analysis and introduce magnetic materials
- Constructional details, the principle of operation, prediction of performance, the methods of testing the transformers and three phase transformer connections.
- Working principles of electrical machines using the concepts of electromechanical energy conversion principles and derive expressions for generated voltage and torque developed in all Electrical Machines.
- Working principles of DC machines as Generator types, determination of their no-load/load characteristics, starting and methods of speed control of motors.
- Various losses taking place in D.C. Motor and to study the different testing methods to arrive at their performance.

UNIT I MAGNETIC CIRCUITS AND MAGNETIC MATERIALS 6+6

Magnetic circuits –Laws governing magnetic circuits - Flux linkage, Inductance and energy – Statically and Dynamically induced EMF - Torque – Properties of magnetic materials, Hysteresis and Eddy Current losses - AC excitation, introduction to permanent magnets-Transformer as a magnetically coupled circuit.

UNIT II TRANSFORMERS 6+6

Construction – principle of operation – equivalent circuit parameters – phasor diagrams, losses – testing – efficiency and voltage regulation-all day efficiency-Sumpner's test, per unit representation – inrush current - three phase transformers-connections – Scott Connection
– Phasing of transformer– parallel operation of three phase transformers-auto transformer –
tap changing transformers- tertiary winding.

UNIT III ELECTROMECHANICAL ENERGY CONVERSION AND CONCEPTS IN ROTATING MACHINES 6+6

Energy in magnetic system – Field energy and co energy-force and torque equations – singly and multiply excited magnetic field systems-mmf of distributed windings – Winding Inductances-, magnetic fields in rotating machines – rotating mmf waves – magnetic saturation and leakage fluxes.

UNIT IV DC GENERATORS 6+6

Construction and components of DC Machine – Principle of operation - Lap and wave windings-EMF equations– circuit model – armature reaction –methods of excitation-commutation - interpoles compensating winding –characteristics of DC generators.

UNIT V DC MOTORS 6+6

Principle and operations - types of DC Motors – Speed Torque Characteristics of DC Motors- starting and speed control of DC motors –Plugging, dynamic and regenerative braking- testing and efficiency – Retardation test- Swinburne's test and Hopkinson's test - Permanent Magnet DC (PMDC)motors-applications of DC
Motor

OUTCOMES: **TOTAL : 60 PERIODS**

- Ability to analyze the magnetic-circuits.
- Ability to acquire the knowledge in constructional details of transformers.
- Ability to understand the concepts of electromechanical energy conversion.
- Ability to acquire the knowledge in working principles of DC Generator.
- Ability to acquire the knowledge in working principles of DC Motor
- Ability to acquire the knowledge in various losses taking place in D.C. Machines

TEXT BOOKS:

1. Stephen J. Chapman, 'Electric Machinery Fundamentals'4 th edition, McGraw Hill Education Pvt. Ltd, 2010.
2. P.C. Sen'Principles of Electric Machines and Power Electronics' John Wiley & Sons; 3rd Edition 2013.
3. Nagrath, I.J. and Kothari.D.P., Electric Machines', McGraw-Hill Education, 2004

REFERENCES

1. Theodore Wildi, "Electrical Machines, Drives, and Power Systems", Pearson Education., (5th Edition)**,** 2002**.**
2. B.R. Gupta ,'Fundamental of Electric Machines' New age International Publishers,3rd Edition ,Reprint 2015.
3. S.K. Bhattacharya, 'Electrical Machines' McGraw - Hill Education, New Delhi, 3rd Edition,2009.
4. Vincent Del Toro, 'Basic Electric Machines' Pearson India Education, 2016.
5. Surinder Pal Bali, 'Electrical Technology Machines & Measurements, Vol.II, Pearson, 2013.
6. Fitzgerald. A.E., Charles Kingsely Jr, Stephen D.Umans, 'Electric Machinery', Sixth edition, McGraw Hill Books Company, 2003.

20153C35 **ELECTRON DEVICES AND CIRCUITS** **L T P C**
3 0 0 3

OBJECTIVES:

The student should be made to:

- Understand the structure of basic electronic devices.
- Be exposed to active and passive circuit elements.
- Familiarize the operation and applications of transistor like BJT and FET.
- Explore the characteristics of amplifier gain and frequency response.
- Learn the required functionality of positive and negative feedback systems.

UNIT I PN JUNCTION DEVICES 9

PN junction diode –structure, operation and V-I characteristics, diffusion and transition capacitance - Rectifiers – Half Wave and Full Wave Rectifier,– Display devices- LED, Laser diodes, Zener diodecharacteristics- Zener Reverse characteristics – Zener as regulator

UNIT II TRANSISTORS AND THYRISTORS 9

BJT, JFET, MOSFET- structure, operation, characteristics and Biasing UJT, Thyristors and IGBT - Structure and characteristics.

UNIT III AMPLIFIERS 9

BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response –MOSFET small signal model– Analysis of CS and Source follower – Gain and frequency response- High frequency analysis.

UNIT IV MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER 9

BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis – FET input stages – Single tuned amplifiers – Gain and frequency response – Neutralization methods, power amplifiers –Types (Qualitative analysis).

UNIT V FEEDBACK AMPLIFIERS AND OSCILLATORS 9

Advantages of negative feedback – voltage / current, series , Shunt feedback –positive feedback – Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.

OUTCOMES: **TOTAL : 45 PERIODS**

Upon Completion of the course, the students will be ability to:

- Explain the structure and working operation of basic electronic devices.
- Able to identify and differentiate both active and passive elements
- Analyze the characteristics of different electronic devices such as diodes and transistors
- Choose and adapt the required components to construct an amplifier circuit.
- Employ the acquired knowledge in design and analysis of oscillators

TEXT BOOKS:

1. . David A. Bell ,"Electronic devices and circuits", Oxford University higher education, 5th edition 2008.
2. Sedra and smith, "Microelectronic circuits",7th Ed., Oxford University Press

REFERENCES:

1. Balbir Kumar, Shail.B.Jain, "Electronic devices and circuits" PHI learning private limited, 2nd edition 2014.
2. Thomas L.Floyd, "Electronic devices" Conventional current version, Pearson prentice hall, 10th Edition, 2020.
3. Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGraw Hill, 3rd Edition, 2003.
4. Robert L.Boylestad, "Electronic devices and circuit theory", 2002.
5. Robert B. Northrop, "Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation", CRC Press, 2004.

20153C36	POWER PLANT ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVE:

- Providing an overview of Power Plants and detailing the role of Mechanical Engineers in their operation and maintenance.

UNIT I COAL BASED THERMAL POWER PLANTS 9

Rankine cycle - improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.

UNIT II DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS 9

Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimisation. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.

UNIT III NUCLEAR POWER PLANTS 9

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : Boili*ng Water Reactor* (BWR), P*ressurized Water Reactor* (PW R), CANada Deuterium-Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

UNIT IV POWER FROM RENEWABLE ENERGY 9

Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, *Solar* Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.

UNIT V ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS 9

Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

TOTAL : 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Explain the layout, construction and working of the components inside a thermal power plant.
CO2 Explain the layout, construction and working of the components inside a Diesel, Gas and Combined cycle power plants.
CO3 Explain the layout, construction and working of the components inside nuclear power plants.
CO4 Explain the layout, construction and working of the components inside Renewable energy power plants.
CO5 Explain the applications of power plants while extend their knowledge to power plant economics and environmental hazards and estimate the costs of electrical energy production.

TEXT BOOK:

1. Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008.

REFERENCES:

1. El-Wakil. M.M., "Power Plant Technology", Tata McGraw – Hill Publishing Company Ltd., 2010.

2. Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.
3. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, "Power Plant Engineering", Second Edition, Standard Handbook of McGraw – Hill, 1998.

20153L37	ELECTRONICS LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES:

- To enability the students to understand the behavior of semiconductor device based on experimentation.

LIST OF EXPERIMENTS

1. Characteristics of Semiconductor diode and Zener diode
2. Characteristics of a NPN Transistor under common emitter , common collector and common base configurations
3. Characteristics of JFET and draw the equivalent circuit
4. Characteristics of UJT and generation of saw tooth waveforms
5. Design and Frequency response characteristics of a Common Emitter amplifier
6. Characteristics of photo diode & photo transistor, Study of light activated relay circuit
7. Design and testing of RC phase shift and LC oscillators
8. Single Phase half-wave and full wave rectifiers with inductive and capacitive filters
9. Differential amplifiers using FET
10. Study of CRO for frequency and phase measurements
11. Realization of passive filters

OUTCOMES:

- Ability to understand and analyse electronic circuits.

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Semiconductor devices like Diode, Zener Diode, NPN Transistors, JFET, UJT, Photo diode, Photo Transistor
2. Resistors, Capacitors and inductors
3. Necessary digital IC 8
4. Function Generators 10
5. Regulated 3 output Power Supply 5, ± 15V 10
6. CRO 10
7. Storage Oscilloscope 1
8. Bread boards
9. Atleast one demo module each for the listed equipments.
10. Component data sheets to be provided

20153L38	ELECTRICAL MACHINES LABORATORY-I	L	T	P	C
		0	0	3	2

OBJECTIVES:

- To expose the students to the operation of D.C. machines and transformers and give them experimental skill.

LIST OF EXPERIMENTS

1. Open circuit and load characteristics of DC shunt generator- critical resistance and critical speed.
2. Load characteristics of DC compound generator with differential and cumulative connections.
3. Load test on DC shunt motor.
4. Load test on DC compound motor.
5. Load test on DC series motor.
6. Swinburne's test and speed control of DC shunt motor.
7. Hopkinson's test on DC motor – generator set.
8. Load test on single-phase transformer and three phase transformers.
9. Open circuit and short circuit tests on single phase transformer.
10. Sumpner's test on single phase transformers.
11. Separation of no-load losses in single phase transformer.
12 Study of starters and 3-phase transformers connections.

OUTCOMES: **TOTAL: 60 PERIODS**

- Ability to understand and analyze DC Generator
- Ability to understand and analyze DC Motor
- Ability to understand and analyse Transformers.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. DC Shunt Motor with Loading Arrangement – 3 nos
2. DC Shunt Motor Coupled with Three phase Alternator – 1 No.
3. Single Phase Transformer – 4 nos
4. DC Series Motor with Loading Arrangement – 1 No.
5. DC compound Motor with Loading Arrangement – 1 No.
6. Three Phase Induction Motor with Loading Arrangement – 2 nos
7. Single Phase Induction Motor with Loading Arrangement – 1 No.
8. DC Shunt Motor Coupled With DC Compound Generator – 2 nos
9. DC Shunt Motor Coupled With DC Shunt Motor – 1 No.
10. Tachometer -Digital/Analog – 8 nos
11. Single Phase Auto Transformer – 2 nos
12. Three Phase Auto Transformer – 1 No.
13. Single Phase Resistive Loading Bank – 2 nos
14. Three Phase Resistive Loading Bank. – 2 nos

20149S41C **NUMERICAL METHODS**

L	T	P	C
4	0	0	4

OBJECTIVES :

- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals in real life situations.
- To acquaint the student with understanding of numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.
- To understand the knowledge of various techniques and methods of solving various types of partial differential equations.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 12

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

UNIT II INTERPOLATION AND APPROXIMATION 12

Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Difference operators and relations - Interpolation with equal intervals - Newton's forward and backward difference formulae.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 12

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's Method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 12

Single step methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge - Kutta method for solving first order equations - Multi step methods - Milne's and Adams - Bash forth predictor corrector methods for solving first order equations.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 12

Finite difference methods for solving second order two - point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

TOTAL : 60 PERIODS

OUTCOMES :

Upon successful completion of the course, students should be able to:

- Understand the basic concepts and techniques of solving algebraic and transcendental equations.
- Appreciate the numerical techniques of interpolation and error approximations in various intervals in real life situations.
- Apply the numerical techniques of differentiation and integration for engineering problems.
- Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
- Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

TEXTBOOKS :

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9^{th} Edition, Cengage Learning, 2016.
2. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10^{th} Edition, New Delhi, 2015.

REFERENCES :

1. Brian Bradie, "A Friendly Introduction to Numerical Analysis", Pearson Education, Asia, New Delhi, 2007.
2. Gerald. C. F. and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6^{th} Edition, New Delhi, 2006.
3. Mathews, J.H. "Numerical Methods for Mathematics, Science and Engineering", 2^{nd} Edition, Prentice Hall, 1992.
4. Sankara Rao. K., "Numerical Methods for Scientists and Engineers", Prentice Hall of India Pvt. Ltd, 3^{rd} Edition, New Delhi, 2007.
5. Sastry, S.S, "Introductory Methods of Numerical Analysis", PHI Learning Pvt. Ltd, 5^{th} Edition, 2015.

20153C42	ELECTRICAL MACHINES – II	L	T	P	C
		2	2	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Construction and performance of salient and non – salient type synchronous generators.
- Principle of operation and performance of synchronous motor.
- Construction, principle of operation and performance of induction machines.
- Starting and speed control of three-phase induction motors.
- Construction, principle of operation and performance of single phase induction motors and special machines.

UNIT I SYNCHRONOUS GENERATOR 6+6

Constructional details – Types of rotors –winding factors- emf equation – Synchronous reactance – Armature reaction – Phasor diagrams of non salient pole synchronous generator connected to infinite bus--Synchronizing and parallel operation – Synchronizing torque -Change of excitation and mechanical input- Voltage regulation – EMF, MMF, ZPF and A.S.A methods – steady state power- angle characteristics– Two reaction theory –slip test -short circuit transients - Capability Curves

UNIT II SYNCHRONOUS MOTOR 6+6

Principle of operation – Torque equation – Operation on infinite bus bars - V and Inverted V curves – Power input and power developed equations – Starting methods – Current loci for constant power input, constant excitation and constant power developed-Hunting – natural frequency of oscillations – damper windings- synchronous condenser.

UNIT III THREE PHASE INDUCTION MOTOR 6+6

Constructional details – Types of rotors –- Principle of operation – Slip –cogging and crawling- Equivalent circuit – Torque-Slip characteristics - Condition for maximum torque – Losses and efficiency – Load test - No load and blocked rotor tests - Circle diagram – Separation of losses – Double cage induction motors –Induction generators – Synchronous induction motor.

UNIT IV STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR 6+6

Need for starting – Types of starters – DOL, Rotor resistance, Autotransformer and Star- delta starters – Speed control – Voltage control, Frequency control and pole changing – Cascaded connection-V/f control – Slip power recovery scheme-Braking of three phase induction motor: Plugging, dynamic braking and regenerative braking.

UNIT V SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES 6+6

Constructional details of single phase induction motor – Double field revolving theory and operation – Equivalent circuit – No load and blocked rotor test – Performance analysis – Starting methods of single-phase induction motors – Capacitor-start capacitor run Induction motor- Shaded pole induction motor - Linear induction motor – Repulsion motor - Hysteresis motor - AC series motor- Servo motors- Stepper motors - introduction to magnetic levitation systems.

TOTAL : 60 PERIODS

OUTCOMES:

- Ability to understand the construction and working principle of Synchronous Generator
- Ability to understand MMF curves and armature windings.
- Ability to acquire knowledge on Synchronous motor.
- Ability to understand the construction and working principle of Three phase Induction Motor
- Ability to understand the construction and working principle of Special Machines
- Ability to predetermine the performance characteristics of Synchronous Machines.

TEXT BOOKS:

1. A.E. Fitzgerald, Charles Kingsley, Stephen. D. Umans, 'Electric Machinery', Mc Graw Hill publishing Company Ltd, 2003.
2. Vincent Del Toro, 'Basic Electric Machines' Pearson India Education, 2016.
3. Stephen J. Chapman, 'Electric Machinery Fundamentals'4th edition, McGraw Hill Education Pvt. Ltd, 2010.

REFERENCES

1. D.P. Kothari and I.J. Nagrath, 'Electric Machines', McGraw Hill Publishing Company Ltd, 2002.
2. P.S. Bhimbhra, 'Electrical Machinery', Khanna Publishers, 2003.
3. M.N. Bandyopadhyay, Electrical Machines Theory and Practice, PHI Learning PVT LTD., New Delhi, 2009.
4. B.R.Gupta, 'Fundamental of Electric Machines' New age International Publishers,3rd Edition ,Reprint 2015.
5. Murugesh Kumar, 'Electric Machines', Vikas Publishing House Pvt. Ltd, 2002.
6. Alexander S. Langsdorf, 'Theory of Alternating-Current Machinery', McGraw Hill Publications, 2001.

20153C43	**TRANSMISSION AND DISTRIBUTION**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

- To study the structure of electric power system and to develop expressions for the computation of transmission line parameters.
- To obtain the equivalent circuits for the transmission lines based on distance and to determine voltage regulation and efficiency.
- To understand the mechanical design of transmission lines and to analyze the voltage distribution in insulator strings to improve the efficiency.
- To study the types, construction of cabilitys and methods to improve the efficiency.
- To study about distribution systems, types of substations, methods of grounding, EHVAC, HVDC and FACTS.

UNIT I TRANSMISSION LINE PARAMETERS 9

Structure of Power System - Parameters of single and three phase transmission lines with single and double circuits -Resistance, inductance and capacitance of solid, stranded and bundled conductors, Symmetrical and unsymmetrical spacing and transposition - application of self and mutual GMD; skin and proximity effects -Typical configurations, conductor types and electrical parameters of EHV lines.

UNIT II MODELLING AND PERFORMANCE OF TRANSMISSION LINES 9

Performance of Transmission lines - short line, medium line and long line - equivalent circuits, phasor diagram, attenuation constant, phase constant, surge impedance - transmission efficiency and voltage regulation, real and reactive power flow in lines - Power Circle diagrams - Formation of Corona – Critical Voltages – Effect on Line Performance.

UNIT III MECHANICAL DESIGN OF LINES 9

Mechanical design of OH lines – Line Supports –Types of towers – Stress and Sag Calculation – Effects of Wind and Ice loading. Insulators: Types, voltage distribution in insulator string, improvement of string efficiency, testing of insulators.

UNIT IV UNDER GROUND CABILITYS 9

Underground cabilitys - Types of cabilitys – Construction of single core and 3 core Cabilitys - Insulation Resistance – Potential Gradient - Capacitance of Single-core and 3 core cabilitys - Grading of cabilitys - Power factor and heating of cabilitys– DC cabilitys.

UNIT V DISTRIBUTION SYSTEMS 9

Distribution Systems – General Aspects – Kelvin's Law – AC and DC distributions - Techniques of Voltage Control and Power factor improvement – Distribution Loss –Types of Substations -Methods of Grounding – Trends in Transmission and Distribution: EHVAC, HVDC and FACTS (Qualitative treatment only).

TOTAL : 45 PERIODS

OUTCOMES:

- To understand the importance and the functioning of transmission line parameters.
- To understand the concepts of Lines and Insulators.
- To acquire knowledge on the performance of Transmission lines.
- To acquire knowledge on Underground Cabilitys
- To become familiar with the function of different components used in Transmission and Distribution levels of power system and modelling of these components.

TEXT BOOKS:

1. D.P.Kothari, I.J. Nagarath, 'Power System Engineering', Mc Graw-Hill Publishing Company limited, New Delhi, Second Edition, 2008.
2. C.L.Wadhwa, 'Electrical Power Systems', New Academic Science Ltd, 2009.
3. S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall of India Pvt. Ltd, New Delhi, Second Edition, 2011.

REFERENCES

1. B.R.Gupta, 'Power System Analysis and Design' S. Chand, New Delhi, Fifth Edition, 2008.
2. Luces M.Fualken berry, Walter Coffer, 'Electrical Power Distribution and Transmission', Pearson Education, 2007.
3. Arun Ingole, "power transmission and distribution" Pearson Education, 2017
4. J.Brian, Hardy and Colin R.Bayliss 'Transmission and Distribution in Electrical Engineering', Newnes; Fourth Edition, 2012.
5. G.Ramamurthy, "Handbook of Electrical power Distribution," Universities Press, 2013.
6. V.K.Mehta, Rohit Mehta, 'Principles of power system', S. Chand & Company Ltd, New Delhi, 2013

20153C44	MEASUREMENTS AND INSTRUMENTATION	L	T	P	C
		3	0	0	3

OBJECTIVES:
To impart knowledge on the following Topics

- Basic functional elements of instrumentation
- Fundamentals of electrical and electronic instruments
- Comparison between various measurement techniques
- Various storage and display devices
- Various transducers and the data acquisition systems

UNIT I INTRODUCTION 9
Functional elements of an instrument – Static and dynamic characteristics – Errors in measurement – Statistical evaluation of measurement data – Standards and calibration- Principle and types of analog and digital voltmeters, ammeters.

UNIT II ELECTRICAL AND ELECTRONIC INSTRUMENTS 9
Principle and types of multi meters – Single and three phase watt meters and energy meters – Magnetic measurements – Determination of B-H curve and measurements of iron loss – Instrument transformers – Instruments for measurement of frequency and phase.

UNIT III COMPARATIVE METHODS OF MEASUREMENTS 9
D.C potentiometers, D.C (Wheat stone, Kelvin and Kelvin Double bridge) & A.C bridges (Maxwell, Anderson and Schering bridges), transformer ratio bridges, self-balancing bridges. Interference & screening – Multiple earth and earth loops - Electrostatic and electromagnetic Interference – Grounding techniques.

UNIT IV STORAGE AND DISPLAY DEVICES 9
Magnetic disk and tape – Recorders, digital plotters and printers, CRT display, digital CRO, LED, LCD & Dot matrix display – Data Loggers.

UNIT V TRANSDUCERS AND DATA ACQUISITION SYSTEMS 9
Classification of transducers – Selection of transducers – Resistive, capacitive & inductive Transducers – Piezoelectric, Hall effect, optical and digital transducers – Elements of data acquisition system – Smart sensors-Thermal Imagers.

TOTAL : 45 PERIODS

OUTCOMES:

- To acquire knowledge on Basic functional elements of instrumentation
- To understand the concepts of Fundamentals of electrical and electronic instruments
- Ability to compare between various measurement techniques
- To acquire knowledge on Various storage and display devices
- To understand the concepts Various transducers and the data acquisition systems
- Ability to model and analyze electrical and electronic Instruments and understand the operational features of display Devices and Data Acquisition System.

TEXT BOOKS:

1. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2010.
2. J. B. Gupta, 'A Course in Electronic and Electrical Measurements', S. K. Kataria & Sons, Delhi, 2013.
3. Doebelin E.O. and Manik D.N., Measurement Systems – Applications and Design, Special Indian Edition, McGraw Hill Education Pvt. Ltd., 2007.

REFERENCES

1. H.S. Kalsi, 'Electronic Instrumentation', McGraw Hill, III Edition 2010.
2. D.V.S. Murthy, 'Transducers and Instrumentation', Prentice Hall of India Pvt Ltd, 2015.
3. David Bell, ' Electronic Instrumentation & Measurements', Oxford University Press,2013.
4. Martin Reissland, 'Electrical Measurements', New Age International (P) Ltd., Delhi, 2001.
5. Alan. S. Morris, Principles of Measurements and Instrumentation, 2nd Edition, Prentice Hall of India, 2003.

20153C45	LINEAR INTEGRATED CIRCUITS AND APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart knowledge on the following topics

- Signal analysis using Op-amp based circuits.
- Applications of Op-amp.
- Functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits.
- IC fabrication procedure.

UNIT I IC FABRICATION 9

IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realisation of monolithic ICs and packaging. Fabrication of diodes, capacitance, resistance, FETs and PV Cell.

UNIT II CHARACTERISTICS OF OPAMP 9

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – Inverting and Non-inverting Amplifiers, summer, differentiator and integrator-V/I & I/V converters.

UNIT III APPLICATIONS OF OPAMP 9

Instrumentation amplifier and its applications for transducer Bridge, Log and Antilog Amplifiers- Analog multiplier & Divider, first and second order active filters, comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R- 2R ladder and weighted resistor types), A/D converters using opamps.

UNIT IV SPECIAL ICs 9

Functional block, characteristics of 555 Timer and its PWM application - IC-566 voltage controlled oscillator IC; 565-phase locked loop IC, AD633 Analog multiplier ICs.

UNIT V APPLICATION ICs 9

AD623 Instrumentation Amplifier and its application as load cell weight measurement - IC voltage regulators –LM78XX, LM79XX; Fixed voltage regulators its application as Linear power supply - LM317, 723 Variability voltage regulators, switching regulator- SMPS - ICL 8038 function generator IC.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to acquire knowledge in IC fabrication procedure
- Ability to analyze the characteristics of Op-Amp
- To understand the importance of Signal analysis using Op-amp based circuits.
- Functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits.
- To understand and acquire knowledge on the Applications of Op-amp
- Ability to understand and analyse, linear integrated circuits their Fabrication and Application.

TEXT BOOKS:

1. David A. Bell, ‘Op-amp & Linear ICs’, Oxford, 2013.
2. D. Roy Choudhary, Sheil B. Jani, ‘Linear Integrated Circuits’, II edition, New Age, 2003.
3. Ramakant A.Gayakward, ‘Op-amps and Linear Integrated Circuits’, IV edition, Pearson Education, 2003 / PHI. 2000.

REFERENCES

1. Fiore,”Opamps & Linear Integrated Circuits Concepts & applications”, Cengage, 2010.
2. Floyd ,Buchla,”Fundamentals of Analog Circuits, Pearson, 2013.
3. Jacob Millman, Christos C.Halkias, ‘Integrated Electronics - Analog and Digital circuits system’, McGraw Hill, 2003.
4. Robert F.Coughlin, Fredrick F. Driscoll, ‘Op-amp and Linear ICs’, Pearson, 6th edition,2012.
5. Sergio Franco, ‘Design with Operational Amplifiers and Analog Integrated Circuits’, Mc Graw Hill, 2016.
6. Muhammad H. Rashid,’ Microelectronic Circuits Analysis and Design’ Cengage Learning, 2011.

20153C46	CONTROL SYSTEMS	LT P C
		3 2 0 4

COURSE OBJECTIVES

- To understand the use of transfer function models for analysis physical systems and introduce the control system components.
- To provide adequate knowledge in the time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of systems.
- To introduce stability analysis and design of compensators

UNIT I SYSTEMS AND REPRESENTATION 9

Basic elements in control systems: – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs.

UNIT II TIME RESPONSE 9

Time response: – Time domain specifications – Types of test input – I and II order system response – Error coefficients – Generalized error series – Steady state error – Root locus construction- Effects of P, PI, PID modes of feedback control –Time response analysis.

UNIT III FREQUENCY RESPONSE 9

Frequency response: – Bode plot – Polar plot – Determination of closed loop response from open loop response - Correlation between frequency domain and time domain specifications

UNIT IV STABILITY AND COMPENSATOR DESIGN 9

Characteristics equation – Routh Hurwitz criterion – Nyquist stability criterion- Performance criteria – Effect of Lag, lead and lag-lead compensation on frequency response-Design of Lag, lead and lag- lead compensator using bode plots.

UNIT V STATE VARIABLE ANALYSIS 9

Concept of state variables – State models for linear and time invariant Systems – Solution of state and output equation in controllable canonical form – Concepts of controllability and observability.

TOTAL (L: 45+T:30): 75 PERIODS

COURSE OUTCOMES

At the end of the course, the student should have the :

- Ability to develop various representations of system based on the knowledge of
- Mathematics, Science and Engineering fundamentals.
- Ability to do time domain and frequency domain analysis of various models of linear system.
- Ability to interpret characteristics of the system to develop mathematical model.
- Ability to design appropriate compensator for the given specifications.
- Ability to come out with solution for complex control problem.
- Ability to understand use of PID controller in closed loop system.

TEXT BOOKS

1. Nagarath, I.J. and Gopal, M., “Control Systems Engineering”, New Age International Publishers, 2017.
2. Benjamin C. Kuo, “Automatic Control Systems”, Wiley, 2014.

REFERENCES

1. Katsuhiko Ogata, “Modern Control Engineering”, Pearson, 2015.
2. Richard C.Dorf and Bishop, R.H., “Modern Control Systems”, Pearson Education,2009.
3. John J.D., Azzo Constantine, H. and Houpis Sttuart, N Sheldon, “Linear Control System Analysis and Design with MATLAB”, CRC Taylor& Francis Reprint 2009.
4. Rames C.Panda and T. Thyagarajan, “An Introduction to Process Modelling Identification and Control of Engineers”, Narosa Publishing House, 2017.
5. M.Gopal, “Control System: Principle and design”, McGraw Hill Education, 2012.
6. NPTEL Video Lecture Notes on “Control Engineering “by Prof. S. D. Agashe, IIT Bombay.

20153L47	ELECTRICAL MACHINES LABORATORY - II	L	T	P	C
		0	0	3	2

OBJECTIVES:

- To expose the students to the operation of synchronous machines and induction motors and give them experimental skill.

LIST OF EXPERIMENTS

1. Regulation of three phase alternator by EMF and MMF methods.
2. Regulation of three phase alternator by ZPF and ASA methods.
3. Regulation of three phase salient pole alternator by slip test.
4. Measurements of negative sequence and zero sequence impedance of alternators.
5. V and Inverted V curves of Three Phase Synchronous Motor.
6. Load test on three-phase induction motor.
7. No load and blocked rotor tests on three-phase induction motor (Determination of equivalent circuit parameters).
8. Separation of No-load losses of three-phase induction motor.
9. Load test on single-phase induction motor.
10. No load and blocked rotor test on single-phase induction motor.
11. Study of Induction motor Starters

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course, the student should have the :

- Ability to understand and analyze EMF and MMF methods
- Ability to analyze the characteristics of V and Inverted V curves
- Ability to understand the importance of Synchronous machines
- Ability to understand the importance of Induction Machines
- Ability to acquire knowledge on separation of losses

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Synchronous Induction motor 3HP – 1 No.
2. DC Shunt Motor Coupled With Three phase Alternator – 4 nos
3. DC Shunt Motor Coupled With Three phase Slip ring Induction motor – 1 No.
4. Three Phase Induction Motor with Loading Arrangement – 2 nos
5. Single Phase Induction Motor with Loading Arrangement – 2 nos
6. Tachometer -Digital/Analog – 8 nos
7. Single Phase Auto Transformer – 2 nos
8. Three Phase Auto Transformer – 3 nos
9. Single Phase Resistive Loading Bank – 2 nos
10. Three Phase Resistive Loading Bank – 2 nos
11. Capacitor Bank – 1 No.

20153L48 LINEAR AND DIGITAL INTEGRATED CIRCUITS LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:

- To learn design, testing and characterizing of circuit behavior with digital and analog ICs.

LIST OF EXPERIMENTS

1. Implementation of Boolean Functions, Adder and Subtractor circuits.
2. Code converters: Excess-3 to BCD and Binary to Gray code converter and vice-versa
3. Parity generator and parity checking
4. Encoders and Decoders
5. Counters: Design and implementation of 3-bit modulo counters as synchronous and Asynchronous types using FF IC's and specific counter IC.
6. Shift Registers: Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitability IC's.
7. Study of multiplexer and de multiplexer
8. Timer IC application: Study of NE/SE 555 timer in Astability, Monostability operation.
9. Application of Op-Amp: inverting and non-inverting amplifier, Adder, comparator, Integrator and Differentiator.
10. Voltage to frequency characteristics of NE/ SE 566 IC.
11. Variability Voltage Regulator using IC LM320.

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course, the student should have the :

- Ability to understand and implement Boolean Functions.
- Ability to understand the importance of code conversion
- Ability to Design and implement 4-bit shift registers
- Ability to acquire knowledge on Application of Op-Amp
- Ability to Design and implement counters using specific counter IC.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS: (3 per Batch)

S.No	Name of the equipments / Components	Quantity Required	Remarks
1	Dual ,(0-30V) variability Power Supply	10	-
2	CRO	9	30MHz
3	Digital Multimeter	10	Digital
4	Function Generator	8	1 MHz
5	IC Tester (Analog)	2	
6	Bread board	10	

7	Computer (PSPICE installed)	1	
Consumabilitys (sufficient quantity)			
1	IC 741/ IC NE555/566/565		
2	Digital IC types		
3	LED		
4	LM317		
5	LM723		
6	ICSG3524 / SG3525		
7	Transistor – 2N3391		
8	Diodes, IN4001,BY126		
9	Zener diodes		
10	Potentiometer		
11	Step-down transformer 230V/12-0-12V		
12	Capacitor		
13	Resistors 1/4 Watt Assorted		
14	Single Strand Wire		

20153C51 **POWER SYSTEM ANALYSIS**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To model the power system under steady state operating condition
- To understand and apply iterative techniques for power flow analysis
- To model and carry out short circuit studies on power system
- To model and analyze stability problems in power system

UNIT I POWER SYSTEM 9

Need for system planning and operational studies - Power scenario in India - Power system components – Representation - Single line diagram - per unit quantities - p.u. impedance diagram - p.u. reactance diagram - Network graph, Bus incidence matrix, Primitive parameters, Bus admittance matrix from primitive parameters - Representation of off- nominal transformer - Formation of bus admittance matrix of large power network.

UNIT II POWER FLOW ANALYSIS 9

Bus classification - Formulation of Power Flow problem in polar coordinates - Power flow solution using Gauss Seidel method - Handling of Voltage controlled buses - Power Flow Solution by Newton Raphson method.

UNIT III SYMMETRICAL FAULT ANALYSIS 9

Assumptions in short circuit analysis - Symmetrical short circuit analysis using Thevenin's theorem - Bus Impedance matrix building algorithm (without mutual coupling) - Symmetrical fault analysis through bus impedance matrix - Post fault bus voltages - Fault level - Current limiting reactors.

UNIT IV UNSYMMETRICAL FAULT ANALYSIS 9

Symmetrical components - Sequence impedances - Sequence networks - Analysis of unsymmetrical faults at generator terminals: LG, LL and LLG - unsymmetrical fault occurring at any point in a power system - computation of post fault currents in symmetrical component and phasor domains.

UNIT V STABILITY ANALYSIS 9

Classification of power system stability – Rotor angle stability - Swing equation - Swing curve - Power-Angle equation - Equal area criterion - Critical clearing angle and time - Classical step-by-step solution of the swing equation – modified Euler method.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to model the power system under steady state operating condition
- Ability to understand and apply iterative techniques for power flow analysis
- Ability to model and carry out short circuit studies on power system
- Ability to model and analyze stability problems in power system
- Ability to acquire knowledge on Fault analysis.
- Ability to model and understand various power system components and carry out power flow, short circuit and stability studies.

TEXT BOOKS:

1. John J. Grainger, William D. Stevenson, Jr, 'Power System Analysis', Mc Graw Hill Education (India) Private Limited, New Delhi, 2015.
2. Kothari D.P. and Nagrath I.J., 'Power System Engineering', Tata McGraw-Hill Education, Second Edition, 2008.
3. Hadi Saadat, 'Power System Analysis', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.

REFERENCES

1. Pai M A, 'Computer Techniques in Power System Analysis', Tata Mc Graw-Hill Publishing Company Ltd., New Delhi, Second Edition, 2007.
2. J. Duncan Glover, Mulukutla S.Sarma, Thomas J. Overbye, 'Power System Analysis & Design', Cengage Learning, Fifth Edition, 2012.
3. Gupta B.R., 'Power System - Analysis and Design', S. Chand Publishing, 2001.
4. Kundur P., 'Power System Stability and Control', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.

20153C52	MICROPROCESSORS AND MICROCONTROLLERS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Architecture of µP8085 & µC 8051
- Addressing modes & instruction set of 8085 & 8051.
- Need & use of Interrupt structure 8085 & 8051.
- Simple applications development with programming 8085 & 8051

UNIT I 8085 PROCESSOR 9

Hardware Architecture, pinouts – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts.

UNIT II PROGRAMMING OF 8085 PROCESSOR 9

Instruction -format and addressing modes – Assembly language format – Data transfer, data manipulation& control instructions – Programming: Loop structure with counting & Indexing – Look up tability - Subroutine instructions - stack.

UNIT III 8051 MICRO CONTROLLER 9

Hardware Architecture, pinouts – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts- Data Transfer, Manipulation, Control Algorithms& I/O instructions, Comparison to Programming concepts with 8085.

UNIT IV PERIPHERAL INTERFACING 9

Study on need, Architecture, configuration and interfacing, with ICs: 8255, 8259, 8254, 8279, - A/D and D/A converters &Interfacing with 8085& 8051.

UNIT V MICRO CONTROLLER PROGRAMMING & APPLICATIONS 9

Simple programming exercises- key board and display interface –Control of servo motor- stepper motor control- Application to automation systems.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to acquire knowledge in Addressing modes & instruction set of 8085 & 8051.
- Ability to need & use of Interrupt structure 8085 & 8051.
- Ability to understand the importance of Interfacing
- Ability to explain the architecture of Microprocessor and Microcontroller.
- Ability to write the assembly language programme.
- Ability to develop the Microprocessor and Microcontroller based applications.

TEXT BOOKS:

1. Sunil Mathur &Jeebananda Panda, "Microprocessor and Microcontrollers", PHI Learning Pvt. Ltd, 2016.

2. R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', with 8085, Wiley Eastern Ltd., New Delhi, 2013.

3. Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely 'The 8051 Micro Controller and Embedded Systems', PHI Pearson Education, 5th Indian reprint, 2003.

REFERENCES

1. Krishna Kant, "Microprocessor and Microcontrollers", Eastern Company Edition, Prentice Hall of India, New Delhi, 2007.

2. B.RAM," Computer Fundamentals Architecture and Organization" New age International Private Limited, Fifth edition, 2017.

3. Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051,McGraw Hill Edu,2013.

4. Ajay V.Deshmukh, 'Microcontroller Theory &Applications', McGraw Hill Edu,2016

5. Douglas V.Hall, 'Microprocessor and Interfacing', McGraw Hill Edu,2016.

20153C53	POWER ELECTRONICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Different types of power semiconductor devices and their switching
- Operation, characteristics and performance parameters of controlled rectifiers
- Operation, switching techniques and basics topologies of DC-DC switching regulators.
- Different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
- Operation of AC voltage controller and various configurations.

UNIT I POWER SEMI-CONDUCTOR DEVICES 9

Study of switching devices, SCR, TRIAC, GTO, BJT, MOSFET, IGBT and IGCT- Static characteristics: SCR, MOSFET and IGBT - Triggering and commutation circuit for SCR- Introduction to Driver and snubber circuits.

UNIT II PHASE-CONTROLLED CONVERTERS 9

2-pulse, 3-pulse and 6-pulseconverters– performance parameters –Effect of source inductance–– Firing Schemes for converter–Dual converters, Applications-light dimmer, Excitation system, Solar PV systems.

UNIT III DC TO DC CONVERTERS 9

Step-down and step-up chopper-control strategy– Introduction to types of choppers-A, B, C, D and E -Switched mode regulators- Buck, Boost, Buck- Boost regulator, Introduction to Resonant Converters, Applications-Battery operated vehicles.

UNIT IV INVERTERS 9

Single phase and three phase voltage source inverters (both120^0 mode and 180^0 mode)– Voltage& harmonic control--PWM techniques: Multiple PWM, Sinusoidal PWM, modified sinusoidal PWM – Introduction to space vector modulation –Current source inverter, Applications-Induction heating, UPS.

UNIT V AC TO AC CONVERTERS 9

Single phase and Three phase AC voltage controllers–Control strategy- Power Factor Control – Multistage sequence control -single phase and three phase cyclo converters – Introduction to Matrix converters, Applications –welding .

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to analyse AC-AC and DC-DC and DC-AC converters.
- Ability to choose the converters for real time applications.

TEXT BOOKS:

1. M.H. Rashid, 'Power Electronics: Circuits, Devices and Applications', Pearson Education, Third Edition, New Delhi, 2004.
2. P.S.Bimbra "Power Electronics" Khanna Publishers, third Edition, 2003.
3. Ashfaq Ahmed 'Power Electronics for Technology', Pearson Education, Indian reprint, 2003.

REFERENCES

1. Joseph Vithayathil,' Power Electronics, Principles and Applications', McGraw Hill Series, 6th Reprint, 2013.
2. Philip T. Krein, "Elements of Power Electronics" Oxford University Press, 2004 Edition.
3. L. Umanand, "Power Electronics Essentials and Applications", Wiley, 2010.
4. Ned Mohan Tore. M. Undel and, William. P. Robbins, 'Power Electronics: Converters, Applications and Design', John Wiley and sons, third edition, 2003.
5. S.Rama Reddy, 'Fundamentals of Power Electronics', Narosa Publications, 2014.
6. M.D. Singh and K.B. Khanchandani, "Power Electronics," Mc Graw Hill India, 2013.
7. JP Agarwal," Power Electronic Systems: Theory and Design" 1e, Pearson Education, 2002.

20153C55 **DIGITAL SIGNAL PROCESSING**

L	T	P	C
2	2	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Signals and systems & their mathematical representation.
- Discrete time systems.
- Transformation techniques & their computation. Filters and
- their design for digital implementation. Programmability digital
- signal processor & quantization effects.

UNIT I INTRODUCTION 6+6

Classification of systems: Continuous, discrete, linear, causal, stability, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect.

UNIT II DISCRETE TIME SYSTEM ANALYSIS 6+6

Z-transform and its properties, inverse z-transforms; difference equation – Solution by z-transform, application to discrete systems - Stability analysis, frequency response – Convolution – Discrete Time Fourier transform , magnitude and phase representation.

UNIT III DISCRETE FOURIER TRANSFORM & COMPUTATION 6+6

Discrete Fourier Transform- properties, magnitude and phase representation - Computation of DFT using FFT algorithm – DIT &DIF using radix 2 FFT – Butterfly structure.

UNIT IV DESIGN OF DIGITAL FILTERS 6+6

FIR & IIR filter realization – Parallel & cascade forms. FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics. Analog filter design – Butterworth and Chebyshev approximations; IIR Filters, digital design using impulse invariant and bilinear transformation Warping, pre warping.

UNIT V DIGITAL SIGNAL PROCESSORS 6+6

Introduction – Architecture – Features – Addressing Formats – Functional modes - Introduction to Commercial DS Processors.

TOTAL : 60 PERIODS

OUTCOMES:

1. Ability to understand the importance of Fourier transform, digital filters and DS Processors.
2. Ability to acquire knowledge on Signals and systems & their mathematical representation.
3. Ability to understand and analyze the discrete time systems.
4. Ability to analyze the transformation techniques & their computation.
5. Ability to understand the types of filters and their design for digital implementation.
6. Ability to acquire knowledge on programmability digital signal processor & quantization effects.

TEXT BOOKS:

1. J.G. Proakis and D.G. Manolakis, ‘Digital Signal Processing Principles, Algorithms and Applications’, Pearson Education, New Delhi, PHI. 2003.

2. S.K. Mitra, 'Digital Signal Processing – A Computer Based Approach', McGraw Hill Edu, 2013.
3. Lonnie C.Ludeman ,"Fundamentals of Digital Signal Processing",Wiley,2013

REFERENCES

1. Poorna Chandra S, Sasikala. B ,Digital Signal Processing, Vijay Nicole/TMH,2013.
2. Robert Schilling & Sandra L.Harris, Introduction to Digital Signal Processing using Matlab", Cengage Learning,2014.
3. B.P.Lathi, 'Principles of Signal Processing and Linear Systems', Oxford University Press, 2010 3. Taan S. ElAli, 'Discrete Systems and Digital Signal Processing with Mat Lab', CRC Press, 2009.
4. SenM.kuo, woonseng…s.gan, "Digital Signal Processors, Architecture, Implementations & Applications, Pearson,2013
5. DimitrisG.Manolakis, Vinay K. Ingle, applied Digital Signal Processing,Cambridge,2012

20153C56 OBJECT ORIENTED PROGRAMMING L T P C
3 0 0 3

OBJECTIVES:

- To understand Object Oriented Programming concepts and basic characteristics of Java
- To know the principles of packages, inheritance and interfaces
- To define exceptions and use I/O streams
- To develop a java application with threads and generics classes
- To design and build simple Graphical User Interfaces

UNIT I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 10

Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism- OOP in Java – Characteristics of Java – The Java Environment - Java Source File -Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers - static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays , Packages - JavaDoc comments.

UNIT II INHERITANCE AND INTERFACES 9

Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces - Object cloning -inner classes, Array Lists - Strings

UNIT III EXCEPTION HANDLING AND I/O 9

Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files

UNIT IV MULTITHREADING AND GENERIC PROGRAMMING 8

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations.

UNIT V EVENT DRIVEN PROGRAMMING 9

Graphics programming - Frame – Components - working with 2D shapes - Using color, fonts, and images - Basics of event handling - event handlers - adapter classes - actions - mouse events - AWT event hierarchy - Introduction to Swing – layout management - Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows –Menus – Dialog Boxes.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of the course, students will be able to:

- Develop Java programs using OOP principles
- Develop Java programs with the concepts inheritance and interfaces
- Build Java applications using exceptions and I/O streams
- Develop Java applications with threads and generics classes
- Develop interactive Java programs using swings

TEXT BOOKS

1. Herbert Schildt, "Java The complete reference", 8th Edition, McGraw Hill Education, 2011.
2. Cay S. Horstmann, Gary cornell, "Core Java Volume –I Fundamentals", 9th Edition, Prentice Hall, 2013.

REFERENCES

1. Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3rd Edition, Pearson, 2015.
2. Steven Holzner, "Java 2 Black book", Dreamtech press, 2011.
3. Timothy Budd, "Understanding Object-oriented programming with Java", Updated Edition, Pearson Education, 2000.

20153L57	CONTROL AND INSTRUMENTATION LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES:

- To provide knowledge on analysis and design of control system along with basics of instrumentation.

LIST OF EXPERIMENTS

CONTROLSYSTEMS:

1. P, PI and PID controllers
2. Stability Analysis
3. Modeling of Systems – Machines, Sensors and Transducers
4. Design of Lag, Lead and Lag-Lead Compensators
5. Position Control Systems
6. Synchro-Transmitter- Receiver and Characteristics
7. Simulation of Control Systems by Mathematical development tools.

INSTRUMENTATION:

8. Bridge Networks –AC and DC Bridges
9. Dynamics of Sensors/Transducers

   (a) Temperature (b) pressure (c) Displacement (d) Optical (e) Strain (f) Flow

10 Power and Energy Measurement

11 Signal Conditioning

   (a) Instrumentation Amplifier

   (b) Analog – Digital and Digital –Analog converters (ADC and DACs)

12 Process Simulation

TOTAL: 60 PERIODS

OUTCOMES:

- Ability to understand control theory and apply them to electrical engineering problems.
- Ability to analyze the various types of converters.
- Ability to design compensators
- Ability to understand the basic concepts of bridge networks.
- Ability to the basics of signal conditioning circuits.
- Ability to study the simulation packages.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CONTROLSYSTEMS:

1. PID controller simulation and learner kit – 1 No.
2. Digital storage Oscilloscope for capturing transience- 1 No

   2 Personal Computer with control system

   simulation packages - 10 Nos

3. DC motor –Generator test set-up for evaluation of motor parameters
4. CRO 30MHz – 1 No.
5. 2MHz Function Generator – 1No.
6. Position Control Systems Kit (with manual) – 1 No., Tacho Generator Coupling set
7. AC Synchro transmitter& receiver – 1No.
8. Sufficient number of Digital multi meters, speed and torque sensors

INSTRUMENTATION:

9. R, L, C Bridge kit (with manual)
10. a) Electric heater – 1No.
    Thermometer – 1No.Thermistor (silicon type) RTD nickel type – 1No.

    b) 30 psi Pressure chamber (complete set) – 1No. Current generator (0 – 20mA) Air foot pump – 1 No. (with necessary connecting tubes)

    c) LVDT20mm core length movability type – 1No. CRO 30MHz – 1No. d)

    Optical sensor – 1 No. Light source

    e) Strain Gauge Kit with Handy lever beam – 1No.

100gm weights – 10 nos
f) Flow measurement Trainer kit – 1 No.
(1/2 HP Motor, Water tank, Digital Milliammeter, complete set)

11. Single phase Auto transformer – 1No. Watt-hour meter (energy meter) – 1No. Ammeter Voltmeter Rheostat Stop watch
    Connecting wires (3/20)
12. IC Transistor kit – 1No.
13. Instrumentation Amplifier kit-1 No
14. Analog – Digital and Digital –Analog converters (ADC and DACs)- 1 No

20153L58	OBJECT ORIENTED PROGRAMMING LABORATORY	L T P C 0 0 3 2

COURSE OBJECTIVES

- To build software development skills using java programming for real-world applications.
- To understand and apply the concepts of classes, packages, interfaces, arraylist, exception handling and file processing.
- To develop applications using generic programming and event handling.

List of experiments

1. Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection(i.e domestic or commercial). Compute the bill amount using the following tariff. If the type of the EB connection is domestic, calculate the amount to be paid as follows:
   - First 100 units - Rs. 1 per unit
   - 101-200 units - Rs. 2.50 per unit
   - 201 -500 units - Rs. 4 per unit
   - > 501 units - Rs. 6 per unit

If the type of the EB connection is commercial, calculate the amount to be paid as follows:

   - First 100 units - Rs. 2 per unit
   - 101-200 units - Rs. 4.50 per unit
   - 201 -500 units - Rs. 6 per unit
   - > 501 units - Rs. 7 per unit

2. Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa) , time converter (hours to minutes, seconds and vice versa) using packages.
3. Develop a java application with Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
4. Design a Java interface for ADT Stack. Implement this interface using array. Provide necessary exception handling in both the implementations.
5. Write a program to perform string operations using ArrayList. Write functions for the following

   a. Append - add at end

   b. Insert – add at particular index c.

   Search

   d. List all string starts with given letter

6. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.
7. Write a Java program to implement user defined exception handling.
8. Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes.
9. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
10. Write a java program to find the maximum value from the given type of elements using a generic function.
11. Design a calculator using event-driven programming paradigm of Java with the following options.

    a) Decimal manipulations b)
    Scientific manipulations
12. Develop a mini project for any application using Java concepts.

COURSE OUTCOMES **TOTAL : 60 PERIODS**

Upon completion of the course, the students will be able to Develop and implement Java programs for simple applications that make use of classes, packages and interfaces.

- Develop and implement Java programs with arraylist, exception handling and multithreading .
- Design applications using file processing, generic programming and event handling.

20153L59 PROFESSIONAL COMMUNICATION L T P C
0 0 2 1

OBJECTIVES: The course aims to:

- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employability Graduates
- Develop their confidence and help them attend interviews successfully.

UNIT I

Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs

UNIT II

Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations

UNIT III

Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic -— questioning and clarifying –GD strategies- activities to improve GD skills

UNIT IV

Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews

UNIT V

Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long- term career plan-making career changes.

TOTAL : 30 PERIODS

OUTCOMES: At the end of the course Learners will be ability to:

- Make effective presentations
- Participate confidently in Group Discussions.
- Attend job interviews and be successful in them.
- Develop adequate Soft Skills required for the workplace

Recommended Software

1. **Globearena**
2. **Win English**

REFERENCES:

1. Butterfield, Jeff **Soft Skills for Everyone.** Cengage Learning: New Delhi, 2015
2. **Interact** English Lab Manual for Undergraduate Students,. OrientBalckSwan: Hyderabad, 2016.
3. E. Suresh Kumar et al. **Communication for Professional Success.** Orient Blackswan: Hyderabad, 2015
4. Raman, Meenakshi and Sangeeta Sharma. **Professional Communication**. Oxford University Press: Oxford, 2014
5. S. Hariharanetal. **Soft Skills**. MJP Publishers: Chennai, 2010.

SOLID STATE DRIVES

	L	T	P	C
20153C61	3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Steady state operation and transient dynamics of a motor load system.
- Analyze the operation of the converter/chopper fed dc drive, both qualitatively and quantitatively.
- Operation and performance of AC motor drives.
- Analyze and design the current and speed controllers for a closed loop solid state DC motor drive.

UNIT I DRIVE CHARACTERISTICS 9

Electric drive – Equations governing motor load dynamics – steady state stability – multi quadrant Dynamics: acceleration, deceleration, starting & stopping – typical load torque characteristics – Selection of motor.

UNIT II CONVERTER / CHOPPER FED DC MOTOR DRIVE 9

Steady state analysis of the single and three phase converter fed separately excited DC motor drive– continuous conduction – Time ratio and current limit control – 4 quadrant operation of converter / chopper fed drive- Applications.

UNIT III INDUCTION MOTOR DRIVES 9

Stator voltage control–V/f control– Rotor Resistance control-qualitative treatment of slip power recovery drives-closed loop control–– vector control- Applications.

UNIT IV SYNCHRONOUS MOTOR DRIVES 9

V/f control and self-control of synchronous motor: Margin angle control and power factor control- Three phase voltage/current source fed synchronous motor- Applications.

UNIT V DESIGN OF CONTROLLERS FOR DRIVES 9

Transfer function for DC motor / load and converter – closed loop control with Current and speed feedback–armature voltage control and field weakening mode – Design of controllers; current controller and speed controller- converter selection and characteristics.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and suggest a converter for solid state drive.
- Ability to select suitability drive for the given application.
- Ability to study about the steady state operation and transient dynamics of a motor load system.
- Ability to analyze the operation of the converter/chopper fed dc drive.
- Ability to analyze the operation and performance of AC motor drives.
- Ability to analyze and design the current and speed controllers for a closed loop solid state DC motor drive.

TEXT BOOKS:

1. Gopal K.Dubey, Fundamentals of Electrical Drives, Narosa Publishing House, 1992.
2. Bimal K.Bose. Modern Power Electronics and AC Drives, Pearson Education, 2002.
3. R.Krishnan, Electric Motor & Drives: Modeling, Analysis and Control, Pearson, 2001.

REFERENCES

1. Vedam Subramanyam, “ Electric Drives Concepts and Applications ”, 2e, McGraw Hill, 2016

2. Shaahin Felizadeh, "Electric Machines and Drives", CRC Press (Taylor and Francis Group), 2013.
3. John Hindmarsh and Alasdain Renfrew, "Electrical Machines and Drives System," Elsevier 2012.
4. Theodore Wildi, " Electrical Machines ,Drives and power systems ,6th edition, Pearson Education ,2015
5. N.K. De., P.K. SEN" Electric drives" PHI, 2012.

20153C62	**PROTECTION AND SWITCHGEAR**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

To impart knowledge on the following Topics

- Causes of abnormal operating conditions (faults, lightning and switching surges) of the apparatus and system.
- Characteristics and functions of relays and protection schemes.
- Apparatus protection, static and numerical relays
- Functioning of circuit breaker

UNIT I PROTECTION SCHEMES 9

Principles and need for protective schemes – nature and causes of faults – types of faults – Methods of Grounding - Zones of protection and essential qualities of protection – Protection scheme

UNIT II ELECTROMAGNETIC RELAYS 9

Operating principles of relays - the Universal relay – Torque equation – R-X diagram – Electromagnetic Relays – Over current, Directional, Distance, Differential, Negative sequence and Under frequency relays.

UNIT III APPARATUS PROTECTION 9

Current transformers and Potential transformers and their applications in protection schemes - Protection of transformer, generator, motor, bus bars and transmission line.

UNIT IV STATIC RELAYS AND NUMERICAL PROTECTION 9

Static relays – Phase, Amplitude Comparators – Synthesis of various relays using Static comparators – Block diagram of Numerical relays – Over current protection, transformer differential protection, distant protection of transmission lines.

UNIT V CIRCUIT BREAKERS 9

Physics of arcing phenomenon and arc interruption - DC and AC circuit breaking – re-striking voltage and recovery voltage - rate of rise of recovery voltage - resistance switching - current chopping - interruption of capacitive current - Types of circuit breakers – air blast, air break, oil, SF6, MCBs, MCCBs and vacuum circuit breakers – comparison of different circuit breakers – Rating and selection of Circuit breakers.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze Electromagnetic and Static Relays.
- Ability to suggest suitability circuit breaker.
- Ability to find the causes of abnormal operating conditions of the apparatus and system.

- Ability to analyze the characteristics and functions of relays and protection schemes.
- Ability to study about the apparatus protection, static and numerical relays.
- Ability to acquire knowledge on functioning of circuit breaker.

TEXT BOOKS:

1. Sunil S.Rao, 'Switchgear and Protection', Khanna Publishers, New Delhi, 2008.
2. B.Rabindranath and N.Chander, 'Power System Protection and Switchgear', New Age International (P) Ltd., First Edition 2011.
3. Arun Ingole, 'Switch Gear and Protection' Pearson Education, 2017.

REFERENCES

1. BadriRam ,B.H. Vishwakarma, 'Power System Protection and Switchgear', New Age InternationalPvt Ltd Publishers, Second Edition 2011.
2. Y.G.Paithankar and S.R.Bhide, 'Fundamentals of power system protection', Second Edition,Prentice Hall of India Pvt. Ltd., New Delhi, 2010.
3. C.L.Wadhwa, 'Electrical Power Systems', 6th Edition, New Age International (P) Ltd., 2010
4. RavindraP.Singh, 'Switchgear and Power System Protection', PHI Learning Private Ltd., NewDelhi, 2009.
5. VK Metha," Principles of Power Systems" S. Chand, 2005.
6. Bhavesh Bhalja, R.P. Maheshwari, Nilesh G. Chotani,'Protection and Switchgear' Oxford University Press, 2011.

20153C63	**EMBEDDED SYSTEMS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES :

To impart knowledge on the following Topics

- Building Blocks of Embedded System
- Various Embedded Development Strategies
- Bus Communication in processors, Input/output interfacing.
- Various processor scheduling algorithms.
- Basics of Real time operating system and example tutorials to discuss on one real time operating system tool.

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS 9

Introduction to Embedded Systems –Structural units in Embedded processor , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging.

UNIT II EMBEDDED NETWORKING 9

Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols RS232 standard – RS422 – RS 485 - CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I^2C) –need for device drivers.

UNIT III EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT 9

Embedded Product Development Life Cycle- objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model.

UNIT IV RTOS BASED EMBEDDED SYSTEM DESIGN 9

Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication shared memory, message passing-, Inter process Communication– synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance.

UNIT V EMBEDDED SYSTEM APPLICATION AND DEVELOPMENT 9

Case Study of Washing Machine- Automotive Application- Smart card System Application-ATM machine –Digital camera

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze Embedded systems.
- Ability to suggest an embedded system for a given application.
- Ability to operate various Embedded Development Strategies
- Ability to study about the bus Communication in processors.
- Ability to acquire knowledge on various processor scheduling algorithms.
- Ability to understand basics of Real time operating system.

TEXT BOOKS:

1. Peckol, "Embedded system Design", John Wiley & Sons,2010
2. Lyla B Das," Embedded Systems-An Integrated Approach", Pearson, 2013
3. Shibu. K.V, "Introduction to Embedded Systems", 2e, Mc graw Hill, 2017.

REFERENCES

1. Raj Kamal, 'Embedded System-Architecture, Programming, Design', Mc Graw Hill, 2013.
2. C.R.Sarma, "Embedded Systems Engineering", University Press (India) Pvt. Ltd, 2013.
3. Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2006.
4. Han-Way Huang, "Embedded system Design Using C8051", Cengage Learning, 2009.
5. Rajib Mall "Real-Time systems Theory and Practice" Pearson Education, 2007.

20153L66	**POWER ELECTRONICS AND DRIVES LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**2**

OBJECTIVES:

- To provide hands on experience with power electronic converters and testing.

LIST OF EXPERIMENTS

1. Gate Pulse Generation using R, RC and UJT.
2. Characteristics of SCR and TRIAC
3. Characteristics of MOSFET and IGBT
4. AC to DC half controlled converter
5. AC to DC fully controlled Converter
6. Step down and step up MOSFET based choppers
7. IGBT based single phase PWM inverter

8 IGBT based three phase PWM inverter
9 AC Voltage controller
10 Switched mode power converter.
11 Simulation of PE circuits (1Φ & 3Φ semi converters, 1Φ & 3Φ full converters, DC-DC converters, AC voltage controllers).
12 Characteristics of GTO & IGCT.
13 Characteristics of PMBLDC motor

TOTAL: 60 PERIODS

OUTCOMES:

- Ability to practice and understand converter and inverter circuits and apply software for engineering problems.
- Ability to experiment about switching characteristics various switches.
- Ability to analyze about AC to DC converter circuits.
- Ability to analyze about DC to AC circuits.
- Ability to acquire knowledge on AC to AC converters
- Ability to acquire knowledge on simulation software.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Device characteristics(for SCR, MOSFET, TRIAC,GTO,IGCT and IGBT kit with built-in / discrete power supply and meters) - 2 each
2. SinglephaseSCRbasedhalfcontrolledconverterandfullycontrolledconverteralong with built-in/separate/firing circuit/module and meter – 2 each
3. MOSFET based step up and step down choppers (Built in/ Discrete) – 1 each
4. IGBT based single phase PWM inverter module/Discrete Component – 2
5. IGBT based three phase PWM inverter module/Discrete Component – 2
6. Switched mode power converter module/Discrete Component – 2
7. SCR &TRIAC based 1 phase AC controller along with lamp or rheostat load - 2
8. Cyclo converter kit with firing module – 1
9. Dual regulated DC power supply with common ground
10. Cathode ray Oscilloscope –10
11. Isolation Transformer – 5
12. Single phase Auto transformer –3
13. Components (Inductance, Capacitance) 3 set for each
14. Multimeter – 5
15. LCR meter – 3
16. Rheostats of various ranges – 2 sets of 10 value
17. Work tabilitys – 10
18. DC and AC meters of required ranges – 20
19. Component data sheets to be provided

20153L67 MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:

- To provide training on programming of microprocessors and microcontrollers and understand the interface requirements.
- To simulate various microprocessors and microcontrollers using KEIL or Equivalent simulator.

LIST OF EXPERIMENTS

1 Simple arithmetic operations: addition / subtraction / multiplication / division.

2 Programming with control instructions:

(i) Ascending / Descending order, Maximum / Minimum of numbers. (ii) Programs using Rotate instructions.

(iii) Hex / ASCII / BCD code conversions.

3 Interface Experiments: with 8085

(i) A/D Interfacing. & D/A Interfacing.

4 Traffic light controller.

5 I/O Port / Serial communication

6 Programming Practices with Simulators/Emulators/open source

7 Read a key ,interface display

8 Demonstration of basic instructions with 8051 Micro controller execution, including: (i) Conditional jumps & looping

(ii) Calling subroutines.

9 Programming I/O Port and timer of 8051 (i) study on interface with A/D & D/A

(ii) Study on interface with DC & AC motors

10 Application hardware development using embedded processors.

TOTAL: 60 PERIODS

OUTCOMES:

- Ability to understand and apply computing platform and software for engineering problems.
- Ability to programming logics for code conversion.
- Ability to acquire knowledge on A/D and D/A.
- Ability to understand basics of serial communication.
- Ability to understand and impart knowledge in DC and AC motor interfacing.
- Ability to understand basics of software simulators.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Sl.No.	Description of Equipment	Quantity required
1.	8085 Microprocessor Trainer with Power Supply	15
2.	8051 Micro Controller Trainer Kit with power supply	15
3.	8255 Interface boards	5
4.	8251 Interface boards	5

5.	8259 Interface boards	5
6.	8279 Keyboard / Display Interface boards	5
7.	8254 timer/ counters	5
8.	ADC and DAC cards	5
9.	AC & DC motor with Controller s	5
10.	Traffic Light Control Systems	5

20153MP68 MINI PROJECT LT P C

0 0 4 2

OBJECTIVES:

- To develop their own innovative prototype of ideas.
- To train the students in preparing mini project reports and examination.

The students in a group of 5 to 6 works on a topic approved by the head of the department and prepares a comprehensive mini project report after completing the work to the satisfaction. The progress of the project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department. A mini project report is required at the end of the semester. The mini project work is evaluated based on oral presentation and the mini project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 60 PERIODS

OUTCOMES:

- On Completion of the mini project work students will be in a position to take up their final year project work and find solution by formulating proper methodology.

20153C71 **HIGH VOLTAGE ENGINEERING**

L	T	P	C
3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Various types of over voltages in power system and protection methods.
- Generation of over voltages in laboratories.
- Measurement of over voltages.
- Nature of Breakdown mechanism in solid, liquid and gaseous dielectrics.
- Testing of power apparatus and insulation coordination

UNIT I OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS 9

Causes of over voltages and its effects on power system – Lightning, switching surges and temporary over voltages, Corona and its effects – Bewley lattice diagram- Protection against over voltages.

UNIT II DIELECTRIC BREAKDOWN 9

Properties of Dielectric materials - Gaseous breakdown in uniform and non-uniform fields – Corona discharges – Vacuum breakdown – Conduction and breakdown in pure and commercial liquids, Maintenance of oil Quality – Breakdown mechanisms in solid and composite dielectrics- Applications of insulating materials in electrical equipments.

UNIT III GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS 9

Generation of High DC voltage: Rectifiers, voltage multipliers, vandigraff generator: generation of high impulse voltage: single and multistage Marx circuits – generation of high AC voltages: cascaded transformers, resonant transformer and tesla coil- generation of switching surges – generation of impulse currents - Triggering and control of impulse generators.

UNIT IV MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS 9

High Resistance with series ammeter – Dividers, Resistance, Capacitance and Mixed dividers - Peak Voltmeter, Generating Voltmeters - Capacitance Voltage Transformers, Electrostatic Voltmeters – Sphere Gaps - High current shunts- Digital techniques in high voltage measurement.

UNIT V HIGH VOLTAGE TESTING & INSULATION COORDINATION 9

High voltage testing of electrical power apparatus as per International and Indian standards – Power frequency, impulse voltage and DC testing of Insulators, circuit breakers, bushing, isolators and transformers- Insulation Coordination& testing of cabilitys.

OUTCOMES: **TOTAL : 45 PERIODS**

- Ability to understand Transients in power system.
- Ability to understand Generation and measurement of high voltage.
- Ability to understand High voltage testing.
- Ability to understand various types of over voltages in power system.
- Ability to measure over voltages.
- Ability to test power apparatus and insulation coordination

TEXT BOOKS:

1. S.Naidu and V. Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, Fifth Edition, 2013.

2. E. Kuffel and W.S. Zaengl, J.Kuffel, 'High voltage Engineering fundamentals', Newnes Second Edition Elsevier , New Delhi, 2005.

3. C.L. Wadhwa, 'High voltage Engineering', New Age International Publishers, Third Edition, 2010.

REFERENCES

1. L.L. Alston, 'High Voltage Technology', Oxford University Press, First Indian Edition, 2011.

2. Mazen Abdel – Salam, Hussein Anis, Ahdab A-Morshedy, Roshday Radwan, High Voltage Engineering – Theory &Practice, Second Edition Marcel Dekker, Inc., 2010.

3. Subir Ray,' An Introduction to High Voltage Engineering' PHI Learning Private Limited, New Delhi, Second Edition, 2013.

20153C72	**POWER SYSTEM OPERATION AND CONTROL**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

To impart knowledge on the following topics

- Significance of power system operation and control.
- Real power-frequency interaction and design of power-frequency controller.
- Reactive power-voltage interaction and the control actions to be implemented for maintaining the voltage profile against varying system load.
- Economic operation of power system.
- SCADA and its application for real time operation and control of power systems

UNIT I PRELIMINARIES ON POWER SYSTEM OPERATION AND CONTROL 9

Power scenario in Indian grid – National and Regional load dispatching centers – requirements of good power system - necessity of voltage and frequency regulation - real power vs frequency and reactive power vs voltage control loops - system load variation, load curves and basic concepts of load dispatching - load forecasting - Basics of speed governing mechanisms and modeling - speed load characteristics - regulation of two generators in parallel.

UNIT II REAL POWER - FREQUENCY CONTROL 9

Load Frequency Control (LFC) of single area system-static and dynamic analysis of uncontrolled and controlled cases - LFC of two area system - tie line modeling - block diagram representation of two area system - static and dynamic analysis - tie line with frequency bias control – state variability model - integration of economic dispatch control with LFC.

UNIT III REACTIVE POWER – VOLTAGE CONTROL 9

Generation and absorption of reactive power - basics of reactive power control – Automatic Voltage Regulator (AVR) – brushless AC excitation system – block diagram representation of AVR loop - static and dynamic analysis – stability compensation – voltage drop in transmission line - methods of reactive power injection - tap changing transformer, SVC (TCR + TSC) and STATCOM for voltage control.

UNIT IV ECONOMIC OPERATION OF POWER SYSTEM 9

Statement of economic dispatch problem - input and output characteristics of thermal plant - incremental cost curve - optimal operation of thermal units without and with transmission losses (no derivation of transmission loss coefficients) - base point and participation factors method - statement of unit commitment (UC) problem - constraints on UC problem - solution of UC problem using priority list – special aspects of short term and long term hydrothermal problems.

UNIT V COMPUTER CONTROL OF POWER SYSTEMS 9

Need of computer control of power systems-concept of energy control centers and functions – PMU - system monitoring, data acquisition and controls - System hardware configurations - SCADA and EMS functions - state estimation problem – measurements and errors - weighted least square estimation - various operating states - state transition diagram.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand the day-to-day operation of electric power system.
- Ability to analyze the control actions to be implemented on the system to meet the minute-to-minute variation of system demand.
- Ability to understand the significance of power system operation and control.
- Ability to acquire knowledge on real power-frequency interaction.
- Ability to understand the reactive power-voltage interaction.
- Ability to design SCADA and its application for real time operation

TEXT BOOKS:

1. Olle.I.Elgerd, 'Electric Energy Systems theory - An introduction', McGraw Hill Education Pvt. Ltd., New Delhi, 34th reprint, 2010.

2. Allen. J. Wood and Bruce F. Wollen berg, 'Power Generation, Operation and Control', John Wiley & Sons, Inc., 2016.

3. Abhijit Chakrabarti and Sunita Halder, 'Power System Analysis Operation and Control', PHI learning Pvt. Ltd., New Delhi, Third Edition, 2010.

REFERENCES

1. Kothari D.P. and Nagrath I.J., 'Power System Engineering', Tata McGraw-Hill Education, Second Edition, 2008.

2. Hadi Saadat, 'Power System Analysis', McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.

3. Kundur P., 'Power System Stability and Control, McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.

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20153C73 **RENEWABLE ENERGY SYSTEMS**

L	T	P	C
3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Awareness about renewable Energy Sources and technologies. Adequate
- inputs on a variety of issues in harnessing renewable Energy. Recognize
- current and possible future role of renewable energy sources.

UNIT I RENEWABLE ENERGY (RE) SOURCES 9

Environmental consequences of fossil fuel use, Importance of renewable sources of energy, Sustainable Design and development, Types of RE sources, Limitations of RE sources, Present Indian and international energy scenario of conventional and RE sources.

UNIT II WIND ENERGY 9

Power in the Wind – Types of Wind Power Plants(WPPs)–Components of WPPs-Working of WPPs-Siting of WPPs-Grid integration issues of WPPs.

UNIT III SOLAR PV AND THERMAL SYSTEMS 9

Solar Radiation, Radiation Measurement, Solar Thermal Power Plant, Central Receiver Power Plants, Solar Ponds.- Thermal Energy storage system with PCM- Solar Photovoltaic systems : Basic Principle of SPV conversion – Types of PV Systems- Types of Solar Cells, Photovoltaic cell concepts: Cell, module, array ,PV Module I-V Characteristics, Efficiency & Quality of the Cell, series and parallel connections, maximum power point tracking, Applications.

UNIT IV BIOMASS ENERGY 9

Introduction-Bio mass resources –Energy from Bio mass: conversion processes-Biomass Cogeneration-Environmental Benefits. Geothermal Energy: Basics, Direct Use, Geothermal Electricity. Mini/micro hydro power: Classification of hydropower schemes, Classification of water turbine, Turbine theory, Essential components of hydroelectric system.

UNIT V OTHER ENERGY SOURCES 9

Tidal Energy: Energy from the tides, Barrage and Non Barrage Tidal power systems. Wave Energy: Energy from waves, wave power devices. Ocean Thermal Energy Conversion (OTEC)- Hydrogen Production and Storage- Fuel cell : Principle of working- various types - construction and applications. Energy Storage System- Hybrid Energy Systems.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to create awareness about renewable Energy Sources and technologies.
- Ability to get adequate inputs on a variety of issues in harnessing renewable Energy.
- Ability to recognize current and possible future role of renewable energy sources.
- Ability to explain the various renewable energy resources and technologies and their applications.
- Ability to understand basics about biomass energy.
- Ability to acquire knowledge about solar energy.

TEXT BOOKS:

1. Joshua Earnest, Tore Wizeliu, ‘Wind Power Plants and Project Development’, PHI Learning Pvt.Ltd, New Delhi, 2011.

2. D.P.Kothari, K.C Singal, Rakesh Ranjan “Renewable Energy Sources and Emerging Technologies”, PHI Learning Pvt.Ltd, New Delhi, 2013.

3. Scott Grinnell, “Renewable Energy & Sustainable Design”, CENGAGE Learning, USA, 2016.

REFERENCES

1. A.K.Mukerjee and Nivedita Thakur," Photovoltaic Systems: Analysis and Design", PHI Learning Private Limited, New Delhi, 2011

2. Richard A. Dunlap," Sustainable Energy" Cengage Learning India Private Limited, Delhi, 2015.

3. Chetan Singh Solanki, " Solar Photovoltaics : Fundamentals, Technologies and Applications", PHI Learning Private Limited, New Delhi, 2011

4. Bradley A. Striebig,Adebayo A.Ogundipe and Maria Papadakis," Engineering Applications in Sustainable Design and Development", Cengage Learning India Private Limited, Delhi, 2016.

5. Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.

6. Shobh Nath Singh, 'Non-conventional Energy resources' Pearson Education ,2015.

20153L77	**POWER SYSTEM SIMULATION LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**2**

OBJECTIVES:

- To provide better understanding of power system analysis through digital simulation.

LIST OF EXPERIMENTS

1 Computation of Transmission Line Parameters
2 Formation of Bus Admittance and Impedance Matrices and Solution of Networks
3 Power Flow Analysis using Gauss-Seidel Method
4 Power Flow Analysis using Newton Raphson Method
5 Symmetric and unsymmetrical fault analysis
6 Transient stability analysis of SMIB System
7 Economic Dispatch in Power Systems
8 Load – Frequency Dynamics of Single- Area and Two-Area Power Systems
9 State estimation: Weighted least square estimation
10 Electromagnetic Transients in Power Systems : Transmission Line Energization

OUTCOMES: **TOTAL: 60 PERIODS**

- Ability to understand power system planning and operational studies.
- Ability to acquire knowledge on Formation of Bus Admittance and Impedance Matrices and Solution of Networks.
- Ability to analyze the power flow using GS and NR method
- Ability to find Symmetric and Unsymmetrical fault
- Ability to understand the economic dispatch.
- Ability to analyze the electromagnetic transients.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Personal computers (Intel i3, 80GB, 2GBRAM) – 30 nos
2. Printer laser- 1 No.
3. Dot matrix- 1 No.
4. Server (Intel i5, 80GB, 2GBRAM) (High Speed Processor) – 1 No.
5. Software: any power system simulation software with 5 user license
6. Compliers: C, C++, VB, VC++ - 30 users

RENEWABLE ENERGY SYSTEMS LABORATORY	L	T	P	C
	0	0	3	2

OBJECTIVES:

- To train the students in Renewable Energy Sources and technologies.
- To provide adequate inputs on a variety of issues in harnessing Renewable Energy.
- To recognize current and possible future role of Renewable energy sources.

LIST OF EXPERIMENTS

1 Simulation study on Solar PV Energy System.

2 Experiment on "VI-Characteristics and Efficiency of 1kWp Solar PV System".

3 Experiment on "Shadowing effect & diode based solution in 1kWp Solar PV System".

4 Experiment on Performance assessment of Grid connected and Standalone 1kWp Solar Power System.

5 Simulation study on Wind Energy Generator.

6 Experiment on Performance assessment of micro Wind Energy Generator.

7 Simulation study on Hybrid (Solar-Wind) Power System.

8 Experiment on Performance Assessment of Hybrid (Solar-Wind) Power System.

9 Simulation study on Hydel Power.

10 Experiment on Performance Assessment of 100W Fuel Cell.

11 Simulation study on Intelligent Controllers for Hybrid Systems.

OUTCOMES:

- Ability to understand and analyze Renewable energy systems.

TOTAL: 60 PERIODS

- Ability to train the students in Renewable Energy Sources and technologies.
- Ability to provide adequate inputs on a variety of issues in harnessing Renewable Energy.
- Ability to simulate the various Renewable energy sources.
- Ability to recognize current and possible future role of Renewable energy sources.
- Ability to understand basics of Intelligent Controllers.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S.No	Name of the equipments / Components	Quantity Required	Remarks
1.	Personal computers (Intel i3, 80GB, 2GBRAM)	15	-
2.	CRO	9	30MHz
3.	Digital Multimeter	10	Digital
4.	PV panels - 100W, 24V	1	
5.	Battery storage system with charge and discharge control 40Ah	1	
6.	PV Emulator	1	
7.	Micro Wind Energy Generator module	1	

Consumabilitys (Minimum of 5 Nos. each)			
8.	Potentiometer	5	-
9.	Step-down transformer	5	230V/12-0-12V
10	Component data sheets to be provided		

17153CEC -COMPS 0 0 2 2

Electric Circuits and Fields:

Network graph, KCL, KVL, node and mesh analysis, transient response of dc and ac networks; sinusoida steady-state analysis, resonance, basic filter concepts; ideal current and voltage sources, Thevenin's Norton's and Superposition and Maximum Power Transfer theorems, two-port networks, three phas circuits; Gauss Theorem, electric field and potential due to point, line, plane and spherical charg distributions; Ampere's and Biot-Savart's laws; inductance; dielectrics; capacitance.

Signals and Systems:

Representation of continuous and discrete-time signals; shifting and scaling operations; linear, time invariant and causal systems; Fourier series representation of continuous periodic signals; sampling theorem; Fourier, Laplace and Z transforms.

Electrical Machines:

Single phase transformer – equivalent circuit, phasor diagram, tests, regulation and efficiency; three phase transformers – connections, parallel operation; auto-transformer; energy conversion principles; DC machines – types, windings, generator characteristics, armature reaction and commutation, starting and speed control of motors; three phase induction motors – principles, types, performance characteristics, starting and speed control; single phase induction motors; synchronous machines – performance, regulation and parallel operation of generators, motor starting, characteristics and applications; servo and stepper motors.

Power Systems:

Basic power generation concepts; transmission line models and performance; cable performance, insulation; corona and radio interference; distribution systems; per-unit quantities; bus impedance and admittance matrices; load flow; voltage control; power factor correction; economic operation; symmetrical components; fault analysis; principles of over-current, differential and distance protection; solid state relays and digital protection; circuit breakers; system stability concepts, swing curves and equal area criterion; HVDC transmission and FACTS concepts.

Control Systems:

Principles of feedback; transfer function; block diagrams; steady-state errors; Routh and Niquist techniques; Bode plots; root loci; lag, lead and lead-lag compensation; state space model; state transition matrix, controllability and observability.

Electrical and Electronic Measurements:

Bridges and potentiometers; PMMC, moving iron, dynamometer and induction type instruments; measurement of voltage, current, power, energy and power factor; instrument transformers; digital voltmeters and multimeters; phase, time and frequency measurement; Q-meters; oscilloscopes; potentiometric recorders; error analysis.

Analog and Digital Electronics:

Characteristics of diodes, BJT, FET; amplifiers – biasing, equivalent circuit and frequency response; oscillators and feedback amplifiers; operational amplifiers – characteristics and applications; simple active filters; VCOs and timers; combinational and sequential logic circuits; multiplexer; Schmitt trigger; multi-vibrators; sample and hold circuits; A/D and D/A converters; 8-bit microprocessor basics, architecture, programming and interfacing.

Power Electronics and Drives:

Semiconductor power diodes, transistors, thyristors, triacs, GTOs, MOSFETs and IGBTs – static characteristics and principles of operation; triggering circuits; phase control rectifiers; bridge converters – fully controlled and half controlled; principles of choppers and inverters; basis concepts of adjustable speed dc and ac drives.

20153E64A ADVANCED CONTROL SYSTEM LT P C
2 2 0 3

OBJECTIVES

i. To provide knowledge on design state feedback control and state observer.
ii. To provide knowledge in phase plane analysis.
iii. To give basic knowledge in describing function analysis.
iv. To study the design of optimal controller.
v. To study the design of optimal estimator including Kalman Filter

UNIT I STATE VARIABLE ANALYSIS 6+6

Introduction- concepts of state variables and state model-State model for linear continuous time systems, Diagonalisation- solution of state equations- Concepts of controllability and observability.

UNIT II STATE VARIABLE DESIGN 6+6

Introduction to state model: Effect of state feedback - Pole placement design: Necessary and sufficient condition for arbitrary pole placement, State regulator design Design of state observers- Separation principle- Design of servo systems: State feedback with integral control.

UNIT III SAMPLED DATA ANALYSIS 6+6

Introduction spectrum analysis of sampling process signal reconstruction difference equations The Z transform function, the inverse Z transform function, response of Linear discrete system, the Z transform analysis of sampled data control systems, response between sampling instants, the Z and S domain relationship. Stability analysis and compensation techniques.

UNIT IV NON LINEAR SYSTEMS 6+6

Introduction, common physical nonlinearites, The phase plane method: concepts, singular points, stability of non linear systems, construction of phase trajectories system analysis by phase plane method. The describing function method, stability analysis by describing function method, Jump resonance.

UNIT V OPTIMAL CONTROL 6+6

Introduction: Classical control and optimization, formulation of optimal control problem, Typical optimal control performance measures - Optimal state regulator design: Lyapunov equation, Matrix Riccati equation - LQR steady state optimal control – Application examples.

OUTCOMES: **TOTAL: 60 PERIODS**

i. Able to design state feedback controller and state observer.
ii. Able to understand and analyse linear and nonlinear systems using phase plane method.
iii. Able to understand and analyse nonlinear systems using describing function method.
iv. Able to understand and design optimal controller.
v. Able to understand optimal estimator including Kalman Filter.
vi. Ability to apply advanced control strategies to practical engineering problems.

TEXT BOOKS:

1. M.Gopal, “Digital Control and State Variable Methods”, 4th edition, Mc Graw Hill India, 2012
2. K. Ogata, ‘Modern Control Engineering’, 5th Edition, Pearson, 2012.
3. K. P. Mohandas, “Modern Control Engineering”, Sanguine Technical Publishers, 2006.

REFERENCES:

1. M.Gopal, Modern Control System Theory, 3rd edition, New Age International Publishers, 2014.
2. William S Levine, “Control System Fundamentals,” The Control Handbook, CRC Press, Tayler and Francies Group, 2011.
3. Ashish Tewari, ‘Modern Control Design with Matlab and Simulink’, John Wiley, New Delhi, 2002.
4. T. Glad and L. Ljung,, “Control Theory –Multivariable and Non-Linear Methods”, Taylor & Francis, 2002.

20153E64B VISUAL LANGUAGES AND APPLICATIONS

L	T	P	C
3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- To study about the concepts of windows programming models, MFC applications, drawing with the GDI, getting inputs from Mouse and the Keyboard.
- To study the concepts of Menu basics, menu magic and classic controls of the windows programming using VC++.
- To study the concept of Document/View Architecture with single & multiple document interface, toolbars, status bars and File I/O Serialization.
- To study about the integrated development programming event driven programming, variabilitys, constants, procedures and basic ActiveX controls in visual basic.
- To understand the database and the database management system, visual data manager, data bound controls and ADO controls in VB.

UNIT I FUNDAMENTALS OF WINDOWS AND MFC 9

Messages - Windows programming - SDK style - Hungarian notation and windows data types - SDK programming in perspective. The benefits of C++ and MFC - MFC design philosophy – Document / View architecture - MFC class hierarchy - AFX functions. Application object - Frame window object - Message map. Drawing the lines – Curves – Ellipse – Polygons and other shapes. GDI pens – Brushes - GDI fonts - Deleting GDI objects and deselecting GDI objects. Getting input from the mouse: Client & Non-client - Area mouse messages - Mouse wheel - Cursor. Getting input from the keyboard: Input focus - Keystroke messages - Virtual key codes - Character & dead key messages.

UNIT II RESOURCES AND CONTROLS 9

Creating a menu – Loading and displaying a menu – Responding to menu commands – Command ranges - Updating the items in menu, update ranges – Keyboard accelerators. Creating menus programmatically - Modifying menus programmatically - The system menu - Owner draw menus – Cascading menus - Context menus. The C button class – C list box class – C static class - The font view application – C edit class – C combo box class – C scrollbar class. Model dialog boxes – Modeless dialog boxes.

UNIT III DOCUMENT / VIEW ARCHITECTURE 9

The in existence function revisited – Document object – View object – Frame window object – Dynamic object creation. SDI document template - Command routing. Synchronizing multiple views of a document – Mid squares application – Supporting multiple document types – Alternatives to MDI. Splitter Windows: Dynamic splitter window – Static splitter windows. Creating & initializing a toolbar - Controlling the toolbar's visibility – Creating & initializing a status bar - Creating custom status bar panes – Status bar support in appwizard. Opening, closing and creating the files - Reading & Writing – C file derivatives – Serialization basics - Writing serializability classes.

UNIT IV FUNDAMENTALS OF VISUAL BASIC 9

Menu bar – Tool bar – Project explorer – Toolbox – Properties window – Form designer – Form layout – Intermediate window. Designing the user interface: Aligning the controls – Running the application – Visual development and event driven programming.

Variabilitys: Declaration – Types – Converting variability types – User defined data types - Lifetime of a variability. Constants - Arrays – Types of arrays. Procedures: Subroutines – Functions – Calling procedures. Text box controls – List box & Combo box controls – Scroll bar and slider controls – File controls.

UNIT V DATABASE PROGRAMMING WITH VB 9

Record sets – Data control – Data control properties, methods. Visual data manager: Specifying indices with the visual data manager – Entering data with the visual data manager. Data bound list control – Data bound combo box – Data bound grid control. Mapping databases: Database object – Tability def object, Query def object. Programming the active database objects – ADO object model – Establishing a connection - Executing SQL statements – Cursor types and locking mechanism – Manipulating the record set object – Simple record editing and updating.

OUTCOMES:

- Ability to understand and apply computing platform and software for engineering problems
- Ability to study about the concepts of windows programming models.
- Ability to study the concepts of Menu basics, menu magic and classic controls.
- Ability to study the concept of Document/View Architecture with single & multiple document interface.
- Ability to study about the integrated development programming event driven programming.
- Ability to understand the database and the database management system.

TEXT BOOKS:

1. Jeff Prosise, 'Programming Windows With MFC', Second Edition, WP Publishers & Distributors (P) Ltd, Reprinted, 2002.
2. Evangelos Petroutsos, 'Mastering Visual Basic 6.0', BPB Publications, 2002.

REFERENCES

1. Herbert Schildt, 'MFC Programming From the Ground Up', Second Edition, McGraw Hill, reprinted, 2002.
2. John Paul Muller, 'Visual C++ 6 From the Ground Up Second Edition', McGraw Hill, Reprinted, 2002.
3. Curtis Smith & Micheal Amundsen, 'Teach Yourself Database Programming with Visual Basic 6 in 21 days', Techmedia Pub, 1999.

20153E64C	DESIGN OF ELECTRICAL APPARATUS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Magnetic circuit parameters and thermal rating of various types of electrical machines.
- Armature and field systems for D.C. machines.
- Core, yoke, windings and cooling systems of transformers.
- Design of stator and rotor of induction machines and synchronous machines.
- The importance of computer aided design method.

UNIT I DESIGN OF FIELD SYSTEM AND ARMATURE 9

Major considerations in Electrical Machine Design – Materials for Electrical apparatus – Design of Magnetic circuits – Magnetising current – Flux leakage – Leakage in Armature. Design of lap winding and wave winding.

UNIT II DESIGN OF TRANSFORMERS 9

Construction - KVA output for single and three phase transformers – Overall dimensions – design of yoke, core and winding for core and shell type transformers – Estimation of No load current – Temperature rise in Transformers – Design of Tank and cooling tubes of Transformers. Computer program: Complete Design of single phase core transformer

UNIT III DESIGN OF DC MACHINES 9

Construction - Output Equations – Main Dimensions – Choice of specific loadings – Selection of number of poles – Design of Armature – Design of commutator and brushes – design of field Computer program: Design of Armature main dimensions

UNIT IV DESIGN OF INDUCTION MOTORS 9

Construction - Output equation of Induction motor – Main dimensions – choice of specific loadings – Design of squirrel cage rotor and wound rotor –Magnetic leakage calculations – Operating characteristics : Magnetizing current - Short circuit current – Circle diagram - Computer program: Design of slip-ring rotor

UNIT V DESIGN OF SYNCHRONOUS MACHINES 9

Output equations – choice of specific loadings – Design of salient pole machines – Short circuit ratio – Armature design – Estimation of air gap length – Design of rotor –Design of damper winding – Determination of full load field MMF – Design of field winding – Design of turbo alternators -Computer program: Design of Stator main dimensions-Brushless DC Machines

OUTCOMES: TOTAL : 45 PERIODS

- Ability to understand basics of design considerations for rotating and static electrical machines
- Ability to design of field system for its application.
- Ability to design sing and three phase transformer.
- Ability to design armature and field of DC machines.
- Ability to design stator and rotor of induction motor.

TEXT BOOKS:

1. Sawhney, A.K., ‘A Course in Electrical Machine Design’, Dhanpat Rai& Sons, New Delhi, Fifth Edition, 1984.

2. M V Deshpande ‘Design and Testing of Electrical Machines’ PHI learning Pvt Lt, 2011.

3. Sen, S.K., ‘Principles of Electrical Machine Designs with Computer Programmes’, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, Second Edition, 2009.

REFERENCES

1. A.Shanmugasundaram, G.Gangadharan, R.Palani ‘Electrical Machine Design Data Book’, New Age International Pvt. Ltd., Reprint 2007.

2. ‘Electrical Machine Design’, Balbir Singh, Vikas Publishing House Private Limited, 1981.

3. V Rajini, V.S Nagarajan, ‘Electrical Machine Design’, Pearson, 2017.

4. K.M.Vishnumurthy ‘Computer aided design of electrical machines’ B S Publications,2008

20153E64D	**POWER SYSTEM STABILITY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

- To understand the fundamental concepts of stability of power systems and its classification.
- To expose the students to dynamic behaviour of the power system for small and large disturbances.
- To understand and enhance the stability of power systems.

UNIT I INTRODUCTION TO STABILITY 9

Fundamental concepts - Stability and energy of a system - Power System Stability: Definition, Causes, Nature and Effects of disturbances, Classification of stability, Modelling of electrical components - Basic assumptions made in stability studies- Modelling of Synchronous machine for stability studies(classical model) - Rotor dynamics and the swing equation.

UNIT II SMALL-SIGNAL STABILITY 9

Basic concepts and definitions – State space representation, Physical Interpretation of small–signal stability, Eigen properties of the state matrix: Eigenvalues and eigenvectors, modal matrices, eigenvalue and stability, mode shape and participation factor. Small– signal stability analysis of a Single-Machine Infinite Bus (SMIB) Configuration with numerical example.

UNIT III TRANSIENT STABILITY 9

Review of numerical integration methods: modified Euler and Fourth Order Runge-Kutta methods, Numerical stability,. Interfacing of Synchronous machine (classical machine) model to the transient stability algorithm (TSA) with partitioned – explicit approaches- Application of TSA to SMIB system.

UNIT IV VOLTAGE STABILITY 9

Factors affecting voltage stability- Classification of Voltage stability-Transmission system characteristics- Generator characteristics- Load characteristics- Characteristics of reactive power compensating Devices- Voltage collapse.

UNIT V ENHANCEMENT OF SMALL-SIGNAL STABILITY AND TRANSIENT STABILITY 9

Power System Stabilizer –. Principle behind transient stability enhancement methods: high-speed fault clearing, regulated shunt compensation, dynamic braking, reactor switching, independent pole-operation of circuit-breakers, single-pole switching, fast- valving, high-speed excitation systems.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will attain knowledge about the stability of power system
- Learners will have knowledge on small-signal stability, transient stability and voltage stability.
- Learners will be able to understand the dynamic behaviour of synchronous generator for different disturbances.
- Learners will be able to understand the various methods to enhance the stability of a power system.

TEXT BOOKS:

1. Power system stability and control ,P. Kundur ; edited by Neal J. Balu, Mark G. Lauby, McGraw-Hill, 1994.
2. R.Ramnujam," Power System Dynamics Analysis and Simulation, PHI Learning Private Limited, New Delhi, 2009
3. T.V. Cutsem and C.Vournas, "Voltage Stability of Electric Power Systems", Kluwer publishers, 1998.

REFERENCES

1 Peter W., Saucer, Pai M.A., "Power System Dynamics and Stability, Pearson Education (Singapore), 9th Edition, 2007.
2 EW. Kimbark., "Power System Stability", John Wiley & Sons Limited, New Jersey, 2013.
3 SB. Crary., "Power System Stability", John Wiley & Sons Limited, New Jersey, 1955.
4 K.N. Shubhanga,"Power System Analysis" Pearson, 2017.
5 Power systems dynamics: Stability and control / K.R. Padiyar, BS Publications, 2008
6 Power system control and Stability P.M. Anderson, A.A. Foud, Iowa State University Press, 1977.

20153E64E	MODERN POWER CONVERTERS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Switched mode power supplies
- Matrix Converter
- Soft switched converters

UNIT I SWITCHED MODE POWER SUPPLIES (SMPS) 9

DC Power supplies and Classification; Switched mode dc power supplies - with and without isolation, single and multiple outputs; Closed loop control and regulation; Design examples on converter and closed loop performance.

UNIT II AC-DC CONVERTERS 9

Switched mode AC-DC converters. synchronous rectification - single and three phase topologies - switching techniques - high input power factor . reduced input current harmonic distortion. improved efficiency. with and without input-output isolation. performance indices design examples

UNIT III DC-AC CONVERTERS 9

Multi-level Inversion - concept, classification of multilevel inverters, Principle of operation, main features and analysis of Diode clamped, Flying capacitor and cascaded multilevel inverters; Modulation schemes.

UNIT IV AC-AC CONVERTERS WITH AND WITHOUT DC LINK 9

Matrix converters. Basic topology of matrix converter; Commutation – current path; Modulation techniques - scalar modulation, indirect modulation; Matrix converter as only AC-DC converter; AC-AC converter with DC link - topologies and operation - with and without resonance link - converter with dc link converter; Performance comparison with matrix converter with DC link converters.

UNIT V SOFT-SWITCHING POWER CONVERTERS 9

Soft switching techniques. ZVS, ZCS, quasi resonance operation; Performance comparison hard switched and soft switched converters.AC-DC converter, DC-DC converter, DC-AC converter.; Resonant DC power supplies .

OUTCOMES: **TOTAL : 45 PERIODS**

- Ability to suggest converters for AC-DC conversion and SMPS

TEXT BOOKS:

1. Power Electronics Handbook, M.H.Rashid, Academic press, New york, 2000.
2. Advanced DC/DC Converters, Fang Lin Luo and Fang Lin Luo, CRC Press, NewYork, 2004.
3. Control in Power Electronics- Selected Problem, Marian P.Kazmierkowski, R.Krishnan and Frede Blaabjerg, Academic Press (Elsevier Science), 2002.

REFERENCES

1. Power Electronic Circuits, Issa Batarseh, John Wiley and Sons, Inc.2004
2. Power Electronics for Modern Wind Turbines, Frede Blaabjerg and Zhe Chen, Morgan & Claypool Publishers series, United States of America, 2006.
3. Krein Philip T, Elements of Power Electronics,Oxford University press, 2008
4. Agarwal ,Power Electronics: Converters, Applications, and Design, 3rd edition, Jai P, Prentice Hall,2000
5. L. Umanand, Power Electronics: Essentials & Applications, John Wiley and Sons, 2009.

20153E64F	INTELLECTUAL PROPERTY RIGHTS	L T P C
		3 0 0 3

OBJECTIVE:

- To give an idea about IPR, registration and its enforcement.

UNIT I INTRODUCTION **9**

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II REGISTRATION OF IPRs **10**

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III AGREEMENTS AND LEGISLATIONS **10**

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV DIGITAL PRODUCTS AND LAW **9**

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT V ENFORCEMENT OF IPRs **7**

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL:45 PERIODS

OUTCOME:

- Ability to manage Intellectual Property portfolio to enhance the value of the firm.

TEXT BOOKS

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. S. V. Satakar, "Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002

REFERENCES:

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli,"Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

20153E65A **PRINCIPLES OF ROBOTICS** **L T P C**
3 0 0 3

OBJECTIVES:

- To introduce the functional elements of Robotics
- To impart knowledge on the direct and inverse kinematics
- To introduce the manipulator differential motion and control
- To educate on various path planning techniques
- To introduce the dynamics and control of manipulators

UNIT I BASIC CONCEPTS 9
Brief history-Types of Robot–Technology-Robot classifications and specifications-Design and controlissues- Various manipulators – Sensors - work cell - Programming languages.

UNIT II DIRECT AND INVERSE KINEMATICS 9
Mathematical representation of Robots - Position and orientation – Homogeneous transformation-Various joints- Representation using the Denavit Hattenberg parameters -Degrees of freedom-Direct kinematics-Inverse kinematics- SCARA robots- Solvability – Solution methods-Closed form solution.

UNIT III MANIPULATOR DIFFERENTIAL MOTION AND STATICS 9
Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints–Inverse -Wrist and arm singularity - Static analysis - Force and moment Balance.

UNIT IV PATH PLANNING 9
Definition-Joint space technique-Use of p-degree polynomial-Cubic polynomial-Cartesian space technique - Parametric descriptions - Straight line and circular paths - Position and orientation planning.

UNIT V DYNAMICS AND CONTROL 9
Lagrangian mechanics-2DOF Manipulator-Lagrange Euler formulation-Dynamic model – Manipulator control problem-Linear control schemes-PID control scheme-Force control of robotic manipulator.

TOTAL: 45 PERIOD

OUTCOMES:

- Ability to understand basic concept of robotics.
- To analyze Instrumentation systems and their applications to various
- To know about the differential motion add statics in robotics
- To know about the various path planning techniques.
- To know about the dynamics and control in robotics industrie.

TEXT BOOKS:

1. R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi,4th Reprint, 2005.
2. JohnJ.Craig ,Introduction to Robotics Mechanics and Control, Third edition, Pearson Education, 2009.
3. M.P.Groover, M.Weiss, R.N. Nageland N. G.Odrej, Industrial Robotics, McGraw-Hill Singapore, 1996.

REFERENCES:

1. Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis', Oxford University Press, Sixth impression, 2010.
2. K. K.Appu Kuttan, Robotics, I K International, 2007.
3. Edwin Wise, Applied Robotics, Cengage Learning, 2003.
4. R.D.Klafter,T.A.Chimielewski and M.Negin, Robotic Engineering–An Integrated Approach, Prentice Hall of India, New Delhi, 1994.
5. B.K.Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers,Chennai, 1998.
6. S.Ghoshal, " Embedded Systems & Robotics" – Projects using the 8051 Microcontroller", Cengage Learning, 2009.

20153E65B	SPECIAL ELECTRICAL MACHINES	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Construction, principle of operation, control and performance of stepping motors.
- Construction, principle of operation, control and performance of switched reluctance motors.
- Construction, principle of operation, control and performance of permanent magnet brushless D.C. motors.
- Construction, principle of operation and performance of permanent magnet synchronous motors.
- Construction, principle of operation and performance of other special Machines.

UNIT I STEPPER MOTORS 9

Constructional features –Principle of operation –Types – Torque predictions – Linear Analysis – Characteristics – Drive circuits – Closed loop control – Concept of lead angle - Applications.

UNIT II SWITCHED RELUCTANCE MOTORS (SRM) 9

Constructional features –Principle of operation- Torque prediction–Characteristics Steady state performance prediction – Analytical Method – Power controllers – Control of SRM drive- Sensor less operation of SRM – Applications.

UNIT III PERMANENT MAGNET BRUSHLESS D.C. MOTORS 9

Fundamentals of Permanent Magnets- Types- Principle of operation- Magnetic circuit analysis- EMF and Torque equations- Power Converter Circuits and their controllers - Characteristics and control- Applications.

UNIT IV PERMANENT MAGNET SYNCHRONOUS MOTORS (PMSM) 9

Constructional features -Principle of operation – EMF and Torque equations - Sine wave motor with practical windings - Phasor diagram - Power controllers – performance characteristics - Digital controllers – Applications.

UNIT V OTHER SPECIAL MACHINES 9

Constructional features – Principle of operation and Characteristics of Hysteresis motor- Synchronous Reluctance Motor–Linear Induction motor-Repulsion motor- Applications.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to analyze and design controllers for special Electrical Machines.
- Ability to acquire the knowledge on construction and operation of stepper motor.
- Ability to acquire the knowledge on construction and operation of stepper switched reluctance motors.
- Ability to construction, principle of operation, switched reluctance motors.
- Ability to acquire the knowledge on construction and operation of permanent magnet brushless D.C. motors.
- Ability to acquire the knowledge on construction and operation of permanent magnet synchronous motors.
- Ability to select a special Machine for a particular application.

TEXT BOOKS:

- K.Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.
- T. Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press London, 1984
- E.G. Janardanan, 'Special electrical machines', PHI learning Private Limited, Delhi, 2014.

REFERENCES

1. R.Krishnan, 'Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application', CRC Press, New York, 2001.
2. T. Kenjo and S. Nagamori, 'Permanent Magnet and Brushless DC Motors', Clarendon Press, London, 1988.
3. T.J.E.Miller,'Brushless Permanent-Magnet and Reluctance Motor Drives', Oxford University Press, 1989.
4. R.Srinivasan, 'Special Electrical Machines', Lakshmi Publications, 2013.

20153E65C	**POWER QUALITY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES: To impart knowledge about the following topics:

- Causes & Mitigation techniques of various PQ events.
- Various Active & Passive power filters.

UNIT I INTRODUCTION TO POWER QUALITY 9

Terms and definitions & Sources – Overloading, under voltage, over voltage - Concepts of transients - Short duration variations such as interruption - Long duration variation such as sustained interruption - Sags and swells - Voltage sag - Voltage swell - Voltage imbalance – Voltage fluctuations - Power frequency variations - International standards of power quality – Computer Business Equipment Manufacturers Associations (CBEMA) curve

UNIT II VOLTAGE SAG AND SWELL 9

Estimating voltage sag performance - Thevenin's equivalent source - Analysis and calculation of various faulted condition - Estimation of the sag severity - Mitigation of voltage sag, Static transfer switches and fast transfer switches. - Capacitor switching – Lightning - Ferro resonance - Mitigation of voltage swell.

UNIT III HARMONICS 9

Harmonic sources from commercial and industrial loads - Locating harmonic sources – Power system response characteristics - Harmonics Vs transients. Effect of harmonics – Harmonic distortion - Voltage and current distortions - Harmonic indices - Inter harmonics – Resonance Harmonic distortion evaluation, IEEE and IEC standards.

UNIT IV PASSIVE POWER COMPENSATORS 9

Principle of Operation of Passive Shunt and Series Compensators, Analysis and Design of Passive Shunt Compensators Simulation and Performance of Passive Power Filters- Limitations of Passive Filters Parallel Resonance of Passive Filters with the Supply System and Its Mitigation. Fundamentals of load compensation – voltage regulation & power factor correction.

UNIT V POWER QUALITY MONITORING & CUSTOM POWER DEVICES 9

Monitoring considerations - Monitoring and diagnostic techniques for various power quality problems - Quality measurement equipment - Harmonic / spectrum analyzer - Flicker meters Disturbance analyzer - Applications of expert systems for power quality monitoring. Principle& Working of DSTATCOM – DSTATCOM in Voltage control mode, current control mode, DVR Structure – Rectifier supported DVR – DC Capacitor supported DVR -Unified power quality conditioner.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand various sources, causes and effects of power quality issues, electrical systems and their measures and mitigation.
- Ability to analyze the causes & Mitigation techniques of various PQ events.
- Ability to study about the various Active & Passive power filters.
- Ability to understand the concepts about Voltage and current distortions, harmonics.
- Ability to analyze and design the passive filters.
- Ability to acquire knowledge on compensation techniques.
- Ability to acquire knowledge on DVR.

TEXT BOOKS:

1. Roger. C. Dugan, Mark. F. Mc Granagham, Surya Santoso, H.WayneBeaty, “Electrical Power Systems Quality”, McGraw Hill,2003
2. J. Arrillaga, N.R. Watson, S. Chen, “Power System Quality Assessment”, (New York : Wiley),2000.
3. Bhim Singh, Ambrish Chandra, Kamal Al-Haddad,” Power Quality Problems & Mitigation Techniques” Wiley, 2015.

REFERENCES

1. G.T. Heydt, “Electric Power Quality”, 2nd Edition. (West Lafayette, IN, Stars in a Circle Publications, 1994.
2. M.H.J Bollen, “Understanding Power Quality Problems: Voltage Sags and Interruptions”, (New York: IEEE Press), 2000.

20153E65D	EHVAC TRANSMISSION	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:
- EHVAC Transmission lines
- Electrostatic field of AC lines
- Corona in E.H.V. lines

UNIT I INTRODUCTION 9

EHVAC Transmission line trends and preliminary aspect - standard transmission voltages – Estimation at line and ground parameters-Bundle conductors: Properties -Inductance and Capacitance of EHV lines – Positive, negative and zero sequence impedance – Line Parameters for Modes of Propagation.

UNIT II ELECTROSTATIC FIELDS 9

Electrostatic field and voltage gradients – Calculations of electrostatic field of AC lines – Effect of high electrostatic field on biological organisms and human beings - Surface voltage gradients and Maximum gradients of actual transmission lines – Voltage gradients on sub conductor.

UNIT III POWER CONTROL 9

Electrostatic induction in un energized lines – Measurement of field and voltage gradients for three phase single and double circuit lines – Un energized lines. Power Frequency Voltage control and overvoltage in EHV lines: No load voltage – Charging currents at power frequency-Voltage control – Shunt and Series compensation – Static VAR compensation.

UNIT IV CORONA EFFECTS AND RADIO INTERFERENCE 9

Corona in EHV lines – Corona loss formulae-Charge voltage diagram- Attenuation of traveling waves due to Corona – Audio noise due to Corona, its generation, characteristic and limits. Measurements of audio noise radio interference due to Corona - properties of radio noise – Frequency spectrum of RI fields – Measurements of RI and RIV.

UNIT V STEADY STATE AND TRANSIENT LIMITS 9

Design of EHV lines based on steady state and transient limits - EHV cabilitys and their characteristics-Introduction six phase transmission – UHV.

TOTAL : 45 PERIODS

OUTCOMES:
- Ability to understand the principles and types of EHVAC system.
- Ability to analyze the electrostatic field of AC lines
- Ability to study about the compensation.
- Ability to study about the corona in E.H.V. lines
- Ability to understand the EHV cabilitys.
- Ability to analyze the steady state and transient limits.

TEXT BOOKS:

1. Rokosh Das Begamudre, ”Extra High Voltage AC Transmission Engineering”– Wiley Eastern LTD., NEW DELHI 1990.

2. S. Rao, “HVAC and HVDC Transmission, Engineering and Practice” Khanna Publisher, Delhi, 1990.

REFERENCES

1. Subir Ray, “An Introduction to High Voltage Engineering”, Prentice Hall of India Private Limited, 2013.

2. RD Begamudre, "Extra High Voltage AC Transmission Engineering"– New Academic Science Ltd; 4 edition 2011.

3. Edison," EHV Transmission line"**-** Electric Institution, GEC, 1968.

20153E65E COMMUNICATION ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To study the various analog and digital modulation techniques
- To study the principles behind information theory and coding
- To study the various digital communication techniques

UNIT I ANALOG MODULATION 9

Amplitude Modulation – AM, DSBSC, SSBSC, VSB – PSD, modulators and demodulators – Angle modulation – PM and FM – PSD, modulators and demodulators – Superheterodyne receivers

UNITII PULSE MODULATION 9

Low pass sampling theorem – Quantization – PAM – Line coding – PCM, DPCM, DM, and ADPCM And ADM, Channel Vocoder - Time Division Multiplexing, Frequency Division Multiplexing

UNIT III DIGITAL MODULATION AND TRANSMISSION 9

Phase shift keying – BPSK, DPSK, QPSK – Principles of M-ary signaling M-ary PSK & QAM – Comparison, ISI – Pulse shaping – Duo binary encoding – Cosine filters – Eye pattern, equalizers

UNIT IV INFORMATION THEORY AND CODING 9

Measure of information – Entropy – Source coding theorem – Shannon–Fano coding, Huffman Coding, LZ Coding – Channel capacity – Shannon-Hartley law – Shannon's limit – Error control codes – Cyclic codes, Syndrome calculation – Convolution Coding, Sequential and Viterbi decoding

UNIT V SPREAD SPECTRUM AND MULTIPLE ACCESS 9

PN sequences – properties – m-sequence – DSSS – Processing gain, Jamming – FHSS – Synchronisation and tracking – Multiple Access – FDMA, TDMA, CDMA,

OUTCOMES:

At the end of the course, the student should be able to:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- Apply analog and digital communication techniques.
- Use data and pulse communication techniques.
- Analyze Source and Error control coding.

TEXT BOOKS:

1. H Taub, D L Schilling, G Saha, "Principles of Communication Systems" TMH 2007
2. S. Haykin "Digital Communications" John Wiley 2005

REFERENCES:

1. B.P.Lathi, "Modern Digital and Analog Communication Systems", 3rd edition, Oxford University
2. H P Hsu, Schaum Outline Series – "Analog and Digital Communications" TMH 2006
3. B.Sklar, Digital Communications Fundamentals and Applications" 2/e Pearson Education 2007.

20153E75A **DISASTER MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVES:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA)
– Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:

The students will be ability to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.

- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.

TEXTBOOKS:

1. Singhal J.P. “Disaster Management”, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-**13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerability India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

20153E75B	**HUMAN RIGHTS**	**LT P C**
		3 0 0 3

OBJECTIVES :

- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I **9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II **9**

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III **9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV **9**

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V **9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabilityd persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO’s, Media, Educational Institutions, Social Movements.

TOTAL : 45 PERIODS

OUTCOME :

- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

20153E75C	OPERATIONS RESEARCH	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

UNIT I LINEAR MODELS 15

The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.

UNIT II TRANSPORTATION MODELS AND NETWORK MODELS 8

Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route – Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks – Critical path scheduling – Sequencing models.

UNIT III INVENTORY MODELS 6

Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

UNIT IV QUEUEING MODELS 6

Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

UNIT V DECISION MODELS 10

Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life – Economic life– Single / Multi variability search technique – Dynamic Programming – Simple Problem.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can ability to use the optimization techniques for use engineering and Business problems

TEXT BOOK:

1. Hillier and Libeberman, "Operations Research", Holden Day, 2005
2. Taha H.A., "Operations Research", Sixth Edition, Prentice Hall of India, 2003.

REFERENCES:

1. Bazara M.J., Jarvis and Sherali H., "Linear Programming and Network Flows", John Wiley, 2009.

2. Budnick F.S., “Principles of Operations Research for Management”, Richard D Irwin, 1990.
3. Philip D.T. and Ravindran A., “Operations Research”, John Wiley, 1992.
4. Shennoy G.V. and Srivastava U.K., “Operation Research for Management”, Wiley Eastern, 1994.
5. Tulsian and Pasdey V., “Quantitative Techniques”, Pearson Asia, 2002.

20153E75D **PROBABILITY AND STATISTICS**

L	T	P	C
3	0	0	3

OBJECTIVES :

- This course aims at providing the required skill to apply the statistical tools in engineering problems.
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two dimensional random variables.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.

UNIT I PROBABILITY AND RANDOM VARIABLES 12

Probability – The axioms of probability – Conditional probability – Baye’s theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT II TWO - DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTING OF HYPOTHESIS 12

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT IV DESIGN OF EXPERIMENTS 12

One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design - 2^2 factorial design.

UNIT V STATISTICAL QUALITY CONTROL `12

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL : 60 PERIODS

OUTCOMES :

Upon successful completion of the course, students will be able to:

- Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
- Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

TEXT BOOKS :

1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.

REFERENCES :

1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
2. Papoulis, A. and Unnikrishnapillai, S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2010.
3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
4. Spiegel. M.R., Schiller. J. and Srinivasan, R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.
5. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2007.

20153E75E FIBRE OPTICS AND LASER INSTRUMENTS L T P C
3 0 0 3

AIM :

To contribute to the knowledge of Fibre optics and Laser Instrumentation and its Industrial andMedical Application.

COURSE OBJECTIVES

- To expose the students to the basic concepts of optical fibres and their properties.
- To provide adequate knowledge about the Industrial applications of optical fibres.
- To expose the students to the Laser fundamentals.
- To provide adequate knowledge about Industrial application of lasers.
- To provide adequate knowledge about holography and Medical applications of Lasers.

UNIT I OPTICAL FIBRES AND THEIR PROPERTIES 9

Construction of optical fiber cable: Guiding mechanism in optical fiber and Basic component of optical fiber communication, –Principles of light propagation through a fibre: Total internal reflection, Acceptance angle (θa), Numerical aperture and Skew mode, –Different types of fibres and their properties: Single and multimode fibers and Step index and graded index fibers,– fibrecharacteristics: Mechanical characteristics and Transmission characteristics, – Absorption losses – Scattering losses – Dispersion – Connectors and splicers –Fibre termination – Optical sources: Light Emitting Diode (LED), – Optical detectors: PIN Diode.

UNIT II INDUSTRIAL APPLICATION OF OPTICAL FIBRES 9

Fibre optic sensors: Types of fiber optics sensor, Intrinsic sensor- Temperature/ Pressure sensor, Extrinsic sensors, Phase Modulated Fibre Optic Sensor and Displacementsensor (Extrinsic Sensor) – Fibre optic instrumentation system: Measurement of attenuation (by cut back method), Optical domain reflectometers, Fiber Scattering loss Measurement, Fiber Absorption Measurement, Fiber dispersion measurements, End reflection method and Near field scanning techniques – Different types of modulators: Electro-optic modulator (EOM) –Interferometric method of measurement of length – Moire fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain.

UNIT III LASER FUNDAMENTALS 9

Fundamental characteristics of lasers – Level Lasers: Two-Level Laser, Three Level Laser, Quasi Three and four level lasers – Properties of laser: Monochromaticity, Coherence, Divergence and Directionality and Brightness –Laser modes – Resonator configuration – Q-switching and mode locking – Cavity damping – Types of lasers; – Gas lasers, solid lasers, liquid lasers and semiconductor lasers.

UNIT IV INDUSTRIAL APPLICATION OF LASERS 9

Laser for measurement of distance, Laser for measurement of length, Laser for measurement of velocity, Laser for measurement of acceleration, Laser for measurement of current, voltage and Laser for measurement of Atmospheric Effect: Types of LIDAR, Construction And Working, and LIDAR Applications – Material processing: Laser instrumentation for material processing, Powder Feeder, Laser Heating, Laser Welding, Laser Melting, Conduction Limited Melting and Key Hole Melting – Laser trimming of material: Process Of Laser Trimming, Types Of Trim, Construction And Working Advantages – Material Removal and vaporization: Process Of Material Removal.

UNIT V HOLOGRAM AND MEDICAL APPLICATIONS 9

Holography: Basic Principle, Holography vs. photography, Principle Of Hologram Recording, Condition For Recording A Hologram, Reconstructing and viewing the holographic image– Holography for non-destructive testing – Holographic components – Medical applications of lasers, laser-Tissue Interactions Photochemical reactions, Thermalisation, collisional relaxation, Types of Interactions and Selecting an Interaction Mechanism – Laser instruments for surgery, removal of tumors of vocal cards, brain surgery, plastic surgery, gynaecology and oncology.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs):

1. Understand the principle, transmission, dispersion and attenuation characteristics of opticalfibers
2. Apply the gained knowledge on optical fibers for its use as communication medium and as sensor as well which have important applications in production, manufacturing industrial and biomedical applications.
3. Understand laser theory and laser generation system.
4. Students will gain ability to apply laser theory for the selection of lasers for a specific Industrial and medical application.

TEXT BOOKS:

1. J.M. Senior, ‘Optical Fibre Communication – Principles and Practice’, Prentice Hall of India,1985.
2. J. Wilson and J.F.B. Hawkes, ‘Introduction to Opto Electronics’, Prentice Hall of India, 2001.
3. Eric Udd, William B., and Spillman, Jr., “Fiber Optic Sensors: An Introduction for Engineers and Scientists “, John Wiley & Sons, 2011.

REFERENCES:

1. G. Keiser, ‘Optical Fibre Communication’, McGraw Hill, 1995.
2. M. Arumugam, ‘Optical Fibre Communication and Sensors’, Anuradha Agencies, 2002.
3. John F. Ready, “Industrial Applications of Lasers”, Academic Press, Digitized in 2008.

4. Monte Ross, ‘Laser Applications’, McGraw Hill, 1968.
5. John and Harry, “Industrial lasers and their application”, McGraw-Hill, 2002.
6. Keiser, G., “Optical Fiber Communication”, McGraw-Hill, 3rd Edition, 2000. http://nptel.ac.in/courses/117101002/

20153E81A	FLEXIBLE AC TRANSMISSION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- The start-of-art of the power system
- Performance of power systems with FACTS controllers.
- FACTS controllers for load flow and dynamic analysis

UNIT I INTRODUCTION 9

Real and reactive power control in electrical power transmission lines–loads & system compensation-Uncompensated transmission line–shunt and series compensation.

UNIT II STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS 9

Voltage control by SVC–Advantages of slope in dynamic characteristics–Influence of SVC on system voltage–Design of SVC voltage regulator–TCR-FC-TCR-Modeling of SVC for power flow and fast transient stability– Applications: Enhancement of transient stability – Steady state power transfer –Enhancement of power system damping.

UNIT III THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) AND APPLICATIONS 9

Operation of the TCSC–Different modes of operation–Modelling of TCSC, Variability reactance model– Modelling for Power Flow and stability studies. Applications: Improvement of the system stability limit–Enhancement of system damping.

UNIT IV VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS 9

Static Synchronous Compensator (STATCOM)–Principle of operation–V-I Characteristics. Applications: Steady state power transfer-enhancement of transient stability-prevention of voltage instability. SSSC-operation of SSSC and the control of power flow–modelling of SSSC in load flow and transient stability studies- Dynamic voltage restorer(DVR).

UNIT V ADVANCED FACTS CONTROLLERS 9

Interline DVR(IDVR) - Unified Power flow controller (UPFC) - Interline power flow controller (IPFC) - Unified Power quality conditioner (UPQC).

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand, analyze and develop analytical model of FACTS controller for power system application.
- Ability to understand the concepts about load compensation techniques.
- Ability to acquire knowledge on facts devices.
- Ability to understand the start-of-art of the power system
- Ability to analyze the performance of steady state and transients of facts controllers.
- Ability to study about advanced FACTS controllers.

TEXT BOOKS:

1. R.Mohan Mathur, Rajiv K.Varma,“Thyristor–Based Facts Controllers for Electrical Transmission Systems”, IEEE press andJohnWiley&Sons,Inc,2002.

2. NarainG. Hingorani, “Understanding FACTS-Concepts and Technology of Flexible AC Transmission Systems”, Standard Publishers Distributors,Delhi-110006,2011.

3. T.J.E Miller, Power Electronics in power systems, John Wiley and sons.

REFERENCES

1. K.R. Padiyar, "FACTS Controllers in Power Transmission and Distribution", New Age International (P) Limited, Publishers, New Delhi, 2008
2. A.T.John,"FlexibleA.C.TransmissionSystems",InstitutionofElectricalandElectronic Engineers(IEEE), 1999.
3. V.K.Sood, HVDC and FACTS controllers–Applications of Static Converters in Power System, APRIL2004,KluwerAcademic Publishers,2004.

SOFT COMPUTING TECHNIQUES

20153E81B

L	T	P	C
3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Basics of artificial neural network.
- Concepts of modelling and control of neural and fuzzy control schemes.
- Features of hybrid control schemes.

UNIT I ARTIFICIAL NEURAL NETWORK 9

Review of fundamentals – Biological neuron, artificial neuron, activation function, single layer perceptron – Limitation – Multi layer perceptron – Back Propagation Algorithm (BPA) – Recurrent Neural Network (RNN) – Adaptive Resonance Theory (ART) based network – Radial basis function network – online learning algorithms, BP through time – RTRL algorithms – Reinforcement learning.

UNIT II NEURAL NETWORKS FOR MODELING AND CONTROL 9

Modelling of non-linear systems using ANN – Generation of training data – Optimal architecture– Model validation – Control of non-linear systems using ANN – Direct and indirect neuro control schemes – Adaptive neuro controller – Familiarization with neural network toolbox.

UNIT III FUZZY SET THEORY 9

Fuzzy set theory – Fuzzy sets – Operation on fuzzy sets – Scalar cardinality, fuzzy cardinality, union and intersection, complement (Yager and Sugeno), equilibrium points, aggregation, projection, composition, cylindrical extension, fuzzy relation – Fuzzy membership functions.

UNIT IV FUZZY LOGIC FOR MODELING AND CONTROL 9

Modelling of non-linear systems using fuzzy models – TSK model – Fuzzy logic controller – Fuzzification – Knowledge base – Decision making logic – Defuzzification – Adaptive fuzzy systems – Familiarization with fuzzy logic toolbox.

UNIT V HYBRID CONTROL SCHEMES 9

Fuzzification and rule base using ANN – Neuro fuzzy systems – ANFIS – Fuzzy neuron– GA – Optimization of membership function and rule base using Genetic Algorithm – Introduction to other evolutionary optimization techniques, support vector machine– Case study – Familiarization with ANFIS toolbox.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand the concepts of ANN, different features of fuzzy logic and their modelling, control aspects and different hybrid control schemes.
- Ability to understand the basics of artificial neural network.
- Ability to get knowledge on modelling and control of neural.
- Ability to get knowledge on modelling and control of fuzzy control schemes.
- Ability to acquire knowledge on hybrid control schemes.
- Ability to understand the concepts of Adaptive Resonance Theory

TEXT BOOKS:

1. Laurence Fausett, “Fundamentals of Neural Networks”, Prentice Hall, Englewood Cliffs, N.J., 1992
2. Timothy J. Ross, “Fuzzy Logic with Engineering Applications”, McGraw Hill Inc., 2000.

REFERENCES

1. Goldberg, “Genetic Algorithm in Search, Optimization and Machine learning”, Addison Wesley Publishing Company Inc. 1989
2. Millon W.T., Sutton R.S. and Webrose P.J., “Neural Networks for Control”, MIT press, 1992
3. Ethem Alpaydin, “Introduction to Machine learning (Adaptive Computation and Machine Learning series)’, MIT Press, Second Edition, 2010.
4. Zhang Huaguang and Liu Derong, “Fuzzy Modeling and Fuzzy Control Series: Control Engineering”, 2006

20153E81C	**POWER SYSTEMS DYNAMICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES: To impart knowledge about the following topics:

- Basics of dynamics and stability problems
- Modeling of synchronous machines
- Excitation system and speed-governing controllers.
- Small signal stability of a single-machine infinite bus system with excitation system and power system stabilizer.
- Transient stability simulation of multi machine power system.

UNIT I INTRODUCTION 9

Basics of system dynamics – numerical techniques – introduction to software packages to study the responses. Concept and importance of power system stability in the operation and design - distinction between transient and dynamic stability - complexity of stability problem in large system – necessity for reduced models - stability of interconnected systems.

UNIT II SYNCHRONOUS MACHINE MODELLING 9

Synchronous machine - flux linkage equations - Park's transformation - per unit conversion - normalizing the equations - equivalent circuit - current space model - flux linkage state space model. Sub-transient and transient inductances - time constants. Simplified models (one axis and constant flux linkage) - steady state equations and phasor diagrams.

UNIT III MACHINE CONTROLLERS 9

Exciter and voltage regulators - function and types of excitation systems - typical excitation system configuration - block diagram and state space representation of IEEE type 1 excitation system - saturation function - stabilizing circuit. Function of speed governing systems - block diagram and state space representation of IEEE mechanical hydraulic governor and electrical hydraulic governors for hydro turbines and steam turbines.

UNIT IV TRANSIENT STABILITY 9

State equation for multi machine system with one axis model and simulation – modelling of multi machine power system with one axis machine model including excitation system and speed governing system and simulation using R-K method of fourth order (Gill's technique) for transient stability analysis - power system stabilizer. For all simulations, the algorithm and flow chart have to be discussed.

UNIT V DYNAMIC STABILITY 9

System response to small disturbances - linear model of the unregulated synchronous machine and its modes of oscillation - regulated synchronous machine - distribution of power impact - linearization of the load equation for the one machine problem – simplified linear model - effect of excitation on dynamic stability - approximate system representation - supplementary stabilizing signals - dynamic performance measure - small signal performance measures.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.
- Ability to get knowledge on the basics of dynamics and stability problems
- Ability to design and modelling of synchronous machines

- Ability to study about excitation system and speed-governing controllers.
- Ability to understand the concept of small signal stability of a single-machine infinite bus system with excitation system.
- Ability to analyze the transient stability simulation.

TEXT BOOKS:

1. P.M. Anderson and A.A.Fouad, ‘Power System Control and Stability’, Galgotia Publications, New Delhi, 2003.
2. P. Kundur, ‘Power System Stability and Control’, McGraw Hill Inc., USA, 1994.
3. R.Ramanujam, “Power System Dynamics – Analysis and Simulation”, PHI, 2009.

REFERENCES

1. M.A.Pai and W.Sauer, ‘Power System Dynamics and Stability’, Pearson Education Asia, India, 2002.
2. James A.Momoh, Mohamed. E. EI-Hawary. “ Electric Systems, Dynamics and Stability with Artificial Intelligence applications”, Marcel Dekker, USA First Edition, 2000.
3. C.A.Gross, “Power System Analysis,” Wiley India, 2011.
4. B.M.Weedy, B.J.Lory, N.Jenkins, J.B.Ekanayake and G.Strbac,” Electric Power Systems”, Wiley India, 2013.
5. K.Umarao, “Computer Techniques and Models in Power System,” I.K. International, 2007.

20153E81D SMPS AND UPS

L	T	P	C
3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Modern power electronic converters and its applications in electric power utility.
- Resonant converters and UPS

UNIT I DC-DC CONVERTERS 9

Principles of step down and step up converters – Analysis and state space modeling of Buck, Boost, Buck- Boost and Cuk converters.

UNIT II SWITCHED MODE POWER CONVERTERS 9

Analysis and state space modeling of fly back, Forward, Push pull, Luo, Half bridge and full bridge converters- control circuits and PWM techniques.

UNIT III RESONANT CONVERTERS 9

Introduction- classification- basic concepts- Resonant switch- Load Resonant converters- ZVS , Clamped voltage topologies- DC link inverters with Zero Voltage Switching- Series and parallel Resonant inverters- Voltage control.

UNIT IV DC-AC CONVERTERS 9

Single phase and three phase inverters, control using various (sine PWM, SVPWM and PSPWM) techniques, various harmonic elimination techniques- Multilevel inverters- Concepts - Types: Diode clamped- Flying capacitor- Cascaded types- Applications.

UNIT V POWER CONDITIONERS, UPS & FILTERS 9

Introduction- Power line disturbances- Power conditioners –UPS: offline UPS, Online UPS, Applications – Filters: Voltage filters, Series-parallel resonant filters, filter without series capacitors, filter for PWM VSI, current filter, DC filters – Design of inductor and transformer for PE applications – Selection of capacitors.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to analyze the state space model for DC – DC converters
- Ability to acquire knowledge on switched mode power converters.
- Ability to understand the importance of Resonant Converters.
- Ability to analyze the PWM techniques for DC-AC converters
- Ability to acquire knowledge on modern power electronic converters and its applications in electric power utility.
- Ability to acquire knowledge on filters and UPS

TEXT BOOKS:

1. Simon Ang, Alejandro Oliva,” Power-Switching Converters”, Third Edition, CRC Press, 2010.

2. KjeldThorborg, “Power Electronics – In theory and Practice”, Overseas Press, First Indian Edition 2005.

3. M.H. Rashid – Power Electronics handbook, Elsevier Publication, 2001.

REFERENCES

1. Philip T Krein, “ Elements of Power Electronics”, Oxford University Press

2. Ned Mohan, Tore.M.Undeland, William.P.Robbins, Power Electronics converters,

Applications and design- Third Edition- John Wiley and Sons- 2006
3. M.H. Rashid – Power Electronics circuits, devices and applications- third edition Prentice Hall of India New Delhi, 2007.
4. Erickson, Robert W, "Fundamentals of Power Electronics", Springer, second edition, 2010.

20153E81E	ELECTRIC ENERGY GENERATION, UTILIZATION CONSERVATION	L	T	P	C
		3	0	0	3

OBJECTIVES:
To impart knowledge on the following Topics

- To study the generation, conservation of electrical power and energy efficient equipments.
- To understand the principle, design of illumination systems and energy efficiency lamps.
- To study the methods of industrial heating and welding.
- To understand the electric traction systems and their performance.

UNIT I ILLUMINATION 9
Importance of lighting – properties of good lighting scheme – laws of illumination – photometry - types of lamps – lighting calculations – basic design of illumination schemes for residential, commercial, street lighting, factory lighting and flood lighting – LED lighting and energy efficient lamps.

UNIT II REFRIGERATION AND AIR CONDITIONING 9
Refrigeration-Domestic refrigerator and water coolers - Air-Conditioning-Various types of air-conditioning system and their applications, smart air conditioning units - Energy Efficient motors: Standard motor efficiency, need for efficient motors, Motor life cycle, Direct Savings and payback analysis, efficiency evaluation factor.

UNIT III HEATING AND WELDING 9
Role of electric heating for industrial applications – resistance heating – induction heating – dielectric heating - electric arc furnaces. Brief introduction to electric welding – welding generator, welding transformer and the characteristics.

UNIT IV TRACTION 9
Merits of electric traction – requirements of electric traction system – supply systems – mechanics of train movement – traction motors and control – braking – recent trends in electric traction.

UNIT V DOMESTIC UTILIZATION OF ELECTRICAL ENERGY 9
Domestic utilization of electrical energy – House wiring. Induction based appliances, Online and OFF line UPS, Batteries - Power quality aspects – nonlinear and domestic loads – Earthing – Domestic, Industrial and Substation.

TOTAL : 45 PERIODS

OUTCOMES:

- To understand the main aspects of generation, utilization and conservation.
- To identify an appropriate method of heating for any particular industrial application.
- To evaluate domestic wiring connection and debug any faults occurred.
- To construct an electric connection for any domestic appliance like refrigerator as well as to design a battery charging circuit for a specific household application.

- To realize the appropriate type of electric supply system as well as to evaluate the performance of a traction unit.
- To understand the main aspects of Traction.

TEXT BOOKS:

1. Wadhwa, C.L. “Generation, Distribution and Utilization of Electrical Energy”, New Age International Pvt. Ltd, 2003.
2. Dr. Uppal S.L. and Prof. S. Rao, 'Electrical Power Systems', Khanna Publishers, New Delhi, 15th Edition, 2014.
3. Energy Efficiency in Electric Utilities, BEE Guide Book, 2010

REFERENCES

1. Partab.H, “Art and Science of Utilisation of Electrical Energy”, Dhanpat Rai and Co, New Delhi, 2004.
2. Openshaw Taylor.E, “Utilization of Electrical Energy in SI Units”, Orient Longman Pvt. Ltd, 2003.
3. Gupta.J.B, “Utilization of Electric Power and Electric Traction”, S.K.Kataria and Sons, 2002.
4. Cleaner Production – Energy Efficiency Manual for GERIAP, UNEP, Bangkok prepared by National Productivity Council.

20153E81F PROFESSIONAL ETHICS IN ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I HUMAN VALUES 10

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS 9

Senses of ‘Engineering Ethics’ – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg’s theory – Gilligan’s theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT V GLOBAL ISSUES 8

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of the course, the student should be ability to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

TEXT BOOKS:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd.,New Delhi, 2013.
6. World Community Service Centre, ' Value Education', Vethathiri publications, Erode, 2011.

Web sources:

1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

20153E81G	**PRINCIPLES OF MANAGEMENT**	**LT P C**
		3 0 0 3

OBJECTIVES:

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization.

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

UNIT II PLANNING 9

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT III ORGANISING 9

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

UNIT IV DIRECTING 9

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

UNIT V CONTROLLING 9

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

OUTCOMES: TOTAL: 45 PERIODS

- Upon completion of the course, students will be ability to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

TEXT BOOKS:

1. JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", 6th Edition, Pearson Education, 2004.
2. Stephen P. Robbins & Mary Coulter, "Management", Prentice Hall (India)Pvt. Ltd., 10th Edition, 2009.

REFERENCES:

1. Harold Koontz & Heinz Weihrich, "Essentials of Management", Tata McGraw Hill, 1998.
2. Robert Kreitner & Mamata Mohapatra, "Management", Biztantra, 2008.
3. Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management", 7th Edition, Pearson Education, 2011.
4. Tripathy PC & Reddy PN, "Principles of Management", Tata Mcgraw Hill, 1999

20153E82A	ENERGY MANAGEMENT AND AUDITING	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- To impact concepts behind economic analysis and Load management.
- Energy management on various electrical equipments and metering.
- Concept of lighting systems and cogeneration.

UNIT I INTRODUCTION 9

Basics of Energy – Need for energy management – Energy accounting - Energy monitoring, targeting and reporting - Energy audit process.

UNIT II ENERGY MANAGEMENT FOR MOTORS AND COGENERATION 9

Energy management for electric motors – Transformer and reactors - Capacitors and synchronous machines, energy management by cogeneration – Forms of cogeneration – Feasibility of cogeneration – Electrical interconnection.

UNIT III LIGHTING SYSTEMS 9

Energy management in lighting systems – Task and the working space - Light sources – Ballasts – Lighting controls – Optimizing lighting energy – Power factor and effect of harmonics, lighting and energy standards.

UNIT IV METERING FOR ENERGY MANAGEMENT 9

Metering for energy management – Units of measure - Utility meters – Demand meters – Paralleling of current transformers – Instrument transformer burdens – Multi tasking solid state meters, metering location vs requirements, metering techniques and practical examples.

UNIT V ECONOMIC ANALYSIS AND MODELS 9

Economic analysis – Economic models - Time value of money - Utility rate structures – Cost of electricity – Loss evaluation, load management – Demand control techniques – Utility monitoring and control system – HVAC and energy management – Economic justification.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand the basics of Energy audit process.
- Ability to understand the basics of energy management by cogeneration
- Ability to acquire knowledge on Energy management in lighting systems
- Ability to impact concepts behind economic analysis and Load management.
- Ability to understand the importance of Energy management on various electrical equipment and metering.
- Ability to acquire knowledge on HVAC.

TEXT BOOKS:

1. Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, Guide to Energy Management, Fifth Edition, The Fairmont Press, Inc., 2006
2. Eastop T.D & Croft D.R, Energy Efficiency for Engineers and Technologists,.Logman Scientific & Technical, ISBN-0-582-03184 , 1990.

REFERENCES

1. Reay D.A, Industrial Energy Conservation, 1st edition, Pergamon Press, 1977.
2. IEEE Recommended Practice for Energy Management in Industrial and Commercial Facilities, IEEE, 196.
3. Amit K. Tyagi, Handbook on Energy Audits and Management, TERI, 2003.
4. Electricity in buildings good practice guide, McGraw-Hill Education, 2016.
5. National Productivity Council Guide Books

20153E82B **DATA STRUCTURES** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the concepts of ADTs
- To Learn linear data structures – lists, stacks, and queues
- To understand sorting, searching and hashing algorithms
- To apply Tree and Graph structures

UNIT I LINEAR DATA STRUCTURES – LIST 9

Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation –– singly linked lists- circularly linked lists- doubly-linked lists – applications of lists –Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).

UNIT II LINEAR DATA STRUCTURES – STACKS, QUEUES 9

Stack ADT – Operations - Applications - Evaluating arithmetic expressions- Conversion of Infix to postfix expression - Queue ADT – Operations - Circular Queue – Priority Queue - deQueue – applications of queues.

UNIT III NON LINEAR DATA STRUCTURES – TREES 9

Tree ADT – tree traversals - Binary Tree ADT – expression trees – applications of trees – binary search tree ADT –Threaded Binary Trees- AVL Trees – B-Tree - B+ Tree - Heap – Applications of heap.

UNIT IV NON LINEAR DATA STRUCTURES - GRAPHS 9

Definition – Representation of Graph – Types of graph - Breadth-first traversal - Depth-first traversal – Topological Sort – Bi-connectivity – Cut vertex – Euler circuits – Applications of graphs.

UNIT V SEARCHING, SORTING AND HASHING TECHNIQUES 9

Searching- Linear Search - Binary Search. Sorting - Bubble sort - Selection sort - Insertion sort - Shell sort – Radix sort. Hashing- Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Implement abstract data types for linear data structures.
- Apply the different linear and non-linear data structures to problem solutions.
- Critically analyze the various sorting algorithms.

TEXT BOOKS:

1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education,1997.
2. Reema Thareja, “Data Structures Using C”, Second Edition , Oxford University Press, 2011

REFERENCES:
1. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", Second Edition, Mcgraw Hill, 2002.
2. Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education,1983.
3. Stephen G. Kochan, "Programming in C", 3rd edition, Pearson Education.
4. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, University Press, 2008

20153E82C	**HIGH VOLTAGE DIRECT CURRENT TRANSMISSION**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES: To impart knowledge about the following topics:
- Planning of DC power transmission and comparison with AC power transmission.
- HVDC converters. HVDC
- system control. Harmonics and
- design of filters.
- Power flow in HVDC system under steady state.

UNIT I INTRODUCTION 9

DC Power transmission technology–Comparison of AC and DC transmission–Application of DC transmission–Description of DC transmission system–Planning for HVDC transmission–Modern trends in HVDC technology–DC breakers–Operating problems– HVDC transmission based on VSC –Types and applications of MTDC systems.

UNIT II ANALYSIS OF HVDC CONVERTERS 9

Line commutated converter -Analysis of Graetz circuit with and without overlap -Pulse number– Choice of converter configuration – Converter bridge characteristics– Analysis of a 12 pulse converters– Analysis of VSC topologies and firing schemes.

UNIT III CONVERTER AND HVDC SYSTEM CONTROL 9

Principles of DC link control–Converter control characteristics–System control hierarchy– Firing angle control– Current and extinction angle control–Starting and stopping of DC link –Power control –Higher level controllers –Control of VSC based HVDC link.

UNIT IV REACTIVE POWER AND HARMONICS CONTROL 9

Reactive power requirements in steady state–Sources of reactive power–SVC and STATCOM– Generation of harmonics –Design of AC and DC filters– Active filters.

UNIT V POWER FLOW ANALYSIS IN AC/DC SYSTEMS 9

Per unit system for DC quantities–DC system model –Inclusion of constraints –Power flow analysis –case study

TOTAL : 45 PERIODS

OUTCOMES:
- Ability to understand the principles and types of HVDC system.
- Ability to analyze and understand the concepts of HVDC converters.
- Ability to acquire knowledge on DC link control.
- Ability to understand the concepts of reactive power management, harmonics and

power flow analysis.

- Ability to get knowledge about Planning of DC power transmission and comparison with AC power transmission.
- Ability to understand the importance of power flow in HVDC system under steady state.

TEXT BOOKS:

1. Padiyar,K.R.,“HVDC power transmission system”, New Age International(P)Ltd. NewDelhi, Second Edition,2010.
2. Arrillaga,J.,“High Voltage Direct Current Transmission”, Peter Pregrinus, London,1983.

REFERENCES

1. Kundur P.,“ Power System Stability and Control”, McGraw-Hill,1993.
2. Colin Adamson and Hingorani NG,“ High Voltage Direct Current Power Transmission”, Garraway Limited, London, 1960.
3. Edward Wilson Kimbark,“ Direct Current Transmission”, Vol.I, Wiley inter science, New York, London, Sydney,1971.

20153E82D	MICROCONTROLLER BASED SYSTEM DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Architecture of PIC microcontroller
- Interrupts and timers
- Peripheral devices for data communication and transfer
- Functional blocks of ARM processor
- Architecture of ARM processors

UNIT I INTRODUCTION TO PIC MICROCONTROLLER 9

Introduction to PIC Microcontroller–PIC 16C6x and PIC16C7x Architecture–IC16cxx–-Pipelining - Program Memory considerations – Register File Structure - Instruction Set - Addressing modes – Simple Operations.

UNIT II INTERRUPTS AND TIMER 9

PIC micro controller Interrupts- External Interrupts-Interrupt Programming–Loop time subroutine Timers-Timer Programming– Front panel I/O-Soft Keys– State machines and key switches– Display of Constant and Variability strings.

UNIT III PERIPHERALS AND INTERFACING 9

I^2C Bus for Peripherals Chip Access– Bus operation-Bus subroutines– Serial EEPROM— Analog to Digital Converter–UART-Baud rate selection–Data handling circuit–Initialization - LCD and keyboard Interfacing -ADC, DAC, and Sensor Interfacing.

UNIT IV INTRODUCTION TO ARM PROCESSOR 9

Architecture –ARM programmer’s model –ARM Development tools- Memory Hierarchy – ARM Assembly Language Programming–Simple Examples–Architectural Support for

Operating systems.

UNIT V ARM ORGANIZATION 9

3-Stage Pipeline ARM Organization– 5-Stage Pipeline ARM Organization–ARM Instruction Execution- ARM Implementation– ARM Instruction Set– ARM coprocessor interface– Architectural support for High Level Languages – Embedded ARM Applications.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and apply computing platform and software for engineering problems.
- Ability to understand the concepts of Architecture of PIC microcontroller
- Ability to acquire knowledge on Interrupts and timers.
- Ability to understand the importance of Peripheral devices for data communication.
- Ability to understand the basics of sensor interfacing
- Ability to acquire knowledge in Architecture of ARM processors

TEXT BOOKS:

1. Peatman,J.B., "Design with PIC Micro Controllers"PearsonEducation,3rdEdition, 2004.

2. Furber,S., "ARM System on Chip Architecture" Addison Wesley trade Computer Publication, 2000.

REFERENCES

1. Mazidi, M.A.,"PIC Microcontroller" Rollin Mckinlay, Danny causey ,Prentice Hall of India, 2007.

20153E82E	**SMART GRID**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES: To impart knowledge about the following topics:

- Smart Grid technologies, different smart meters and advanced metering infrastructure.
- The power quality management issues in Smart Grid.
- The high performance computing for Smart Grid applications

UNIT I INTRODUCTION TO SMART GRID 9

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, National and International Initiatives in Smart Grid.

UNIT II SMART GRID TECHNOLOGIES 9

Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/VAR control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plugin Hybrid Electric Vehicles(PHEV).

UNIT III SMART METERS AND ADVANCED METERING INFRASTRUCTURE 9

IntroductiontoSmartMeters,AdvancedMeteringinfrastructure(AMI)driversandbenefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU), Intelligent Electronic Devices(IED)&their application for monitoring & protection.

UNIT IV POWER QUALITY MANAGEMENT IN SMART GRID 9

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, W eb based Power Quality monitoring, Power Quality Audit.

UNIT V HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS 9

Local Area Network(LAN),House Area Network(HAN), Wide Area Network(WAN), Broad band over Power line(BPL),IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will develop more understanding on the concepts of Smart Grid and its present developments.
- Learners will study about different Smart Grid technologies.
- Learners will acquire knowledge about different smart meters and advanced metering infrastructure.
- Learners will have knowledge on power quality management in Smart Grids
- Learners will develop more understanding on LAN, WAN and Cloud Computing for Smart Grid applications.

TEXT BOOKS:

1. Stuart Borlase "Smart Grid: Infrastructure, Technology and Solutions",CRCPress2012.
2. JanakaEkanayake,NickJenkins,KithsiriLiyanage,JianzhongWu,AkihikoYokoyama, "Smart Grid: TechnologyandApplications",Wiley2012.

REFERENCES

- VehbiC. Güngör ,Dilan Sahin, Taskin Kocak, Salih Ergüt, Concettina Buccella, Carlo Cecati, and Gerhard P. Hancke, "Smart Grid Technologies: Communication Technologies and Standards" IEEE Transactions On Industrial Informatics, Vol.7,No.4, November2011.
- Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang "SmartGrid –The New and Improved Power Grid: A Survey" ,IEEE Transaction on Smart Grids,vol.14,2012.
- James Momohe "Smart Grid: Fundamentals of Design and Analysis,", Wiley-IEEE Press , 2012.

20153E82F	**BIOMEDICAL INSTRUMENTATION**	**L T P C**
		3 0 0 3

OBJECTIVES:

- To Introduce Fundamentals of Biomedical Engineering
- To study the communication mechanics in a biomedical system with few examples
- To study measurement of certain important electrical and non-electrical parameters

- To understand the basic principles in imaging techniques
- To have a basic knowledge in life assisting and therapeutic devices

UNIT I FUNDAMENTALS OF BIOMEDICAL ENGINEERING 9

Cell and its structure – Resting and Action Potential – Nervous system and its fundamentals - Basic components of a biomedical system- Cardiovascular systems- Respiratory systems -Kidney and blood flow - Biomechanics of bone - Biomechanics of soft tissues -Physiological signals and transducers - Transducers – selection criteria – Piezo electric, ultrasonic transducers - Temperature measurements - Fibre optic temperature sensors

UNIT II NON ELECTRICAL PARAMETERS MEASUREMENT AND DIAGNOSTIC PROCEDURES 9

Measurement of blood pressure - Cardiac output - Heart rate - Heart sound - Pulmonary function measurements – spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analysers, pH of blood –measurement of blood pCO2, pO2, finger-tip oxymeter - ESR, GSR measurements.

UNIT III ELECTRICAL PARAMETERS ACQUISITION AND ANALYSIS 9

Electrodes – Limb electrodes –floating electrodes – pregelled disposability electrodes - Micro, needle and surface electrodes – Amplifiers, Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier - ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms - Electrical safety in medical environment, shock hazards – leakage current-Instruments for checking safety parameters of biomedical equipment.

UNIT IV IMAGING MODALITIES AND ANALYSIS 9

Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography –Different types of biotelemetry systems - Retinal Imaging - Imaging application in Biometric systems.

UNIT V LIFE ASSISTING, THERAPEUTIC AND ROBOTIC DEVICES 9

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialysers – Lithotripsy - ICCU patient monitoring system - Nano Robots - Robotic surgery –Orthopedic prostheses fixation.

TOTAL : 45 PERIODS

OUTCOMES: At the end of the course students will have the

- Ability to understand the philosophy of the heart, lung, blood circulation and respiration system.
- Ability to provide latest ideas on devices of non-electrical devices.
- Ability to gain knowledge on various sensing and measurement devices of electrical origin.
- Ability to understand the analysis systems of various organ types.
- Ability to bring out the important and modern methods of imaging techniques and their analysis.
- Ability to explain the medical assistance/techniques, robotic and therapeutic equipments.

TEXT BOOKS:

1. Leslie Cromwell, “Biomedical Instrumentation and Measurement”, Prentice Hall of India, New Delhi, 2007.
2. Khandpur R.S, Handbook of Biomedical Instrumentation, Tata McGraw-Hill, New Delhi,2nd edition, 2003
3. Joseph J Carr and John M.Brown, Introduction to Biomedical Equipment Technology, John

Wiley and sons, New York, 4th edition, 2012

REFERENCES

1. John G. Webster, Medical Instrumentation Application and Design, John Wiley and sons, New York, 1998.
2. Duane Knudson, Fundamentals of Biomechanics, Springer, 2nd Edition, 2007.
3. Suh, Sang, Gurupur, Varadraj P., Tanik, Murat M., Health Care Systems, Technology and Techniques, Springer, 1st Edition, 2011.
4. Ed. Joseph D. Bronzino, The Biomedical Engineering Hand Book, Third Edition, Boca Raton, CRC Press LLC, 2006.
5. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.

20153E82G FUNDAMENTALS OF NANOSCIENCE **L T P C**
3 0 0 3

OBJECTIVES:

To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION **8**

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION **9**

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS **12**

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO_2,MgO, ZrO_2, NiO, nanoalumina, CaO, $AgTiO_2$, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications.

UNIT IV CHARACTERIZATION TECHNIQUES **9**

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation.

UNIT V APPLICATIONS **7**

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery.

TOTAL : 45 PERIODS

OUTCOMES:

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS :

1. A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, “Nanoscale Charecterisation of surfaces & Interfaces”, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

REFERENCES:

1. G Timp, “Nanotechnology”, AIP press/Springer, 1999.
2. Akhlesh Lakhtakia,“The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations”. Prentice-Hall of India (P) Ltd, New Delhi, 2007.

1.1.3 SUPPORTING DOCUMENTS

1.1.3 Total number of courses having focus on employability/

entrepreneurship/ skill development offered by the University during the year.

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL &

ELECTRONICS ENGINEERING

Skill Development	
Employability	
Entrepreneurship	

PRIST
DEEMED TO BE
UNIVERSITY
NAAC ACCREDITED
THANJAVUR – 613 403 - TAMIL NADU

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL &

ELECTRONICS ENGINEERING

COURSE STRUCTURE
M.TECH-POWER SYSTEMS
(PART TIME)
[Regulation2022]

[for candidates admitted to M.Tech Power Systemprogram from June2022 onwards]

PRIST UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**PROGRAMME: M.TECH-POWER SYSTEMS (PART TIME) CURRICULUM -REGULATION 2022**

SEMESTER – I

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1.	22248S11DP	Applied Mathematics for Power System Engineering	3	1	0	4
2.	22272C12P	System Theory	3	1	0	4
3.	22272C13P	Advanced Power System Analysis	3	1	0	4
4.	22272L14P	Power System Simulation Laboratory	0	0	3	3
		TOTAL				**15**

SEMESTER – II

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272C21P	EHV power transmission.	3	1	0	4
2	22272C22P	Advanced Power System Protection	3	1	0	4
3	22272E23_P	Elective-I	3	0	0	3
4	222TECWRP	Technical Writing/Seminars	0	0	3	3
		TOTAL				**14**

SEMESTER – III

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272C31P	Economic Operations of Power Systems	3	1	0	4
2	22272C32P	HVDC and FACTS	3	1	0	4
3	22272E33_P	Elective –II	3	0	0	3

Skill Development   Employability   Entrepreneurship

4	22272L34P	Advanced Power System Simulation Laboratory	0	0	3	3
		TOTAL				**14**

SEMESTER – IV

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272C41P	Power System Control	3	1	0	4
2	22272C42P	Electrical Transients in power systems	3	1	0	4
3	22272E43_P	Elective –III	3	0	0	3
4	22272P44P	Project work Phase –I	0	0	10	10
		TOTAL				**21**

SEMESTER – V

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1.	22272E51_P	Elective –IV	3	0	0	3
2.	22272E52_P	Elective –V	3	0	0	3
3.	22272E53_P	Elective –VI	3	0	0	3
		TOTAL				**9**

SEMESTER – VI

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1.	22272P61P	Project work Phase -II	0	0	15	**15**

Total Credits = 88

Skill Development Employability Entrepreneurship

Elective –III

Elective –I

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E23AP	Analysis and Design of Power Converters	3	0	0	3
2.	22272E23BP	Modeling and Analysis of Electrical Machines	3	0	0	3
3.	22272E23CP	Advanced Power System Dynamics	3	0	0	3
4.	22272E23DP	Analysis and Computation of Electromagnetic Transients in Power Systems	3	0	0	3

Elective –II

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E33AP	Smart Grid	3	0	0	3
2.	22272E33BP	Solar and Energy Storage Systems	3	0	0	3
3.	22272E33CP	Power System Reliability	3	0	0	3
4.	22272E33DP	Distributed Generation and Microgrid	3	0	0	3

Elective –III

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E43AP	Wind Energy conversion systems	3	0	0	3
2.	22272E43BP	AI Techniques to Power Systems	3	0	0	3
3.	22272E43CP	Electrical Distribution System	3	0	0	3
4.	22272E43DP	Energy Management and Auditing	3	0	0	3

Skill Development Employability Entrepreneurship

Elective –IV

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E51AP	Power Electronics applications in Power systems	3	0	0	3
2.	22272E51BP	Power system Dynamics	3	0	0	3
3.	22272E51CP	Electric Vehicles and Power Management	3	0	0	3
4.	22272E51DP	Electromagnetic Interference and Compatibility	3	0	0	3

Elective –V

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22275E52AP	Power Conditioning	3	0	0	3
2.	22275E52BP	Deregulated Power System	3	0	0	3
3.	22275E52CP	Control System Design for Power Electronics	3	0	0	3
4.	22275E52DP	Principles of EHV Transmission	3	0	0	3

Elective –VI

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E53AP	Software for Control system Design	3	0	0	3
2.	22272E53BP	Industrial Power system analysis and design	3	0	0	3
3.	22272E53CP	Soft Computing Techniques	3	0	0	3
4.	22272E53DP	Restructured Power System	3	0	0	3

Skill Development Employability Entrepreneurship

Credit Distribution

Sem.	Core Courses				Elective Courses		Total Credits
	Theory Courses		Practical Courses				
	Nos.	Credits	Nos.	Credits	Nos.	Credits	
I	02	08	01	03	-	-	15
II	02	08	01	03	01	03	14
III	02	08	01	03	01	03	14
IV	02	08	01	10	01	03	21
V	-	-	-	-	03	09	09
VI	-	-	01	15	-	-	15
Total Credits							**88**

22248S11DP -APPLIED MATHEMATICS FOR POWER SYSTEM ENGINEERING

3 1 0 4

1. ADVANCED MATRIX THEORY 9

Matrix norms – Jordan canonical form – Generalized eigenvectors – Singular value decomposition – Pseudo inverse – Least square approximations.

2. RANDOM PROCESSES 9

Random variable, discrete, continuous types - Binomial, Poisson, normal and exponential distributions density & distribution Functions- Moments Moment Generating Functions – Notion of stochastic processes - Auto-correlation – Cross correlation .

3. LINEAR PROGRAMMING 9

Basic concepts – Graphical and Simplex methods –Transportation problem – Assignment problem.

4. DYNAMIC PROGRAMMING 9

Elements of the dynamic programming model – optimality principle – Examples of dynamic programming models and their solutions.

5. INTEGRAL TRANSFORMS 9

Finite Fourier transform - Fourier series - Finite sine Transform - Cosine transform - finite Hankel transform - definition, Transform of df/dx where p is a root of $J_n(p) = 0$, Transform of

$\frac{d^2f}{dx^2} + \frac{1}{x}\frac{df}{dx}$, and Transform of $\frac{d^2f}{dx^2} + \frac{1}{x}\frac{df}{dx} - \frac{n^2f}{x^2}$

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Lewis.D.W., Matrix Theory ,Allied Publishers, Chennai 1995.
2. Bronson, R, Matrix Operations, Schaums outline Series, McGraw Hill, New York. 1989.
3. Andrews, L.A., and Shivamoggi B.K., “Integral Transforms for Engineers and Applied Mathematicians”, Macmillan , New York ,1988.
4. Taha, H.A., " Operations research - An Introduction ", Mac Millan publishing Co., (1982).
5. Gupta, P.K.and Hira, D.S., " Operations Research ", S.Chand & Co., New Delhi, (1999).6..
6. Ochi, M.K. " Applied Probability and Stochastic Processes ", John Wiley & Sons (1992).
7. Peebles Jr., P.Z., " Probability Random Variables and Random Signal Principles, McGraw Hill Inc., (1993).

22272C12P - SYSTEM THEORY

3 1 0 4

1. PHYSICAL SYSTEMS AND STATE ASSIGNMENT 9

Systems - electrical - mechanical - hydraulic - pneumatic - thermal systems - modelling of some typical systems like D.C. Machines - inverted pendulum.

2. STATE SPACE ANALYSIS 9

Realisation of state models - non-uniqueness - minimal realisation - balanced realisation - solution of state equations - state transition matrix and its properties - free and forced responses - properties - controllability and observability - stabilisability and detectability - Kalman decomposition.

3. MIMO SYSTEMS - FREQUENCY DOMAIN DESCRIPTIONS 9

Properties of transfer functions - impulse response matrices - poles and zeros of transfer function matrices - critical frequencies - resonance - steady state and dynamic response - bandwidth - Nyquist plots - singular value analysis.

4. NON-LINEAR SYSTEMS 9

Types of non-linearity - typical examples - equivalent linearization - phase plane analysis - limit cycles - describing functions - analysis using describing functions - jump resonance.

5. STABILITY 9

Stability concepts - equilibrium points - BIBO and asymptotic stability - direct method of Liapunov - application to non-linear problems - frequency domain stability criteria - Popov's method and its extensions.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. M. Gopal, 'Modern Control Engineering', Wiley, 1996.
2. J.S. Bay, 'Linear State Space Systems', McGraw-Hill, 1999.
3. Eroni-Umez and Eroni, 'System dynamics & Control', Thomson Brooks / Cole, 1998.
4. K. Ogatta, 'Modern Control Engineering', Pearson Education, Low Priced Edition, 1997.
5. G.J. Thaler, 'Automatic control systems', Jaico publishers, 1993.
6. John S. Bay, 'Linear State Space Systems', McGraw-Hill International Edition, 1999.

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22272C13P - ADVANCED POWER SYSTEM ANALYSIS

3 1 0 4

OBJECTIVES:

- To introduce different techniques of dealing with sparse matrix for large scale power systems.
- To impart in-depth knowledge on different methods of power flow solutions.
- To perform optimal power flow solutions in detail.
- To perform short circuit fault analysis and understand the consequence of different type of faults.
- To Illustrate different numeric al integration methods and factors influencing transient stability

UNIT I SOLUTION TECHNIQUE 9

Sparse Matrix techniques for large scale power systems: Optimal ordering schemes forpreserving sparsity. Flexible packed storage scheme for storing matrix as compact arrays –Factorization by Bifactorization and Gauss elimination methods; Repeat solution using Left and Right factors and L and U matrices.

UNIT II POWER FLOW ANALYSIS 9

Power flow equation in real and polar forms; Review of Newton's method for solution; Adjustment of P-V buses; Review of Fast Decoupled Power Flow method; Sensitivity factors for P-V bus adjustment..

UNIT III OPTIMAL POWER FLOW 9

Problem statement; Solution of Optimal Power Flow (OPF) – The gradient method, Newton's method, Linear Sensitivity Analysis; LP methods – With real power variables only – LP method with AC power flow variables and detailed cost functions; Security constrained Optimal Power Flow; Interior point algorithm; Bus Incremental costs.

UNIT IV SHORT CIRCUIT ANALYSIS 9

Formation of bus impedance matrix with mutual coupling (single phase basis and three phase basis)- Computer method for fault analysis using ZBUS and sequence components. Derivation of equations for bus voltages, fault current and line currents, both in sequence and phase – symmetrical and unsymmetrical faults.

UNIT V TRANSIENT STABILITY ANALYSIS 9

Introduction, Numerical Integration Methods: Euler and Fourth Order Runge-Kutta methods, Algorithm for simulation of SMIB and multi-machine system with classical synchronous machine model; Factors influencing transient stability, Numerical stability and implicit Integration methods.

L = 45 T = 15 P = 0 C =4

OUTCOMES:

- Ability to apply the concepts of sparse matrix for large scale power system analysis
- Ability to analyze power system studies that needed for the transmission system planning.

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REFERENCES:

1. A.J.Wood and B.F.Wollenberg, “Power Generation Operation and Control”, John Wiley and sons, New York, 1996.
2. W.F.Tinney and W.S.Meyer, “Solution of Large Sparse System by Ordered Triangular Factorization” IEEE Trans. on Automatic Control, Vol : AC-18, pp:333346 Aug 1973.
3.K.Zollenkopf, “Bi-Factorization: Basic Computational Algorithm and Programming Techniques ; pp:75-96 ; Book on “Large Sparse Set of Linear Systems” Editor: J.K.Rerd,Academic Press, 1971.
4. M.A.Pai,” Computer Techniques in Power System Analysis”,Tata McGraw-Hill Publishing Company Limited, New Delhi, 2006.
5. G W Stagg , A.H El. Abiad, “Computer Methods in Power System Analysis”, McGraw Hill, 1968.
6. P.Kundur, “Power System Stability and Control”, McGraw Hill, 1994.

22272L14P- POWER SYSTEM SIMULATION LABORATORY 0 0 3 3

OBJECTIVES:

- To have hands on experience on various system studies and different techniques used
- for system planning using Software packages
- To perform the dynamic analysis of power system
-

LIST OF EXPERIMENTS

1. Power flow analysis by Newton-Raphson method and Fast decoupled method

2. Transient stability analysis of single machine-infinite bus system using classical machine model

3. Contingency analysis: Generator shift factors and line outage distribution factors

4. Economic dispatch using lambda-iteration method

5. Unit commitment: Priority-list schemes and dynamic programming

6. State Estimation (DC)

7. Analysis of switching surge using EMTP: Energisation of a long distributed- parameter line

8. Analysis of switching surge using EMTP : Computation of transient recovery voltage

9. Simulation and Implementation of Voltage Source Inverter

10. Digital Over Current Relay Setting and Relay Coordination using Suitable software packages

11 Co-ordination of over-current and distance relays for radial line protection

TOTAL: 60 PERIODS

OUTCOMES:

- Upon Completion of the course, the students will be able to:
- Analyze the power flow using Newton-Raphson method and Fast decoupled method.
- Perform contingency analysis & economic dispatch
- Set Digital Over Current Relay and Coordinate Relay

SEMESTER -II

22272C21P- EHV POWER TRANSMISSION

3 1 0 4

1. INTRODUCTION 9

Standard transmission voltages – different configurations of EHV and UHV lines – average values of line parameters – power handling capacity and line loss – costs of transmission lines and equipment – mechanical considerations in line performance.

2. CALCULATION OF LINE PARAMETERS 9

Calculation of resistance, inductance and capacitance for multi-conductor lines – calculation of sequence inductances and capacitances – line parameters for different modes of propagation – resistance and inductance of ground return, numerical example involving a typical 400/220kV line using line constant program.

3. VOLTAGE GRADIENTS OF CONDUCTORS 9

Charge-potential relations for multi-conductor lines – surface voltage gradient on conductors – gradient factors and their use – distribution of voltage gradient on sub conductors of bundle - voltage gradients on conductors in the presence of ground wires on towers.

4. CORONA EFFECTS 9

Power losses and audible losses: I R loss and corona loss - audible noise generation and characteristics - limits for audible noise - Day-Night equivalent noise level- radio interference: corona pulse generation and properties - limits for radio interference fields

5. ELECTROSTATIC FIELD OF EHV LINES 9

Effect of EHV line on heavy vehicles - calculation of electrostatic field of AC lines- effect of high field on humans, animals, and plants - measurement of electrostatic fields - electrostatic Induction in unenergised circuit of a D/C line - induced voltages in insulated ground wires - electromagnetic interference

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Rakosh Das Begamudre, “Extra High Voltage AC Transmission Engineering”, Second Edition, New Age International Pvt. Ltd., 1990.
2. Power Engineer’s Handbook, Revised and Enlarged 6th Edition, TNEB Engineers’ Association, October 2002.
3. Microtran Power System Analysis Corporation, Microtran Reference Manual, Vancouver Canada. (Website: www.microtran.com).

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22272C22P - ADVANCED POWER SYSTEM PROTECTION 3 1 0 4

OBJECTIVES:

- To illustrate concepts of transformer protection
- To describe about the various schemes of Over current protection
- To analyze distance and carrier protection
- To familiarize the concepts of Generator protection and Numerical protection

UNIT I OVER CURRENT & EARTH FAULT PROTECTION 9

Zones of protection – Primary and Backup protection – operating principles and Relay Construction - Time – Current characteristics-Current setting – Time setting-Over current protective schemes –Concept of Coordination - Protection of parallel / ring feeders – Reverse power or directional relay –Polarisation Techniques – Cross Polarisation – Quadrature Connection -Earth fault and phase fault protection - Combined Earth fault and phase fault protection scheme - Phase fault protective - scheme directional earth fault relay - Static over current relays – Numerical over – current protection; numerical coordination example for a radial feeder

UNIT II TRANSFORMER & BUSBAR PROTECTION 9

Types of transformers –Types of faults in transformers- Types of Differential Protection – High Impedance – External fault with one CT saturation – Actual behaviors of a protective CT – Circuit model of a saturated CT - Need for high impedance – Disadvantages - Percentage Differential Bias Characteristics – Vector group & its impact on differential protection - Inrush phenomenon – Zero Sequence filtering – High resistance Ground Faults in Transformers – Restricted Earth fault Protection - Inter-turn faults in transformers – Incipient faults in transformers - Phenomenon of overfluxing in transformers – Transformer protection application chart. Differential protection of busbars external and internal fault - Supervisory relay-protection of three – Phase busbars – Numerical examples on design of high impedance busbar differential scheme –Biased Differential Characteristics – Comparison between Transformer differential & Busbar differential.

UNIT III DISTANCE AND CARRIER PROTECTION OF TRANSMISSION LINES 9

Drawback of over – Current protection – Introduction to distance relay – Simple impedance relay – Reactance relay – mho relays comparison of distance relay – Distance protection of a three – Phase line-reasons for inaccuracy of distance relay reach - Three stepped distance protection Trip contact configuration for the three - Stepped distance protection - Three-stepped protection f three-phase line against all ten shunt faults - Impedance seen from relay side - Three-stepped protection of double end fed lines-need for carrier – Aided protection – Various options for a carrier –Coupling and trapping the carrier into the desired line section - Unit type carrier aided

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directional comparison relaying – Carrier aided distance schemes for acceleration of zone II; numerical example for a typical distance protection scheme for a transmission line.

UNIT IV GENERATOR PROTECTION 9

Electrical circuit of the generator –Various faults and abnormal operating conditions – Stator Winding Faults – Protection against Stator (earth) faults – third harmonic voltage protection – Rotor fault – Abnormal operating conditions - Protection against Rotor faults – Potentiometer Method – injection method – Pole slipping – Loss of excitation – Protection against Mechanical faults; Numerical examples for typical generator protection schemes

UNIT V NUMERICAL PROTECTION

Introduction–Block diagram of numerical relay - Sampling theorem- Correlation with a reference (LES) technique-Digital filtering-numerical over - Current protection– Numerical transformer differential protection-Numerical distance protection of transmission line

L = 45 T = 15 P = 0 C =4

OUTCOMES:

- Learners will be able to understand the various schemes available in Transformer
- protection
- Learners will have knowledge on Overcurrent protection.
- Learners will attain knowledge about Distance and Carrier protection in transmission lines.
- Learners will understand the concepts of Generator protection.
- Learners will attain basic knowledge on substation automation.

REFERENCES

1 Y.G. Paithankar and S.R Bhide, "Fundamentals of Power System Protection", Prentice-Hall of India, 2003

2 Badri Ram and D.N. Vishwakarma, "Power System Protection and Switchgear", Tata McGraw- Hill Publishing Company, 2002.

3 T.S.M. Rao, "Digital Relay / Numerical relays", Tata McGraw Hill, New Delhi, 1989.

4 P.Kundur, "Power System Stability and Control", McGraw-Hill, 1993.

22272C31P - ECONOMIC OPERATIONS OF POWER SYSTEMS

3 1 0 4

1. INTRODUCTION 9

Planning and operational problems of power systems – review of economic dispatch and calculation using B matrix loss formula – use of participation factors in on line economic dispatch.

2. OPTIMAL POWER FLOW PROBLEM 9

Real and reactive power control variables – operation and security constraints and their limits – general OPF problem with different objective functions – formulation – cost loss minimization using Dommel and Tinney's method and SLP – development of model and algorithm – MVAR planning – optimal sitting and sizing of capacitors using SLR method – interchange evaluation using SLP.

3. HYDRO THERMAL SCHEDULING 9

Problems definition and mathematical model of long and short term problems – discretization – dynamic and incremental dynamic programming – methods of local variation – hydro thermal system with pumped hydro units – solution by local variation treating pumped hydro unit for load management and spinning reserve.

4. UNIT COMMITMENT 9

Constraints in unit commitment – solution by priority list method – dynamic programming method – backward and forward – restricted search range.

5. MAINTENANCE SCHEDULING 9

Factors considered in maintenance scheduling for generating units – turbines – boilers – introduction to maintenance scheduling using mathematical programming.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Allen J.Wood and Bruce F.Wollenberg, "Power generation and control", John Wiley & Sons, New York, 1984.
2. Krichmayer L., "Economic operation of power systems", John Wiley and sons Inc, New York, 1958.
3. Krichmayer L.K, "Economic control of Interconnected systems", Jhon Wiley and sons Inc, New York, 1959.
4. Elgerd O.I., "Electric energy systems theory – an introduction", McGraw Hill, New Delhi, 1971.

22272C32P - HVDC and FACTS

3 1 0 4

OBJECTIVES:

- To emphasis the need for FACTS controllers.
- To learn the characteristics, applications and modeling of series and controllers.
- To analyze the interaction of different FACTS controller and coordination
- To impart knowledge on operation, modelling and control of HVDC link.
- To perform steady state analysis of AC/DC system.

UNIT I INTRODUCTION 9

Review of basics of power transmission networks-control of power flow in AC transmission line- Analysis of uncompensated AC Transmission line- Passive reactive power compensation: Effect of series and shunt compensation at the mid-point of the line on power transfer- Need for FACTS controllers- types of FACTS controllers. Comparison of AC & DC Transmission, Applications of DC Transmission Topologies.

UNIT II SVC & STATCOM 9

Configuration of SVC- voltage regulation by SVC- Modelling of SVC for load flow analysisDesign of SVC to regulate the mid-point voltage of a SMIB system- Applications Static synchronous compensator (STATCOM)- Operation of STATCOM – Voltage regulation – Power flow control with STATCOM.

UNIT III TCSC and SSSC 9

Concepts of Controlled Series Compensation- Operation of TCSC - Analysis of TCSC operation - Modelling of TCSC for load flow studies - Static synchronous series compensator (SSSC)- Operation of SSSC - Modelling of SSSC for power flow – operation of Unified power flow controllers(UPFC).

UNIT IV ANALYSIS OF HVDC LINK 9

Simplified analysis of six pulse Graetz bridge – Charecteristics - Analysis of converter operations – Commutation overlap – Equivalence circuit of bipolar DC transmission link – Modes of operation – Mode ambiguity – Different firing angle controllers – Power flow control.

UNIT V POWER FLOW ANALYSIS IN AC/DC SYSTEMS 9

Per unit system for DC Quantities - Modelling of DC links - Solution of DC load flow - Solution of AC-DC power flow – Unified and Sequential methods.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will be able to refresh on basics of power transmission networks and need for FACTS controllers
- Learners will understand the significance about different voltage source converter based FACTS controllers
- Learners will understand the significance of HVDC converters and HVDC system control
- Learners will attain knowledge on AC/DC power flow analysis

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REFERENCES

1. Mohan Mathur, R., Rajiv. K. Varma, “Thyristor – Based Facts Controllers for Electrical Transmission Systems”, IEEE press and John Wiley & Sons, Inc.
2. K.R.Padiyar, “FACTS Controllers in Power Transmission and Distribution”, New Age International (P) Ltd., Publishers, New Delhi, Reprint 2008.
3. K.R.Padiyar, “HVDC Power Transmission Systems”, New Age International (P) Ltd., New Delhi, 2002.
4. J.Arrillaga, “High Voltage Direct Current Transmission”, Peter Pregrinus, London, 1983.
5. V.K.Sood, “HVDC and FACTS controllers- Applications of Static Converters in Power System”, Kluwer Academic Publishers 2004

22272L34P- ADVANCED POWER SYSTEM SIMULATION LABORATORY

LT P C

0 0 4 2

OBJECTIVES:

- To analyze the effect of FACTS controllers by performing steady state analysis.
- To have hands on experience on different wind energy conversion technologies

LIST OF EXPERIMENTS

1. Small-signal stability analysis of single machine-infinite bus system using classical machine model
2. Small-signal stability analysis of multi-machine configuration with classical machine model
3. Induction motor starting analysis
4. Load flow analysis of two-bus system with STATCOM
5. Transient analysis of two-bus system with STATCOM
6. Available Transfer Capability calculation using an existing load flow program
7. Study of variable speed wind energy conversion system- DFIG
8. Study of variable speed wind energy conversion system- PMSG
9. Computation of harmonic indices generated by a rectifier feeding a R-L load
10. Design of active filter for mitigating harmonics

SEMESTER – IV

22272C41P - POWER SYSTEM CONTROL 3 1 0 4

1. AUTOMATIC GENERATION CONTROL 9

Plant and system level control problem – ALFC of single area system modeling state and transient response – EDC control loop – ALFC of multi area system – modeling – static and transient response of two area system development of state variable model – two area system – AGC system design Kalman's method.

2. AUTOMATIC VOLTAGE CONTROL 9

Modeling of AVR loop – components – dynamic and static analysis – stability compensation – system level voltage control using OLTC, capacitor and generator voltages – expert system application for system voltage control.

3. SECURITY CONTROL CONCEPT 9

System operating states by security control functions – monitoring evaluation of system state by contingency analysis – corrective controls (preventive, emergency and restorative) – islanding scheme.

4. STATE ESTIMATION 9

Least square estimation – basic solution – sequential form of solution – static state estimation of power system by different algorithms – tracking state estimation of power system-computation consideration – external equivalency. Treatment of bad data and on line load flow analysis.

5. COMPUTER CONTROL OF POWER SYSTEM 9

Energy control center – various levels – national – regional and state level SCADA system – computer configuration – functions, monitoring, data acquisition and controls – EMS system – software in EMS system. Expert system applications for power system operation.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Kundur.P., "power system stability and control", McGraw Hill, 1994.
2. Anderson P.M., and Fouad A.A, "power system control and stability", Galgotia publication, New Delhi, 1981.
3. Taylor C.W., "power systems voltage stability", McGraw Hill, New Delhi, 1993.
4. IEEE recommended practice for excitation system models for power system stability studies, IEEE standard 421.5, 1992.
5. Kimbark E.W., "power system stability", Vol.3., Synchronous machines, John Wiley and sons, 1956.
6. T.V Custem, C.Vournas, "voltage stability of power system", Kluwer Acadamic Publishers, 1998.
7. Elgerd O.L., "Elctric energy systems theory – an introduction", McGraw Hill, New Delhi, 1971.

22272C42P- ELECTRICAL TRANSIENTS IN POWER SYSTEMS

3 1 0 4

1. TRAVELLING WAVES ON TRANSMISSION LINE 9

Lumped and Distributed Parameters – Wave Equation – Reflection, Refraction, Behavior of Travelling waves at the line terminations – Lattice Diagrams – Attenuation and Distortion – Multi-conductor system and Velocity wave.

2. COMPUTATION OF POWER SYSTEM TRANSIENTS 9

Principle of digital computation – Matrix method of solution, Modal analysis, Z transforms, Computation using EMTP – Simulation of switches and non-linear elements.

3. LIGHTNING, SWITCHING AND TEMPORARY OVERVOLTAGES 9

Lightning: Physical phenomena of lightning – Interaction between lightning and power system – Factors contributing to line design – Switching: Short line or kilometric fault – Energizing transients - closing and re-closing of lines - line dropping, load rejection - Voltage induced by fault – Very Fast Transient Overvoltage (VFTO)

4. BEHAVIOUR OF WINDING UNDER TRANSIENT CONDITION 9

Initial and Final voltage distribution - Winding oscillation - traveling wave solution - Behavior of the transformer core under surge condition – Rotating machine – Surge in generator and motor

5. INSULATION CO-ORDINATION 9

Principle of insulation co-ordination in Air Insulated substation (AIS) and Gas Insulated Substation (GIS), insulation level, statistical approach, co-ordination between insulation and protection level –overvoltage protective devices – lightning arresters, substation earthing.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Pritindra Chowdhari, "Electromagnetic transients in Power System", John Wiley and Sons Inc., 1996.
2. Allan Greenwood, "Electrical Transients in Power System", Wiley & Sons Inc. New York, 1991.
3. Klaus Ragaller, "Surges in High Voltage Networks", Plenum Press, New York, 1980.
4. Rakosh Das Begamudre, "Extra High Voltage AC Transmission Engineering", (Second edition) Newage International (P) Ltd., New Delhi, 1990.
5. Naidu M S and Kamaraju V, "High Voltage Engineering", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.
6. IEEE Guide for safety in AC substation grounding IEEE Standard 80-2000.
7. Working Group 33/13-09 (1988), 'Very fast transient phenomena associated with Gas Insulated System', CIGRE, 33-13, pp. 1-2

22272E23AP – ANALYSIS AND DESIGN OF POWER CONVERTERS L T P C
3 0 0 3

OBJECTIVES:

- To determine the operation and characteristics of controlled rectifiers.
- To apply switching techniques and basic topologies of DC-DC switching regulators.
- To introduce the design of power converter components.
- To provide an in depth knowledge about resonant converters.
- To comprehend the concepts of AC-AC power converters and their applications.

UNIT I SINGLE PHASE & THREE PHASE CONVERTERS 9

Principle of phase controlled converter operation – single-phase full converter and semi-converter (RL,RLE load)- single phase dual converter – Three phase operation full converter and semi-converter (R,RL,RLE load) – reactive power – power factor improvement techniques – PWM rectifiers.

UNIT II DC-DC CONVERTERS 9

Limitations of linear power supplies, switched mode power conversion, Non-isolated DC-DC converters: operation and analysis of Buck, Boost, Buck-Boost, Cuk& SEPIC – under continuous and discontinuous operation – Isolated converters: basic operation of Flyback, Forward and Push-pull topologies.

UNIT III DESIGN OF POWER CONVERTER COMPONENTS 9

Introduction to magnetic materials- hard and soft magnetic materials –types of cores , copper windings – Design of transformer –Inductor design equations –Examples of inductor design for buck/flyback converter-selection of output filter capacitors – selection of ratings for devices – input filter design.

UNIT IV RESONANT DC-DC CONVERTERS 9

Switching loss, hard switching, and basic principles of soft switching- classification of resonant converters- load resonant converters – series and parallel – resonant switch converters – operation and analysis of ZVS, ZCS converters comparison of ZCS/ZVS-Introduction to ZVT/ZCT PWM converters.

UNIT V AC-AC CONVERTERS 9

Principle of on-off and phase angle control – single phase ac voltage controller – analysis with R & RL load – Three phase ac voltage controller – principle of operation of cyclo converter – single phase and three phase cyclo converters – Introduction to matrix converters.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course the student will be able to:

- Analyze various single phase and three phase power converters
- Select and design dc-dc converter topologies for a broad range of power conversion

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applications.

- Develop improved power converters for any stringent application requirements.
- Design ac-ac converters for variable frequency applications.

TEXT BOOKS:

1 Ned Mohan,T.MUndeland and W.P Robbin, “Power Electronics: converters, Application and design” John Wiley and sons.Wiley India edition, 2006.

2 Rashid M.H., “Power Electronics Circuits, Devices and Applications ", Prentice Hall India, Third Edition, New Delhi, 2004.

3 P.C. Sen, “Modern Power Electronics”, Wheeler Publishing Co, First Edition, New Delhi, 1998.

4 P.S.Bimbra, “Power Electronics”, Khanna Publishers, Eleventh Edition, 2003

5 Simon Ang, Alejandro Oliva, “Power-Switching Converters, Second Edition, CRC Press, Taylor & Francis Group, 2010

6 V.Ramanarayanan, “Course material on Switched mode power conversion”, 2007

7 Alex Van den Bossche and VencislavCekovValchev, “Inductors and TransformersforPowerElectronics”, CRC Press, Taylor & Francis Group, 2005

8 W. G. Hurley and W. H.Wolfle, “Transformers and Inductors for Power Electronics Theory, Design and Applications”, 2013 John Wiley & Sons Ltd.

9 Marian.K.Kazimierczuk and DariuszCzarkowski, “Resonant Power Converters”, John Wiley & Sons limited, 2011

22272E23BP - MODELING AND ANALYSIS OF ELECTRICAL MACHINES

3 1 0 4

UNIT I PRINCIPLES OF ELECTROMAGNETIC ENERGY CONVERSION

General expression of stored magnetic energy - co-energy and force/torque - example using single and doubly excited system.

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UNIT II BASIC CONCEPTS OF ROTATING MACHINES

Calculation of air gap M.M.F. - per phase machine inductance using physical machine data - voltage and torque equation of D.C. machine - three phase symmetrical induction machine and salient pole synchronous machines in phase variable form.

UNIT III INTRODUCTION TO REFERENCE FRAME THEORY

Static and rotating reference frames - transformation relationships - examples using static symmetrical three phase R, R-L, R-L-M and R-L-C circuits - application of reference frame theory to three phase symmetrical induction and synchronous machines - dynamic direct and quadrature axis model in arbitrarily rotating reference frames - voltage and torque equations - derivation of steady state phasor relationship from dynamic model - generalized theory of rotating electrical machine and Kron's primitive machine.

UNIT IVD ETERMINATIONOF SYNCHRONOUS MACHINE DYNAMIC EQUIVALENT CIRCUIT PARAMETERS

Standard and derived machine time constants - frequency response test - analysis and dynamic modeling of two phase asymmetrical induction machine and single phase induction machine.

UNIT V SPECIAL MACHINES

Permanent magnet synchronous machine - surface permanent magnet (square and sinusoidal back E.M.F. type) and interior permanent magnet machines - construction and operating principle - dynamic modeling and self controlled operation - analysis of switch reluctance motors.

L = 45 T = 15 P = 0 C =4

TEXT BOOKS

1. Charles Kingsley, A.E. Fitzgerald Jr. and Stephen D. Umans, 'Electric Machinery', Tata McGraw-Hill, Fifth Edition, 1992.
2. R. Krishnan, 'Electric Motor & Drives: Modelling, Analysis and Control', Prentice Hall of India, 2001.

REFERENCES

1. C.V. Jones, 'The Unified Theory of Electrical Machines', Butterworth, 1967.
2. T.J.E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives' Clarendon Press, 1989.

Skill Development Employability Entrepreneurship

22272E51BP ADVANCED POWER SYSTEM DYNAMICS L T P C
OBJECTIVES: 3 0 0 3

- To perform transient stability analysis using unified algorithm.
- To impart knowledge on sub-synchronous resonance and oscillations
- To analyze voltage stability problem in power system.
- To familiarize the methods of transient stability enhancement

UNIT ITRANSIENT STABILITY ANALYSIS 9

Review of numerical integration methods: Euler and Fourth Order Runge-Kutta methods, Numerical stability and implicit methods, Interfacing of Synchronous machine (variable voltage) model to the transient stability algorithm (TSA) with partitioned – explicit and implicit approaches – Interfacing SVC with TSA-methods to enhance transient stability

UNIT II UNIFIED ALGORITHM FOR DYNAMIC ANALYSIS OF POWER SYSTEMS 9

Need for unified algorithm- numerical integration algorithmic steps-truncation error-variable step size – handling the discontinuities- numerical stability- application of the algorithm for transient. Mid-term and long-term stability simulations

UNIT III SUBSYSNCHRONOUS RESONANCE (SSR) AND OSCILLATIONS 9

Subsynchronous Resonance (SSR) – Types of SSR - Characteristics of series –Compensated transmission systems –Modeling of turbine-generator-transmission network- Self-excitation due to induction generator effect – Torsional interaction resulting in SSR – Methods of analyzing SSR – Numerical examples illustrating instability of subsynchronous oscillations – time-domain simulation of subsynchronous resonance – EMTP with detailed synchronous machine model- Turbine Generator Torsional Characteristics: Shaft system model – Examples of torsional characteristics – Torsional Interaction with Power System Controls: Interaction with generator excitation controls – Interaction with speed governors – Interaction with nearby DC converters

UNIT IV TRANSMISSION, GENERATION AND LOAD ASPECTS OF VOLTAGE STABILITY ANALYSIS 9

Review of transmission aspects – Generation Aspects: Review of synchronous machine theory – Voltage and frequency controllers – Limiting devices affecting voltage stability – Voltage-reactive power characteristics of synchronous generators – Capability curves – Effect of machine limitation on deliverable power – Load Aspects – Voltage dependence of loads – Load restoration dynamics – Induction motors – Load tap changers – Thermostatic load recovery – General aggregate load models.

UNIT V ENHANCEMENT OF TRANSIENT STABILITY AND COUNTER MEASURES FOR SUB SYNCHRONOUS RESONANCE 9

Principle behind transient stability enhancement methods: high-speed fault clearing, reduction of transmission system reactance, regulated shunt compensation, dynamic braking, reactor switching, independent pole-operation of circuit-breakers, single-pole switching, fast-valving, high-speed excitation systems; NGH damper scheme.

TOTAL : 45 PERIODS

Skill Development Employability Entrepreneurship

OUTCOMES:

- Learners will be able to understand the various schemes available in Transformer protection
- Learners will have knowledge on Over current protection.
- Learners will attain knowledge about Distance and Carrier protection in transmission lines.
- Learners will understand the concepts of Busbar protection.
- Learners will attain basic knowledge on numerical protection techniques

REFERENCES

1 R.Ramnujam," Power System Dynamics Analysis and Simulation", PHI Learning Private Limited, New Delhi, 2009

2 T.V. Cutsem and C.Vournas, "Voltage Stability of Electric Power Systems", Kluwer publishers,1998

3 P. Kundur, "Power System Stability and Control", McGraw-Hill, 1993.

4 H.W. Dommel and N.Sato, "Fast Transient Stability Solutions," IEEE Trans., Vol. PAS-91, pp, 1643-1650, July/August 1972.

5 Roderick J . Frowd and J. C. Giri, "Transient stability and Long term dynamics unified", IEEE Trans., Vol 101, No. 10, October 1982.

6 M.Stubbe, A.Bihain,J.Deuse, J.C.Baader, "A New Unified software program for the study of the dynamic behaviour of electrical power system" IEEE Transaction, Power Systems, Vol.4.No.1,Feb:1989 Pg.129 to 138

22272E23DP **ANALYSIS AND COMPUTATION OF ELECTROMAGNETIC TRANSIENTS IN POWER SYSTEMS**

L T P C

3 0 0 3

OBJECTIVES:

- To understand the various types of transients and its analysis in power system.
- To learn about modeling and computational aspects transients computation

UNIT I REVIEW OF TRAVELLING WAVE PHENOMENA 9

Lumped and Distributed Parameters – Wave Equation – Reflection, Refraction, Behaviour of Travelling waves at the line terminations – Lattice Diagrams – Attenuation and Distortion.

UNIT II LIGHTNING, SWITCHING AND TEMPORARY OVERVOLTAGES 9

Lightning overvoltages: interaction between lightning and power system- ground wire voltage and voltage across insulator; switching overvoltage: Short line or kilometric fault, energizing transients - closing and re-closing of lines, methods of control; temporary overvoltages: line dropping, load rejection; voltage induced by fault; very fast transient overvoltage (VFTO).

UNIT III PARAMETERS AND MODELING OF OVERHEAD LINES 9

Review of line parameters for simple configurations: series resistance, inductance and shunt capacitance; bundle conductors : equivalent GMR and equivalent radius; modal propagation in transmission lines: modes on multi-phase transposed transmission lines, α-β-0 transformation and symmetrical components transformation, modal impedances; analysis of modes on untransposed lines; effect of ground return and skin effect; transposition schemes;

UNIT V FAST TRANSIENTS PHENOMENON IN AIS AND GIS 9

Digital computation of line parameters: why line parameter evaluation programs? Salient features of a typical line parameter evaluation program; constructional features of that affect transmission line parameters; line parameters for physical and equivalent phase conductors elimination of ground wires bundling of conductors; principle of digital computation of transients: features and capabilities of electromagnetic transients program; steady state and time step solution modules: basic solution methods; case studies on simulation of various types of transients

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will be able to model over head lines, cables and transformers.
- Learners will be able to analyze power system transients.

REFERENCES

1 Allan Greenwood, "Electrical Transients in Power System", Wiley & Sons Inc. New York, 1991.

Skill Development Employability Entrepreneurship

2 R. Ramanujam, “Computational Electromagnetic Transients: Modeling, Solution Methods and Simulation”, I.K. International Publishing House Pvt. Ltd, New Delhi, 2014.
3 Naidu M S and Kamaraju V, “High Voltage Engineering”, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.

22272E33AP SMART GRID LTPC

3003

OBJECTIVES:

- To Study about Smart Grid technologies, different smart meters and advanced metering infrastructure.
- To familiarize the power quality management issues in Smart Grid.
- To familiarize the high performance computing for Smart Grid applications

UNIT IINTRODUCTION TO SMART GRID 9

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, National and International Initiatives in Smart Grid.

UNIT II SMART GRID TECHNOLOGIES 9

Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/Var control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV).

UNIT III SMART METERS AND ADVANCED METERING INFRASTRUCTURE 9

Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU), Intelligent Electronic Devices (IED) & their application for monitoring & protection.

UNIT IV POWER QUALITY MANAGEMENT IN SMART GRID 9

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

UNIT V HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS 9

Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

TOTAL : 45 PERIODS

Skill Development Employability Entrepreneurship

OUTCOMES:

- Learners will develop more understanding on the concepts of Smart Grid and its present developments.
- Learners will study about different Smart Grid technologies.
- Learners will acquire knowledge about different smart meters and advanced metering infrastructure.
- Learners will have knowledge on power quality management in Smart Grids
- Learners will develop more understanding on LAN, WAN and Cloud Computing for Smart Grid application

REFERENCES

1 Stuart Borlase "Smart Grid :Infrastructure, Technology and Solutions", CRC Press 2012.

2 Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley 2012.

3 Vehbi C. Güngör, DilanSahin, TaskinKocak, Salih Ergüt, Concettina Buccella, Carlo Cecati, and Gerhard P. Hancke, "Smart Grid Technologies: Communication Technologies and Standards" IEEE Transactions On Industrial Informatics, Vol. 7, No. 4, November 2011.

4 Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang "Smart Grid – The New and Improved Power Grid: A Survey" , IEEE Transaction on Smart Grids, vol. 14, j2012.

22272E33BP SOLAR AND ENERGY STORAGE SYSTEMS LTPC

3003

OBJECTIVES:

- To Study about solar modules and PV system design and their applications
- To Deal with grid connected PV systems
- To Discuss about different energy storage systems

UNIT IINTRODUCTION 9

Characteristics of sunlight – semiconductors and P-N junctions –behavior of solar cells – cell properties – PV cell interconnection

UNIT II STAND ALONE PV SYSTEM 9

Solar modules – storage systems – power conditioning and regulation - MPPT- protection – stand alone PV systems design – sizing

UNIT III GRID CONNECTED PV SYSTEMS 9

PV systems in buildings – design issues for central power stations – safety – Economic aspect – Efficiency and performance - International PV programs

UNIT IV ENERGY STORAGE SYSTEMS 9

Impact of intermittent generation – Battery energy storage – solar thermal energy storage – pumped hydroelectric energy storage

UNIT V APPLICATIONS 9

Water pumping – battery chargers – solar car – direct-drive applications –Space – Telecommunications.

TOTAL : 45 PERIODS

OUTCOMES:

- Students will develop more understanding on solar energy storage systems
- Students will develop basic knowledge on standalone PV system
- Students will understand the issues in grid connected PV systems
- Students will study about the modeling of different energy storage systems and their performances
- Students will attain more on different applications of solar energy

Skill Development Employability Entrepreneurship

REFERENCES

1 Solanki C.S., “Solar Photovoltaics: Fundamentals, Technologies And Applications”, PHI Learning Pvt. Ltd.,2015.

2 Stuart R.Wenham, Martin A.Green, Muriel E. Watt and Richard Corkish, “Applied Photovoltaics”, 2007,Earthscan, UK. Eduardo Lorenzo G. Araujo, “Solar electricity engineering of photovoltaic systems”, Progensa,1994.

3 Frank S. Barnes & Jonah G. Levine, “Large Energy storage Systems Handbook”, CRC Press, 2011.

4 McNeils, Frenkel, Desai, “Solar & Wind Energy Technologies”, Wiley Eastern, 1990

5 S.P. Sukhatme , “Solar Energy”, Tata McGraw Hill,1987.

22272E33CP POWER SYSTEM RELIABILITY L T P C

OBJECTIVES: 3 0 0 3

- To introduces the objectives of Load forecasting.
- To study the fundamentals of Generation system, transmission system and Distribution system reliability analysis
- To illustrate the basic concepts of Expansion planning

UNIT I LOAD FORECASTING 9

Objectives of forecasting - Load growth patterns and their importance in planning - Load forecasting Based on discounted multiple regression technique-Weather sensitive load forecasting-Determination of annual forecasting-Use of AI in load forecasting.

UNIT II GENERATION SYSTEM RELIABILITY ANALYSIS 9

Probabilistic generation and load models- Determination of LOLP and expected value of demand not served –Determination of reliability of ISO and interconnected generation systems

UNIT III TRANSMISSION SYSTEM RELIABILITY ANALYSIS 9

Deterministic contingency analysis-probabilistic load flow-Fuzzy load flow probabilistic transmission system reliability analysis-Determination of reliability indices like LOLP and expected value of demand not served

UNIT IV EXPANSION PLANNING 9

Basic concepts on expansion planning-procedure followed for integrate transmission system planning, current practice in India-Capacitor placer problem in transmission system and radial distributions system.

UNIT V DISTRIBUTION SYSTEM PLANNING OVERVIEW 9

Introduction, sub transmission lines and distribution substations-Design primary and secondary systems-distribution system protection and coordination of protective devices.

TOTAL: 45 PERIODS

OUTCOMES:

- Students will develop the ability to learn about load forecasting.
- Students will learn about reliability analysis of ISO and interconnected systems.
- Students will understand the concepts ot Contingency analysis and Probabilistic Load flow Analysis
- Students will be able to understand the concepts of Expansion planning

Skill Development Employability Entrepreneurship

- Students will have knowledge on the fundamental concepts of the Distribution system planning

REFERENCES

1 Roy Billinton & Ronald N. Allan, "Reliability Evaluation of Power Systems" Springer Publication,

2 R.L. Sullivan, "Power System Planning", Tata McGraw Hill Publishing Company Ltd 1977.

3 X. Wang & J.R. McDonald, "Modern Power System Planning", McGraw Hill Book Company 1994.

4 T. Gonen, "Electrical Power Distribution Engineering", McGraw Hill Book Company 1986.

5 B.R. Gupta, "Generation of Electrical Energy",S.Chand Publications 1983.

22272E33DP DISTRIBUTED GENERATION AND MICROGRID **L T P C**

OBJECTIVES: **3 0 0 3**

- To illustrate the concept of distributed generation
- To analyze the impact of grid integration.
- To study concept of Microgrid and its configuration

UNIT I INTRODUCTION 9

Conventional power generation: advantages and disadvantages, Energy crises, Non-conventional energy (NCE) resources: review of Solar PV, Wind Energy systems, Fuel Cells, micro-turbines, biomass, and tidal sources.

UNIT II DISTRIBUTED GENERATIONS (DG) 9

Concept of distributed generations, topologies, selection of sources, regulatory standards/ framework, Standards for interconnecting Distributed resources to electric power systems: IEEE 1547. DG installation classes, security issues in DG implementations. Energy storage elements: Batteries, ultra-capacitors, flywheels. Captive power plants

UNIT III IMPACT OF GRID INTEGRATION 9

Requirements for grid interconnection, limits on operational parameters,: voltage, frequency, THD, response to grid abnormal operating conditions, islanding issues. Impact of grid integration with NCE sources on existing power system: reliability, stability and power quality issues.

UNIT IV BASICS OF A MICROGRID 9

Concept and definition of microgrid, microgrid drivers and benefits, review of sources of microgrids, typical structure and configuration of a microgrid, AC and DC microgrids, Power Electronics interfaces in DC and AC microgrids

UNIT V CONTROL AND OPERATION OF MICROGRID 9

Modes of operation and control of microgrid: grid connected and islanded mode, Active and reactive power control, protection issues, anti-islanding schemes: passive, active and communication based techniques, microgrid communication infrastructure, Power quality issues in microgrids, regulatory standards, Microgrid economics, Introduction to smart microgrids.

TOTAL : 45 PERIODS

Skill Development Employability Entrepreneurship

OUTCOMES:

- Learners will attain knowledge on the various schemes of conventional and nonconventional power generation.

- Learners will have knowledge on the topologies and energy sources of distributed generation.
- Learners will learn about the requirements for grid interconnection and its impact with NCE sources
- Learners will understand the fundamental concept of Microgrid.

REFERENCES

1 Amirnaser Yezdani, and Reza Iravani, "Voltage Source Converters in Power Systems: Modeling, Control and Applications", IEEE John Wiley Publications, 2010.

2 DorinNeacsu, "Power Switching Converters: Medium and High Power", CRC Press, Taylor & Francis, 2006

3 Chetan Singh Solanki, "Solar Photo Voltaics", PHI learning Pvt. Ltd., New Delhi,2009

4 J.F. Manwell, J.G. McGowan "Wind Energy Explained, theory design and applications", Wiley publication 2010.

5 D. D. Hall and R. P. Grover, "Biomass Regenerable Energy", John Wiley, New York, 1987.

6 John Twidell and Tony Weir, "Renewable Energy Resources" Tyalor and Francis Publications, Second edition 2006.

22272E43AP - WIND ENERGY CONVERSION SYSTEMS

3 1 0 4

UNIT-I INTRODUCTION: **9**

History of wind Electric generation - Darrieus wind - Horizontal and vertical axis-Wind turbine - other modern developments - Future possibilities.

UNIT-II WIND RESOURCE AND ITS POTENTIAL FOR ELECVTRIC POWER GENERATION: **9**

Power Extracted By A Wind Driven Machine - Nature and occurrence of wind characteristics and power production - variation of mean wind speed with time.

UNIT-III WIND POWER SITES AND WIND MEASUREMENTS: **9**

Average wind speed and other factors affecting choice of the site - Effect of wind direction - Measurement of wind velocity - Personal estimation without instruments- anemometers - Measurement of wind direction.

UNIT-IV WIND TURBINES WITH ASYNCHRONOUS GENERATORS AND CONTROL ASPECTS: **9**

Asynchronous systems - Ac Generators - Self excitation of Induction Generator - Single Phase operation of Induction Generator - Permanenet magnet Generators - Basic control aspects - fixed speed ratio control scheme - fixed vs variable speed operation of WECS.

UNIT-V GENERATION OF ELECTRICITY **9**

Active and reactive power - P and Q transfer in power systems - Power converters - Characteristics of Generators - Variable Speed options - Economics.

L = 45 T = 15 P = 0 C =4

REFERENCES:

1. N.G.Calvert, 'Wind Power Principles: Their Application on small scale', Charles Friffin& co. Ltd, London, 1979.
2. Gerald W.Koeppel, "Pirnam's and Power from the wind", Van Nastran Reinhold Co., London, 1979.
3. Gary L. Johnson, "Wind Energy System", Prentice hall Inc., Englewood Cliffs, New Jersey, 1985.
4. Wind energy conversion system by L. Lfreris, Prentice hall (U.K) Ltd., 1990.

22272E43BP - AI TECHNIQUES TO POWER SYSTEMS

3 1 0 4

1. INTRODUCTION TO NEURAL NETWORKS 9

Basics of ANN - perceptron - delta learning rule - back propagation algorithm - multilayer feed forward network - memory models - bi-directional associative memory - Hopfield network.

2. APPLICATIONS TO POWER SYSTEM PROBLEMS 9

Application of neural networks to load forecasting - contingency analysis - VAR control - economic load dispatch.

3. INTRODUCTION TO FUZZY LOGIC 9

Crispness - vagueness - fuzziness - uncertainty - fuzzy set theory fuzzy sets - fuzzy set operations - fuzzy measures - fuzzy relations - fuzzy function - structure of fuzzy logic controller – fuzzification models - data base - rule base - inference engine defuzzification module.

4. APPLICATIONS TO POWER SYSTEMS 9

Decision making in power system control through fuzzy set theory - use of fuzzy set models of LP in power systems scheduling problems - fuzzy logic based power system stabilizer.

5. GENETIC ALGORITHM AND ITS APPLICATIONS TO POWER SYSTEMS 9

Introduction - simple genetic algorithm - reproduction - crossover - mutation – advanced operators in genetic search - applications to voltage control and stability studies.

L = 45 T = 15 P = 0 C =4

REFERENCES:

1. James A. Freeman and Skapura.B.M „Neural Networks - Algorithms Applications and Programming Techniques‟, Addison Wesley, 1990.
2. George Klir and Tina Folger.A, „Fuzzy sets, Uncertainty and Information‟, Prentice Hall of India, 1993.
3. Zimmerman.H.J„„Fuzzy Set Theory and its Applications‟, Kluwer Academic Publishers 1994.
4. IEEE tutorial on „Application of Neural Network to Power Systems‟, 1996.
5. Loi Lei Lai, „Intelligent System Applications in Power Engineering‟, John Wiley & SonsLtd.,1998.

Skill Development Employability Entrepreneurship

22272E43CP **ELECTRICAL DISTRIBUTION SYSTEM** **L T P C**

OBJECTIVES: **3 0 0 3**

- To provide knowledge about the distribution system electrical characteristics
- To gain knowledge about planning and designing of distribution system
- To analyze power quality in distribution system
- To analyze the power flow in balanced and unbalanced system

UNIT I **INTRODUCTION** **9**

Distribution System-Distribution Feeder Electrical Characteristics-Nature of Loads : Individual Customer Load, Distribution Transformer Loading and Feeder Load -Approximate Method of Analysis: Voltage Drop, Line Impedance, "K" Factors, Uniformly Distributed Loads and Lumping Loads in Geometric Configurations.

UNIT II **DISTRIBUTION SYSTEM PLANNING** **9**

Factors effecting planning, present techniques, planning models(Short term planning, long term planning and dynamic planning), planning in the future, future nature of distribution planning, Role of computer in Distribution planning. Load forecast, Load characteristics and Load models.

UNIT III **DISTRIBUTION SYSTEM LINE MODEL** **9**

Exact Line Segment Model-Modified Line Model- Approximate Line Segment Model-Modified "Ladder" Iterative Technique-General Matrices for Parallel Lines.

UNIT IV **VOLTAGE REGULATION** **9**

Standard Voltage Ratings-Two-Winding Transformer Theory-Two-Winding Autotransformer-Step-Voltage Regulators: Single-Phase Step-Voltage Regulators-Three-Phase Step-Voltage Regulators- Application of capacitors in Distribution system.

UNIT V **DISTRIBUTION FEEDER ANALYSIS** **9**

Power-Flow Analysis- Ladder Iterative Technique -Unbalanced Three-Phase Distribution Feeder- Modified Ladder Iterative Technique- Load Allocation- Short-Circuit Studies.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to apply the concepts of planning and design of distribution system for utility systems
- Ability to implement the concepts of volatage control in distribution system.
- Ability to analyze the power flow in balanced and unbalanced system

Skill Development Employability Entrepreneurship

REFERENCES

1. William H. Kersting," Distribution System Modeling and Analysis " CRC press 3rd edition,2012.
2. Turan Gonen, “Electric Power Distribution System Engineering”, McGraw Hill Company. 1986
3. James Northcote – Green, Robert Wilson, “Control and Automation of Electrical Power Distribution Systems”, CRC Press, New York, 2007.
4. Pabla H S, “Electrical Power Distribution Systems”, Tata McGraw Hill. 2004

22272E43DP- ENERGY MANAGEMENT AND AUDITING **L T P C**

OBJECTIVES: **3 0 0 3**

- To study the concepts behind economic analysis and Load management.
- To emphasize the energy management on various electrical equipments and metering.
- To illustrate the concept of lighting systems and cogeneration.

UNIT I INTRODUCTION 9

Need for energy management - energy basics- designing and starting an energy management program – energy accounting -energy monitoring, targeting and reporting-energy audit process.

UNIT II ENERGY COST AND LOAD MANAGEMENT 9

Important concepts in an economic analysis - Economic models-Time value of money-Utility rate structures- cost of electricity-Loss evaluation- Load management: Demand control techniques-Utility monitoring and control system-HVAC and energy management-Economic justification.

UNIT III ENERGY MANAGEMENT FOR MOTORS, SYSTEMS, AND ELECTRICAL EQUIPMENT 9

Systems and equipment- Electric motors-Transformers and reactors-Capacitors and synchronous machines.

UNIT IV METERING FOR ENERGY MANAGEMENT 9

Relationships between parameters-Units of measure-Typical cost factors- Utility meters - Timing of meter disc for kilowatt measurement - Demand meters - Paralleling of current transformers - Instrument transformer burdens-Multitasking solid-state meters - Metering location vs. requirements- Metering techniques and practical examples.

UNIT V LIGHTING SYSTEMS & COGENERATION 9

Concept of lighting systems - The task and the working space -Light sources - Ballasts - Luminaries - Lighting controls-Optimizing lighting energy - Power factor and effect of harmonics on power quality - Cost analysis techniques-Lighting and energy standards Cogeneration: Forms of cogeneration - feasibility of cogeneration- Electrical interconnection.

TOTAL : 45 PERIODS

OUTCOMES:

- Students will develop the ability to learn about the need for energy management and auditing process

Skill Development Employability Entrepreneurship

22272E43DP- ENERGY MANAGEMENT AND AUDITING L T P C

- Learners will learn about basic concepts of economic analysis and load management.
- Students will understand the energy management on various electrical equipments.
- Students will have knowledge on the concepts of metering and factors influencing cost function

- Students will be able to learn about the concept of lighting systems, light sources and various forms of cogeneration

REFERENCES

1 Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, "Guide to Energy Management", Fifth Edition, The Fairmont Press, Inc., 2006
2 Eastop T.D & Croft D.R, "Energy Efficiency for Engineers and Technologists", Logman Scientific & Technical, 1990.
3 Reay D.A, "Industrial Energy Conservation", 1st edition, Pergamon Press, 1977.
4 "IEEE Recommended Practice for Energy Management in Industrial and Commercial Facilities", IEEE, 1996
5 Amit K. Tyagi, "Handbook on Energy Audits and Management", TERI, 2003.

22272E51AP- POWER ELECTRONICS APPLICATIONS IN POWER SYSTEMS LTPC

3 1 0 4

UNIT: I STATIC COMPENSATOR CONTROL 9

Theory of load compensation - voltage regulation and power factor correction - phase balance and PF correction of unsymmetrical loads - Property of static compensator - Thyristor controlled rectifier (TCR) - Thyristor Controlled Capacitor (TSC) -Saturable core reactor - Control Strategies.

UNIT: II HARMONIC CONTROL AND POWER FACTOR IMPROVEMENT 9

Input power factor for different types of converters - power factor improvement using Load and forced commutated converters.

UNIT: III VOLTAGE CONTROL USING STATIC TAP-CHANGERS 9

Conventional tap changing methods, static tap changers using Thyristor, different schemes - comparison.

UNIT: IV STATIC EXCITATION CONTROL 9

Solid state excitation of synchronous generators - Different schemes - Generex excitation systems.

UNIT: V UNINTERRUPTABLE POWER SUPPLY SYSTEM 9

Parallel, Redundant and non- redundant UPS - Ups using resonant power converters - Switch mode power supplies.

L = 45 T = 15 P = 0 C =4

TEXT BOOK

Miller. T.J.E, “Reactive power control in Electric systems”. Wiley inter science, New York, 1982.

REFRENCES

1. “Static Compensator for AC power systems”, Proc. IEE vol.128 Nov. 1981. pp 362-406.
2 “A Static alternative to the transformer on load tap changing”, IEEE Trans. On Pas, Vol.PAS-99, Jan. /Feb. 1980, pp86-89.
3. “Improvements in Thyristor controlled static on- load tap controllers for transformers”, IEEE Trans. on PAS, Vol.PAS-101, Sept.1982, pp3091-3095.
4. “Shunt Thyristor rectifiers for the Generex Excitation systems”, IEEE Trans. On PAS. PAS -96, July/August, 1977, pp1219-1325.

Skill Development Employability Entrepreneurship

22272E32B- POWER SYSTEM DYNAMICS

3 1 0 4

1. SYNCHRONOUS MACHINE MODELLING 9

Schematic Diagram, Physical Description: armature and field structure, machines with multiple pole pairs, mmf waveforms, direct and quadrature axes, Mathematical Description of a Synchronous Machine: Basic equations of a synchronous machine: stator circuit equations, stator self, stator mutual and stator to rotor mutual inductances, dq0 Transformation: flux linkage and voltage equations for stator and rotor in dq0 coordinates, electrical power and torque, physical interpretation of dq0 transformation, Per Unit Representations: L_{ad}-reciprocal per unit system and that from power-invariant form of Park's transformation; Equivalent Circuits for direct and quadrature axes, Steady-state Analysis: Voltage, current and flux-linkage relationships, Phasor representation, Rotor angle, Steady-state equivalent circuit, Computation of steady-state values, Equations of Motion: Swing Equation, calculation of inertia constant, Representation in system studies, Synchronous Machine Representation in Stability Studies: Simplifications for large-scale studies : Neglect of stator $p\Psi$ terms and speed variations, Simplified model with amortisseurs neglected: two-axis model with amortisseur windings neglected, classical model.

2. MODELLING OF EXCITATION AND SPEED GOVERNING SYSTEMS 9

Excitation System Requirements; Elements of an Excitation System; Types of Excitation System;Control and protective functions;IEEE (1992) block diagram for simulation of excitation systems. Turbine and Governing System Modelling: Functional Block Diagram of Power Generation and Control, Schematic of a hydroelectric plant, classical transfer function of a hydraulic turbine (no derivation), special characteristic of hydraulic turbine, electrical analogue of hydraulic turbine, Governor for Hydraulic Turbine: Requirement for a transient droop, Block diagram of governor with transient droop compensation, Steam turbine modelling: Single reheat tandem compounded type only and IEEE block diagram for dynamic simulation; generic speed-governing system model for normal speed/load control function.

3. SMALL-SIGNAL STABILITY ANALYSIS WITHOUT CONTROLLERS 9

Classification of Stability, Basic Concepts and Definitions: Rotor angle stability, The Stability Phenomena. Fundamental Concepts of Stability of Dynamic Systems: State-space representation, stability of dynamic system, Linearisation, Eigen properties of the state matrix: Eigen values and eigenvectors, modal matrices, eigen value and stability, mode shape and participation factor. Single-Machine Infinite Bus (SMIB) Configuration: Classical Machine Model stability analysis with numerical example, Effects of Field Circuit Dynamics: synchronous machine, network and linearised system equations, block diagram representation with K-constants; expression for K-constants (no derivation), effect of field flux variation on system stability: analysis with numerical example,

4. SMALL-SIGNAL STABILITY ANALYSIS WITH CONTROLLERS 9

Effects Of Excitation System: Equations with definitions of appropriate K-constants and simple thyristor excitation system and AVR, block diagram with the excitation system, analysis of effect of AVR on synchronizing and damping components using a numerical example, Power System Stabiliser: Block diagram with AVR and PSS, Illustration of principle of PSS application with numerical example, Block diagram of PSS with description, system state matrix including PSS,

Skill Development Employability Entrepreneurship

analysis of stability with numerical a example. Multi-Machine Configuration: Equations in a common reference frame, equations in individual machine rotor coordinates, illustration of formation of system state matrix for a two-machine system with classical models for synchronous machines, illustration of stability analysis using a numerical example. Principle behind small-signal stability improvement methods: delta-omega and delta P-omega stabilizers.

5. ENHANCEMENT OF SMALL SIGNAL STABILITY 9

Power System Stabilizer – Stabilizer based on shaft speed signal (delta omega) – Delta –P-Omega stabilizer-Frequency-based stabilizers – Digital Stabilizer – Excitation control design – Exciter gain – Phase lead compensation – Stabilizing signal washout stabilizer gain – Stabilizer limits

L = 45 T = 15 P = 0 C =4

REFERENCES

1. P. Kundur, “Power System Stability and Control”, McGraw-Hill, 1993.
2. IEEE Committee Report, "Dynamic Models for Steam and Hydro Turbines in Power System Studies”, IEEE Trans., Vol.PAS-92, pp 1904-1915, November/December, 1973. on Turbine-Governor Model.
3. P.M Anderson and A.A Fouad, “Power System Control and Stability”, Iowa State University Press, Ames, Iowa, 1978.

Skill Development Employability Entrepreneurship

22272E51CP ELECTRIC VEHICLES AND POWER MANAGEMENT **L T P C**

3 0 0 3

OBJECTIVES:

- To understand the concept of electrical vehicles and its operations
- To understand the need for energy storage in hybrid vehicles
- To provide knowledge about various possible energy storage technologies that can be
- used in electric vehicles

UNIT I ELECTRIC VEHICLES AND VEHICLE MECHANICS 9

Electric Vehicles (EV), Hybrid Electric Vehicles (HEV), Engine ratings, Comparisons of EV with internal combustion Engine vehicles, Fundamentals of vehicle mechanics

UNIT II ARCHITECTURE OF EV's AND POWER TRAIN COMPONENTS 9

Architecture of EV's and HEV's – Plug-n Hybrid Electric Vehicles (PHEV)- Power train components and sizing, Gears, Clutches, Transmission and Brakes

UNIT III CONTROL OF DC AND AC DRIVES 9

DC/DC chopper based four quadrant operations of DC drives – Inverter based V/f Operation (motoring and braking) of induction motor drive system – Induction motor and permanent motor based vector control operation – Switched reluctance motor (SRM) drives

UNIT IV BATTERY ENERGY STORAGE SYSTEM 9

Battery Basics, Different types, Battery Parameters, Battery modeling, Traction Batteries

UNIT V ALTERNATIVE ENERGY STORAGE SYSTEMS 9

Fuel cell – Characteristics- Types – hydrogen Storage Systems and Fuel cell EV – Ultra capacitors

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will understand the operation of Electric vehicles and various energy storage technologies for electrical vehicles

REFERENCES

1 Iqbal Hussain, "**Electric and Hybrid Vehicles: Design Fundamentals, Second Edition"** CRC Press, Taylor & Francis Group, Second Edition (2011).

2 Ali Emadi, Mehrdad Ehsani, John M.Miller, "Vehicular Electric Power Systems", Special Indian Edition, Marcel dekker, Inc 2010.

Skill Development Employability Entrepreneurship

22272E51DP	ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide fundamental knowledge on electromagnetic interference and electromagnetic compatibility.
- To study the important techniques to control EMI and EMC.
- To expose the knowledge on testing techniques as per Indian and international standards in EMI measurement.

UNIT I INTRODUCTION 9

Definitions of EMI/EMC -Sources of EMI- Intersystems and Intrasystem- Conducted and radiated interference- Characteristics - Designing for electromagnetic compatibility (EMC)- EMC regulationtypical noise path- EMI predictions and modeling, Cross talk - Methods of eliminating interferences.

UNIT II GROUNDING AND CABLING 9

Cabling- types of cables, mechanism of EMI emission / coupling in cables –capacitive couplinginductive coupling- shielding to prevent magnetic radiation- shield transfer impedance, Grounding – safety grounds – signal grounds- single point and multipoint ground systemshybrid grounds- functional ground layout –grounding of cable shields- -guard shields- isolation, neutralizing transformers, shield grounding at high frequencies, digital grounding- Earth measurement Methods

UNIT III BALANCING, FILTERING AND SHIELDING 9

Power supply decoupling- decoupling filters-amplifier filtering –high frequency filtering- EMI filters characteristics of LPF, HPF, BPF, BEF and power line filter design -Choice of capacitors, inductors, transformers and resistors, EMC design components -shielding – near and far fieldsshielding effectiveness - absorption and reflection loss- magnetic materials as a shield, shield discontinuities, slots and holes, seams and joints, conductive gaskets-windows and coatings - grounding of shields

UNIT IVEMI IN ELEMENTS AND CIRCUITS 9

Electromagnetic emissions, noise from relays and switches, non- linearities in circuits, passive inter modulation, transients in power supply lines, EMI from power electronic equipment, EMI as combination of radiation and conduction

UNIT V ELECTROSTATIC DISCHARGE, STANDARDS AND TESTING TECHNIQUES 9

Static Generation- human body model- static discharges- ESD versus EMC, ESD protection in equipments- standards – FCC requirements – EMI measurements – Open area test site measurements and precautions- Radiated and conducted interference measurements, Control requirements and testing methods

TOTAL: 45 PERIODS

OUTCOMES:

- Recognize the sources of Conducted and radiated EMI in Power Electronic Converters and consumer appliances and suggest remedial measures to mitigate the problems
- Assess the insertion loss and design EMI filters to reduce the loss
- Design EMI filters, common-mode chokes and RC-snubber circuits measures to keep the interference within tolerable limits

REFERENCES

1. V.P. Kodali, “Engineering Electromagnetic Compatibility”, S. Chand, 1996
2. Henry W.Ott, “ Noise reduction techniques in electronic systems”, John Wiley & Sons, 1989
3. Bernhard Keiser, “Principles of Electro-magnetic Compatibility”, Artech House, Inc. (685 canton street, Norwood, MA 020062 USA) 1987
4. Bridges, J.E Milleta J. and Ricketts.L.W., “EMP Radiation and Protective techniques”, John Wiley and sons, USA 1976
5. William Duff G., & Donald White R. J, “Series on Electromagnetic Interference and Compatibility”, Vol.
6. Weston David A., “Electromagnetic Compatibility, Principles and Applications”, 1991.

ELECTIVES – V (semester-III)

22275E52AP - POWER CONDITIONING

3 1 0 4

1. INTRODUCTION 9

Introduction – Characterization of Electric Power Quality: Transients, short duration and long duration voltage variations, Voltage imbalance, waveform distortion, Voltage fluctuations, Power frequency variation, Power acceptability curves – power quality problems: poor load power factor, Non linear and unbalanced loads, DC offset in loads, Notching in load voltage, Disturbance in supply voltage – Power quality standards.

2. NON-LINEAR LOADS 9

Single phase static and rotating AC/DC converters, Three phase static AC/DC converters, Battery chargers, Arc furnaces, Fluorescent lighting, pulse modulated devices, Adjustable speed drives.

3. MEASUREMENT AND ANALYSIS METHODS 9

Voltage, Current, Power and Energy measurements, power factor measurements and definitions, event recorders, Measurement Error – Analysis: Analysis in the periodic steady state, Time domain methods, Frequency domain methods: Laplace's, Fourier and Hartley transform – The Walsh Transform – Wavelet Transform.

4. ANALYSIS AND CONVENTIONAL MITIGATION METHODS 9

Analysis of power outages, Analysis of unbalance: Symmetrical components of phasor quantities, Instantaneous symmetrical components, Instantaneous real and reactive powers, Analysis of distortion: On–line extraction of fundamental sequence components from measured samples – Harmonic indices – Analysis of voltage sag: Detorit Edison sag score, Voltage sag energy, Voltage Sag Lost Energy Index (VSLEI)- Analysis of voltage flicker, Reduced duration and customer impact of outages, Classical load balancing problem: Open loop balancing, Closed loop balancing, current balancing, Harmonic reduction, Voltage sag reduction.

5. POWER QUALITY IMPROVEMENT 9

Utility-Customer interface –Harmonic filters: passive, Active and hybrid filters –Custom power devices: Network reconfiguring Devices, Load compensation using DSTATCOM, Voltage regulation using DSTATCOM, protecting sensitive loads using DVR, UPQC – control strategies: P- Q theory, Synchronous detection method – Custom power park – Status of application of custom power devices

L = 45 T = 15 P = 0 C =4

REFERENCES:

1. Arindam Ghosh "Power Quality Enhancement Using Custom Power Devices", Kluwer Academic Publishers, 2002.
2. Heydt.G.T, "Electric Power Quality", Stars in a Circle Publications, 1994(2nd edition)
3. Dugan.R.C, " Electrical Power System Quality",TMH,2008.
4. Arrillga.A.J and Neville R.Watson, Power System Harmonics, John Wiley second Edition,2003.
5. Derek A. Paice, "Power electronic converter harmonics",John Wiley & sons, 1999.

Skill Development Employability Entrepreneurship

ELECTIVES – V (semester-III)

22275E52BP – DEREGULATED POWER SYSTEM

3 1 0 4

1. FUNDAMENTALS AND ARCHITECTURE OF POWERMARKETS 9

Deregulation of Electric utilities: Introduction-Unbundling-Wheeling- Reform motivations- Fundamentals of Deregulated Markets – Types (Future, Day-ahead and Spot) – Participating in Markets (Consumer and Producer Perspective) – bilateral markets – pool markets. Independent System Operator (ISO)-components-types of ISO - role of ISO - Lessons and Operating Experiences of Deregulated Electricity Markets in various Countries (UK, Australia, Europe, US, Asia).

2. TECHNICAL CHALLENGES 9

Total Transfer Capability – Limitations - Margins – Available transfer capability (ATC) – Procedure - Methods to compute ATC – Static and Dynamic ATC – Effect of contingency analysis – Case Study. Concept of Congestion Management – Bid, Zonal and Node Congestion Principles – Inter and Intra zonal congestion – Generation Rescheduling - Transmission congestion contracts – Case Study.

3. TRANSMISSION NETWORKS AND SYSTEM SECURITY SERVICES 9

Transmission expansion in the New Environment – Introduction – Role of transmission planning – Physical Transmission Rights – Limitations – Flow gate - Financial Transmission Rights – Losses – Managing Transmission Risks – Hedging – Investment. Ancillary Services – Introduction – Describing Needs – Compulsory and Demand-side provision – Buying and Selling Ancillary Services – Standards.

4. MARKET PRICING 9

Transmission pricing in open access system – Introduction – Spot Pricing – Uniform Pricing – Zonal Pricing – Locational Marginal Pricing – Congestion Pricing – Ramping and Opportunity Costs. Embedded cost based transmission pricing methods (Postage stamp, Contract path and MW-mile) – Incremental cost based transmission pricing methods (Short run marginal cost, Long run marginal cost) - Pricing of Losses on Lines and Nodes.

5. INDIAN POWER MARKET 9

Current Scenario – Regions – Restructuring Choices – Statewise Operating Strategies – Salient features of Indian Electricity Act 2003 – Transmission System Operator – Regulatory and Policy development in Indian power Sector – Opportunities for IPP and Capacity Power Producer. Availability based tariff – Necessity – Working Mechanism – Beneficiaries – Day Scheduling Process – Deviation from Schedule – Unscheduled Interchange Rate – System Marginal Rate – Trading Surplus Generation – Applications.

L = 45 T = 15 P = 0 C =4

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REFERENCES

1. Kankar Bhattacharya, Math H.J. Bollen and Jaap E. Daalder, "Operation of Restructured Power Systems", Kluwer Academic Publishers, 2001
2. Loi Lei Lai, "Power system Restructuring and Regulation", John Wiley sons, 2001.
3. Shahidehpour.M and Alomoush.M, "Restructuring Electrical Power Systems", Marcel Decker Inc., 2001.
4. Steven Stoft, " Power System Economics", Wiley – IEEE Press, 2002
5. Daniel S. Kirschen and Goran Strbac, " Fundamentals of Power System Economics", John Wiley & Sons Ltd., 2004.
6. Scholarly Transaction Papers and Utility web sites

		L	T	P	C
22275E52CP	**CONTROL SYSTEM DESIGN FOR POWER ELECTRONICS**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To explore conceptual bridges between the fields of Control Systems and Power Electronics
- To Study Control theories and techniques relevant to the design of feedback controllers in Power Electronics.

UNIT I MODELLING OF DC-TO-DC POWER CONVERTERS 9

Modelling of Buck Converter , Boost Converter ,Buck- Boost Converter, Cuk Converter ,Sepic Converter, Zeta Converter, Quadratic Buck Converter ,Double Buck-Boost Converter, Boost-Boost Converter General Mathematical Model for Power Electronics Devices.

UNIT II SLIDING MODE CONTROLLER DESIGN 9

Variable Structure Systems. Single Switch Regulated Systems Sliding Surfaces, Accessibility of the Sliding Surface Sliding Mode Control Implementation of Boost Converter ,Buck-Boost Converter, Cuk Converter ,Sepic Converter, Zeta Converter, Quadratic Buck Converter ,Double Buck-Boost Converter, Boost-Boost Converter.

UNIT III APPROXIMATE LINEARIZATION CONTROLLER DESIGN 9

Linear Feedback Control, Pole Placement by Full State Feedback , Pole Placement Based on Observer Design ,Reduced Order Observers , Generalized Proportional Integral Controllers, Passivity Based Control , Sliding Mode Control Implementation of Buck Converter , Boost Converter ,Buck-Boost Converter.

UNIT IV NONLINEAR CONTROLLER DESIGN 9

Feedback Linearization Isidori's Canonical Form, Input-Output Feedback Linearization, State Feedback Linearization, Passivity Based Control , Full Order Observers , Reduced Order Observers.

UNIT V PREDICTIVE CONTROL OF POWER CONVERTERS 9

Basic Concepts, Theory, and Methods, Application of Predictive Control in Power Electronics, AC-DC-AC Converter System, Faults and Diagnosis Systems in Power Converters.

TOTAL:45 PERIODS

OUTCOMES:

- Ability to understand an overview on modern linear and nonlinear control strategies for power electronics devices
- Ability to model modern power electronic converters for industrial applications
- Ability to design appropriate controllers for modern power electronics devices.

REFERENCES

1. Hebertt Sira-Ramírez, Ramón Silva-Ortigoza, "Control Design Techniques in Power Electronics Devices", Springer 2012

2. Mahesh Patil, Pankaj Rodey, "Control Systems for Power Electronics: A Practical Guide", Springer India, 2015.

Skill Development Employability Entrepreneurship

3. Blaabjerg José Rodríguez, “Advanced and Intelligent Control in Power Electronics and Drives” , Springer, 2014
4. Enrique Acha, Vassilios Agelidis, Olimpo Anaya, TJE Miller, “Power Electronic Control in Electrical Systems”, Newnes, 2002
5. Marija D. Aranya Chakrabortty, Marija , “Control and Optimization Methods for Electric Smart Grids”, Springer, 2012.

22275E52DP PRINCIPLES OF EHV TRANSMISSION **L T P C 3 0 0 3**

OBJECTIVES:

To impart knowledge on,

- Types of power transmission and configurations various parameters and voltage gradients of transmission line conductors.
- The design requirements of EHV AC and DC lines.

UNIT I INTRODUCTION 9

Standard transmission voltages-AC and DC – different line configurations– average values of line parameters – power handling capacity and line loss – costs of transmission lines and equipment – mechanical considerations in line performance.

UNIT II CALCULATION OF LINE PARAMETERS 9

Calculation of resistance, inductance and capacitance for multi-conductor lines – calculation of sequence inductances and capacitances – line parameters for different modes of propagation – effect of ground return.

UNIT III VOLTAGE GRADIENTS OF CONDUCTORS 9

Charge-potential relations for multi-conductor lines – surface voltage gradient on conductors – gradient factors and their use – distribution of voltage gradient on sub conductors of bundle - voltage gradients on conductors in the presence of ground wires on towers-I2R loss and corona loss-RIV.

UNIT IV ELECTROSTATIC FIELD AND DESIGN OF EHV LINES 9

Effect of EHV line on heavy vehicles - calculation of electrostatic field of AC lines- effect of high field on humans, animals, and plants - measurement of electrostatic fields – electrostatic Induction in unenergised circuit of a D/C line - induced voltages in insulated ground wires - electromagnetic interference, Design of EHV lines.

UNIT V HVDC LINES

Introduction- Reliability and failure issues-Design-tower, ROW, clearances, insulators, electrical and mechanical protection-Maintenance-Control and protection-D.C Electric field and Magnetic field -Regulations and guide lines-underground line design.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to model the transmission lines and estimate the voltage gradients and losses
- Ability to design EHV AC and DC transmission lines

REFERENCES

1 Rakosh Das Begamudre, "Extra High Voltage AC Transmission Engineering", Second Edition, New Age International Pvt. Ltd., 2006.
2 Pritindra Chowdhari, "Electromagnetic transients in Power System", John Wiley and Sons Inc., 2009.
3 Sunil S.Rao, "EHV-AC, HVDC Transmission & Distribution Engineering", Third Edition, Khanna Publishers, 2008.
4 William H. Bailey, Deborah E. Weil and James R. Stewart, "A Review on HVDC Power Transmission Environmental Issues", Oak Ridge National Laboratory.

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5 J.C Molburg, J.A. Kavicky, and K.C. Picel ,"A report on The design, Construction and operation of Long-distance High-Voltage Electricity Transmission Technologies" Argonne (National Laboratory) 2007.
6 "Power Engineer's Handbook", Revised and Enlarged 6th Edition, TNEB Engineers' Association, October 2002.

ELECTIVES – VI (semester-III)

22272E53AP- SOFTWARE FOR CONTROL SYSTEM DESIGN

3 1 0 4

1. INTRODUCTION TO DESIGN AND CLASSICAL PID CONTROL

Systems performance and specifications –Proportional, Integral and Derivative Controllers – Structure – Empirical tuning- Zeigler Nichols-Cohen Coon – Root Locus method – Open loop inversion-– Tuning using ISE, IAE and other performance indices.

2. COMPENSATOR DESIGN

Design of lag, lead, lead-lag compensators – Design using bode plots – Polar plots – Nichols charts – root locus and Routh Hurwitz criterion.

3. MATLAB

Introduction – function description – Data types – Tool boxes – Graphical Displays – Programs for solution of state equations – Controller design – Limitations.- simulink-Introduction – Graphical user interface – Starting – Selection of objects – Blocks – Lines - simulation – Application programs – Limitations.

4. MAPLE

Introduction – symbolic programming – Programming constructs – Data structure computation with formulae – Procedures – Numerical Programming.

5. MATLAB

Programs using MATLAB software

L = 45 T = 15 P = 0 C =4

REFERENCES

1. MAPLE V Programming guide.
2. MATLAB user manual.
3. SIMULINK user manual.
4. K.Ogatta ,"Modern Control Engineering",PHI,1997.
5. Dorf and Bishop,"Modern control Engineering', Addison Wesley, 1998.

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ELECTIVES – VI (semester-III)

22272E53BP - INDUSTRIAL POWER SYSTEM ANALYSIS AND DESIGN

LTPC 3 1 0 4

UNIT I MOTOR STARTING STUDIES 9

Introduction-Evaluation Criteria-Starting Methods-System Data-Voltage Drop Calculations-Calculation of Acceleration time-Motor Starting with Limited-Capacity Generators-Computer-Aided Analysis-Conclusions.

UNIT II POWER FACTOR CORRECTION STUDIES 9

Introduction-System Description and Modeling-Acceptance Criteria-Frequency Scan Analysis-Voltage Magnification Analysis-Sustained Overvoltages-Switching Surge Analysis-Back-to-Back Switching-Summary and Conclusions.

UNIT III HARMONIC ANALYSIS 9

Harmonic Sources-System Response to Harmonics-System Model for Computer-Aided Analysis-Acceptance Criteria-Harmonic Filters-Harmonic Evaluation-Case Study-Summary and Conclusions.

UNIT IV FLICKER ANALYSIS 9

Sources of Flicker-Flicker Analysis-Flicker Criteria-Data for Flicker analysis- Case Study-Arc Furnace Load-Minimizing the Flicker Effects-Summary.

UNIT V GROUND GRID ANALYSIS 9

Introduction-Acceptance Criteria-Ground Grid Calculations-Computer-Aided Analysis - Improving the Performance of the Grounding Grids-Conclusions.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Ramasamy Natarajan, ”Computer-Aided Power System Analysis”, Marcel Dekker Inc., 2002.

Skill Development Employability Entrepreneurship

22272E53CP- SOFT COMPUTING TECHNIQUES **L T P C**

OBJECTIVES: **3 0 0 3**

- To expose the concepts of feed forward neural networks.
- To provide adequate knowledge about feed back neural networks.
- To teach about the concept of fuzziness involved in various systems.
- To expose the ideas about genetic algorithm
- To provide adequate knowledge about of FLC and NN toolbox

UNIT I INTRODUCTION AND ARTIFICIAL NEURAL NETWORKS 9

Introduction to intelligent systems- Soft computing techniques- Conventional Computing versus Swarm Computing - Classification of meta-heuristic techniques - Properties of Swarm intelligent Systems - Application domain - Discrete and continuous problems - Single objective and multi-objective problems -Neuron-Nerve structure and synapse- Artificial Neuron and its model- activation functions-Neural network architecture- single layer and multilayer feed forward networks- Mc Culloch Pitts neuron model- perceptron model- Adaline and Madaline- multilayer perception model- back propogation learning methods- effect of learning rule coefficient -back propagation algorithm- factors affecting back propagation training-applications.

UNIT II ARTIFICIAL NEURAL NETWORKS AND ASSOCIATIVE MEMORY 9

Counter propagation network- architecture- functioning & characteristics of counter Propagation network- Hopfield/ Recurrent network configuration - stability constraints associative memory and characteristics- limitations and applications-Hopfield v/s Boltzman machine- Adaptive Resonance Theory- Architecture-classifications- Implementation and training - Associative Memory.

UNIT III FUZZY LOGIC SYSTEM 9

Introduction to crisp sets and fuzzy sets- basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modeling and control- Fuzzification inferencing and defuzzification-Fuzzy knowledge and rule bases-Fuzzy modeling and control schemes for nonlinear systems. Self organizing fuzzy logic control-Fuzzy logic control for nonlinear time delay system.

UNIT IV GENETIC ALGORITHM 9

Evolutionary programs – Genetic algorithms, genetic programming and evolutionary programming - Genetic Algorithm versus Conventional Optimization Techniques - Genetic representations and selection mechanisms; Genetic operators-different types of crossover and mutation operators - Optimization problems using

GA-discrete and continuous - Single objective and multi-objective problems - Procedures in evolutionary programming.

UNIT V HYBRID CONTROL SCHEMES 9

Fuzzification and rule base using ANN–Neuro fuzzy systems-ANFIS – Fuzzy Neuron - Optimization of membership function and rule base using Genetic Algorithm – Introduction to Support Vector Machine - Evolutionary Programming-Particle Swarm Optimization - Case study – Familiarization of NN, FLC and ANFIS Tool Box.

TOTAL : 45 PERIODS

OUTCOMES:

- Will be able to know the basic ANN architectures, algorithms and their limitations.
- Also will be able to know the different operations on the fuzzy sets.
- Will be capable of developing ANN based models and control schemes for non-linear system.
- Will get expertise in the use of different ANN structures and online training algorithm.
- Will be knowledgeable to use Fuzzy logic for modeling and control of non-linear systems.
- Will be competent to use hybrid control schemes and P.S.O and support vector Regressive.

TEXT BOOKS:

1. Laurene V. Fausett, “Fundamentals of Neural Networks: Architectures, Algorithms And Applications”, Pearson Education.
2. Timothy J. Ross, “Fuzzy Logic with Engineering Applications” Wiley India, 2008.
3. Zimmermann H.J. "Fuzzy set theory and its Applications" Springer international edition, 2011.
4. David E.Goldberg, “Genetic Algorithms in Search, Optimization, and Machine Learning”, Pearson Education, 2009.
5. W.T.Miller, R.S.Sutton and P.J.Webrose, “Neural Networks for Control” MIT Press”, 1996.
6. T. Ross, “Fuzzy Logic with Engineering Applications”, Tata McGraw Hill, New Delhi, 1995.
7. Ethem Alpaydin, “Introduction to Machine Learning (Adaptive Computation and Machine Learning Series)”, MIT Press, 2004.
8. Corinna Cortes and V. Vapnik, " Support - Vector Networks, Machine Learning ” 1995.

22272E53DP RESTRUCTURED POWER SYSTEM LTPC
OBJECTIVES: 3003

- To introduce the restructuring of power industry and market models.
- To impart knowledge on fundamental concepts of congestion management.
- To analyze the concepts of locational marginal pricing and financial transmission rights.
- To Illustrate about various power sectors in India

UNIT I INTRODUCTION TO RESTRUCTURING OF POWER INDUSTRY 9

Introduction: Deregulation of power industry, Restructuring process, Issues involved in deregulation, Deregulation of various power systems – Fundamentals of Economics: Consumer behavior, Supplier behavior, Market equilibrium, Short and long run costs, Various costs of production – Market models: Market models based on Contractual arrangements, Comparison of various market models, Electricity vis – a – vis other commodities, Market architecture, Case study.

UNIT II TRANSMISSION CONGESTION MANAGEMENT 9

Introduction: Definition of Congestion, reasons for transfer capability limitation, Importance of congestion management, Features of congestion management – Classification of congestion management methods – Calculation of ATC - Non – market methods – Market methods – Nodal pricing – Inter zonal and Intra zonal congestion management – Price area congestion management – Capacity alleviation method.

UNIT III LOCATIONAL MARGINAL PRICES AND FINANCIAL TRANSMISSION RIGHTS 9

Mathematical preliminaries: - Locational marginal pricing– Lossless DCOPF model for LMP calculation – Loss compensated DCOPF model for LMP calculation – ACOPF model for LMP calculation – Financial Transmission rights – Risk hedging functionality -Simultaneous feasibility test and revenue adequency – FTR issuance process: FTR auction, FTR allocation – Treatment of revenue shortfall – Secondary trading of FTRs – Flow gate rights – FTR and market power - FTR and merchant transmission investment.

UNIT IV ANCILLARY SERVICE MANAGEMENT AND PRICING OF TRANSMISSION NETWORK 9

Introduction of ancillary services – Types of Ancillary services – Classification of Ancillary services – Load generation balancing related services – Voltage control and reactive power support devices – Black start capability service - How to obtain ancillary service –Co-optimization of energy and reserve services - Transmission pricing – Principles – Classification – Rolled in transmission pricing methods –

Marginal transmission pricing paradigm – Composite pricing paradigm – Merits and demerits of different paradigm.

UNIT V REFORMS IN INDIAN POWER SECTOR 9

Introduction – Framework of Indian power sector – Reform initiatives - Availability based tariff – Electricity act 2003 – Open access issues – Power exchange – Reforms in the near future

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will have knowledge on restructuring of power industry
- Learners will understand basics of congestion management
- Learners will attain knowledge about locational margin prices and financial transmission rights
- Learners will understand the significance ancillary services and pricing of transmission network
- Learners will have knowledge on the various power sectors in India

REFERENCES

1 Mohammad Shahidehpour, Muwaffaq Alomoush, Marcel Dekker, “Restructured electrical power systems: operation, trading and volatility” Pub., 2001.
2 Kankar Bhattacharya, Jaap E. Daadler, Math H.J. Boolen, “Operation of restructured power systems”, Kluwer Academic Pub., 2001.
3 Paranjothi, S.R. , “Modern Power Systems” Paranjothi, S.R. , New Age International, 2017.
4 Sally Hunt,” Making competition work in electricity”, John Willey and Sons Inc. 2002.
5 Steven Stoft, “Power system economics: designing markets for electricity”, John Wiley & Sons, 2002.

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SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL& ELECTRONICS ENGINEERING

PROGRAM COURSE STRUCTURE-2022

M.TECH-POWERSYSTEMS(FULLTIME)[Regulation2022]

[For candidates admitted to M.Tech Power System program from June 2022 onwards]

Skill Development Employability Entrepreneurship

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

PROGRAMME:M.TECH-POWER SYSTEMS(FULLTIME)

CURRICULUM-REGULATION 2022

SEMESTER–I

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1.	22248S11D	Applied Mathematics for Power System Engineering	3	1	0	4
2	22272C12	SystemTheory	3	1	0	4
3	22272C13	Advanced Power System Analysis	3	1	0	4
4	22272C14	Economic Operations of Power Systems	3	1	0	4
5	22272C15	HVDC and FACTS	3	1	0	4
6	22272E16_	Elective-I	3	0	0	3
7	22272L17	Power System Simulation Laboratory	0	0	3	3
		TOTAL				**26**

SEMESTER–II

SL. NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272C21	EHV power transmission	3	1	0	4
2	22272C22	Power System Control	3	1	0	4
3	22272C23	Advanced Power System Protection	3	1	0	4
4	22272E24_	Elective –II	3	0	0	3
5	22272E25_	Elective–III	3	0	0	3
6	22272L26	Advanced Power System Simulation Laboratory	0	0	3	3
7	222TECWR	Technical Writing/Seminars	0	0	3	3
		TOTAL				**24**

SEMESTER–III

SL. NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272C31	Electrical Transients in power systems	3	1	0	4
2	22272E32_	Elective –IV	3	0	0	3
3	22272E33_	Elective –V	3	0	0	3
4	22272E34_	Elective –VI	3	0	0	3
5	22272P35	Project work Phase-I	0	0	10	10
		TOTAL				**23**

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SEMESTER–IV

SL. NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272P41	Project work Phase-II	0	0	15	15

Elective –I

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E16A	Analysis of Inverters	3	0	0	3
2.	22272E16B	Modeling and Analysis of Electrical Machines	3	0	0	3
3.	22272E16C	Advanced Power System Dynamics	3	0	0	3
4.	22272E16D	Analysis and Computation of Electromagnetic Transients in Power Systems	3	0	0	3

Elective –II

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E24A	Smart Grid	3	0	0	3
2.	22272E24B	Solar and Energy Storage Systems	3	0	0	3
3.	22272E24C	Power System Reliability	3	0	0	3
4.	22272E24D	Distributed Generation And Microgrid	3	0	0	3

Elective–III

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E25A	Wind Energy conversion Systems	3	0	0	3
2.	22272E25B	AI Techniques to Power Systems	3	0	0	3
3.	22272E25C	Electrical Distribution	3	0	0	3
4.	22272E25D	Energy Management and Auditing	3	0	0	3

Skill Development Employability Entrepreneurship

Elective –IV

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E32A	Power Electronics applications in Power Systems	3	0	0	3
2.	22272E32B	Power systemDynamics	3	0	0	3
3.	22272E32C	Electric Vehicles and Power Management	3	0	0	3
4.	22272E32D	Electromagnetic Interference and Compatibility	3	0	0	3

Elective –V

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E33A	Power Conditioning	3	0	0	3
2.	22272E33B	Deregulated Power System	3	0	0	3
3.	22272E33C	Control System Design for Power Electronics	3	0	0	3
4.	22272E33D	Principles of EHV Transmission	3	0	0	3

Elective –VI

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E34A	Software for Control system Design	3	0	0	3
2.	22272E34B	Industrial Power system Analysis and design	3	0	0	3
3.	22272E34C	Soft Computing Techniques	3	0	0	3
4.	22272E34D	Restructured Power System	3	0	0	3

TotalCredits=88

Skill Development Employability Entrepreneurship

CreditDistribution

Sem.	CoreCourses				Elective Courses		Total Credits
	Theory Courses		Practical Courses				
	Nos.	Credits	Nos.	Credits	Nos.	Credits	
I	04	16	01	03	01	03	26
II	03	12	02	06	02	06	24
III	01	04	-	-	03	09	23
IV	-	-	-	-	-	-	15
Total Credits							**88**

HOD **DEAN**

22248S11D -APPLIED MATHEMATICS for POWER SYSTEM ENGINEERING

ENGINEERING 3104

1. ADVANCEDMATRIXTHEORY 9

Matrix norms – Jordan canonical form – Generalized eigenvectors – Singular value decomposition – Pseudo inverse – Least square approximations.

2. RANDOMPROCESSES 9

Random variable, discrete, continuous types-Binomial, Poisson, normal and exponential distributions density&distribution Functions- Moments Moment Generating Functions – Notionofstochasticprocesses -Auto-correlation –Crosscorrelation.

3. LINEAR PROGRAMMING 9

Basicconcepts –GraphicalandSimplex methods –Transportationproblem – Assignment problem.

4. DYNAMIC PROGRAMMING 9

Elements of the dynamic programming model – optimality principle –Examples of dynamic programming models and their solutions.

5. INTEGRALTRANSFORMS 9

FiniteFouriertransform-Fourierseries-FinitesineTransform-Cosine transform -finite Hankel transform - definition, Transform of df/dx where p is a rootofJn(p)=0, Transform of

d2f1df d2f1dfn2f
---+------,and Transformof---- +----------

dx2 xdx dx2 x dx x2

L = 45T = 15P =0C =4

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1. Lewis.D.W.,Matrix Theory,AlliedPublishers,Chennai1995.
2. Bronson, R,MatrixOperations,SchaumsoutlineSeries,McGrawHill,NewYork. 1989.
3. Andrews,L.A.,andShivamoggiB.K.,“IntegralTransformsforEngineersand Applied Mathematicians”, Macmillan , New York ,1988.
4. Taha, H.A., " Operations research - An Introduction ", Mac Millan publishing Co., (1982).
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Skill Development Employability Entrepreneurship

22272C12-SYSTEMTHEORY

3104

1. PHYSICALSYSTEMSANDSTATEASSIGNMENT 9

Systems-electrical-mechanical-hydraulic-pneumatic-thermalsystems -modellingofsome typical systems like D.C. Machines - inverted pendulum.

2. STATESPACEANALYSIS 9

Realisation of state models - non-uniqueness - minimal realisation - balanced realisation - solution ofstate equations -state transition matrix and its properties - free and forced responses - properties - controllability and observability - stabilisability and detectability - Kalman decomposition.

3. MIMOSYSTEMS-FREQUENCYDOMAINDESCRIPTIONS 9

Properties of transfer functions - impulse response matrices - poles and zeros of transfer function matrices - critical frequencies - resonance - steady state and dynamic response - bandwidth - Nyquist plots - singular value analysis.

4. NON-LINEARSYSTEMS 9

Typesofnon-linearity-typicalexamples-equivalentlinearization-phaseplaneanalysis-limit cycles - describing functions - analysis using describing functions - jump resonance.

5. STABILITY 9

Stability concepts - equilibrium points - BIBO and asymptotic stability - direct method of Liapunov - application to non-linear problems - frequency domain stability criteria - Popov's method and its extensions.

L = 45T = 15P = 0C =4

REFERENCES

1. M.Gopal,'ModernControlEngineering',Wiley,1996.
2. J.S.Bay,'LinearStateSpaceSystems',McGraw-Hill,1999.
3. Eroni-UmezandEroni,'Systemdynamics &Control',ThomsonBrooks/ Cole,1998.
4. K.Ogatta,'ModernControlEngineering',PearsonEducation, LowPriced Edition,1997.
5. G.J.Thaler,'Automaticcontrolsystems',Jaicopublishers, 1993.
6. JohnS.Bay,'LinearStateSpaceSystems',McGraw-Hill InternationalEdition,1999.

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22272C13-ADVANCEDPOWERSYSTEMANALYSIS

3 1 0 4

OBJECTIVES:

- Tointroducedifferenttechniquesofdealingwithsparsematrixforlargescalepower systems.
- Toimpartin-depth knowledgeon differentmethodsof powerflow solutions.
- Toperformoptimalpowerflow solutionsin detail.
- Toperformshortcircuitfaultanalysisandunderstandtheconsequenceofdifferent type of faults.
- ToIllustratedifferentnumericalintegrationmethodsandfactorsinfluencing transient stability

UNITI SOLUTION TECHNIQUE 9

SparseMatrixtechniquesforlargescalepowersystems:Optimalorderingschemesforpreserving sparsity. Flexible packed storage scheme for storing matrix as compact arrays –Factorization by Bifactorization and Gauss elimination methods; Repeat solution using Left and Right factors and L and U matrices.

UNITII POWERFLOW ANALYSIS 9

Power flow equation in real and polar forms; Review of Newton's method for solution; Adjustment of P-V buses; Review of Fast Decoupled Power Flow method;Sensitivity factors for P-V bus adjustment..

UNITIII OPTIMALPOWERFLOW 9

Problem statement; Solution of Optimal Power Flow (OPF) – The gradient method, Newton's method, Linear Sensitivity Analysis; LP methods – With real power variables only – LP method with AC power flow variables and detailed cost functions; Security constrained Optimal Power Flow; Interior point algorithm; Bus Incremental costs.

UNITIV SHORTCIRCUIT ANALYSIS 9

Formation of bus impedance matrix with mutual coupling (single phase basis and three phase basis)-ComputermethodforfaultanalysisusingZBUSandsequencecomponents.Derivationof equations for bus voltages, fault current and line currents, both in sequence and phase – symmetrical and unsymmetrical faults.

UNITV TRANSIENTSTABILITYANALYSIS 9

Introduction, Numerical Integration Methods: Euler and Fourth Order Runge-Kuttamethods, Algorithm for simulation of SMIB and multi-machine system with classical synchronous machine model; Factors influencing transient stability, Numerical stability and implicit Integration methods.

L = 45T = 15P =0C =4

OUTCOMES:

- Abilitytoapplytheconcepts of sparsematrixforlargescale power systemanalysis
- Abilitytoanalyzepowersystemstudiesthatneededforthetransmissionsystem planning.

REFERENCES:

1. A.J.WoodandB.F.Wollenberg,"PowerGenerationOperationandControl",JohnWileyand sons, New York, 1996.
2. W.F.Tinney and W.S.Meyer, "Solution of Large Sparse System by Ordered Triangular Factorization" IEEE Trans. on Automatic Control, Vol : AC-18, pp:333346 Aug 1973.
3.K.Zollenkopf, "Bi-Factorization: Basic Computational Algorithm and Programming Techniques ; pp:75-96 ; Book on "Large Sparse Set of Linear Systems" Editor: J.K.Rerd,Academic Press, 1971.
4. M.A.Pai,"ComputerTechniquesinPowerSystemAnalysis",TataMcGraw-HillPublishing Company Limited, New Delhi, 2006.
5. GWStagg,A.HEl.Abiad,"ComputerMethodsinPowerSystemAnalysis", McGrawHill, 1968.
6. P.Kundur,"PowerSystem StabilityandControl", McGrawHill, 1994.

22272C14-ECONOMICOPERATIONSOFPOWERSYSTEMS

3104

1. INTRODUCTION 9

Planning and operational problems of power systems – review of economic dispatch and calculation using Bmatrix loss formula – use of participation factors in on line economic dispatch.

2. OPTIMALPOWERFLOW PROBLEM 9

Real and reactive power control variables – operation and security constraints and their limits – general OPF problem with different objective functions – formulation – cost loss minimization using Dommel and Tinney's method and SLP – development of model and algorithm – MVAR planning – optimal sitting and sizing of capacitors using SLR method – interchange evaluation using SLP.

3. HYDROTHERMALSCHEDULING 9

Problems definition and mathematical model of long and short term problems – discretization – dynamic and incremental dynamic programming – methods of local variation – hydro thermal system with pumped hydro units – solution by local variation treating pumped hydro unit for load management and spinning reserve.

4. UNITCOMMITMENT 9

Constraints in unit commitment – solution bypriorityIist method – dynamic programmingmethod – backward and forward – restricted search range.

5. MAINTENANCESCHEDULING 9

Factors considered in maintenance scheduling for generating units – turbines – boilers – introduction to maintenance scheduling using mathematical programming.

L = 45T = 15P =0C =4

REFERENCES

1. Allen J.Wood and Bruce F.Wollenberg, "Power generation and control", John Wiley & Sons, New York, 1984.
2. Krichmayer L., "Economic operation of power systems", John Wileyand sons Inc, New York, 1958.
3. KrichmayerL.K,"EconomiccontrolofInterconnectedsystems",JhonWileyandsonsInc, New York, 1959.
4. ElgerdO.I.,"Electricenergysystemstheory–anintroduction",McGrawHill,NewDelhi, 1971.

22272C15-HVDCANDFACTS

3104

OBJECTIVES:

- ToemphasistheneedforFACTScontrollers.
- Tolearnthecharacteristics,applicationsandmodelingofseriesandcontrollers.
- ToanalyzetheinteractionofdifferentFACTScontrollerandcoordination
- Toimpartknowledgeonoperation,modellingandcontrolofHVDClink.
- ToperformsteadystateanalysisofAC/DC system.

UNITI INTRODUCTION 9

Review of basics of power transmission networks-control of power flow in AC transmissionline-Analysis of uncompensated AC Transmission line- Passive reactive power compensation: Effect of series and shunt compensation at the mid-point of the line on power transfer- Need for FACTS controllers- types of FACTS controllers. Comparison of AC & DC Transmission, Applications of DC Transmission Topologies.

UNITII SVC&STATCOM 9

Configuration of SVC- voltage regulation by SVC- Modelling of SVC for load flow analysisDesign of SVC to regulate the mid-point voltage of a SMIB system- Applications Static synchronous compensator(STATCOM)- Operation of STATCOM – Voltage regulation – Power flow control with STATCOM.

UNITIII TCSC and SSSC 9

ConceptsofControlledSeriesCompensation-OperationofTCSC-AnalysisofTCSCoperation - Modelling of TCSC for load flow studies - Static synchronous series compensator (SSSC)-Operation of SSSC - Modelling of SSSC for power flow – operation of Unifiedpower flow controllers(UPFC).

UNITIV ANALYSISOFHVDCLINK 9

SimplifiedanalysisofsixpulseGraetzbridge–Charecteristics-Analysisofconverter operations–Commutationoverlap–EquivalencecircuitofbipolarDCtransmissionlink– Modes of operation – Mode ambiguity – Different firing angle controllers – Power flow control.

UNIT V POWER FLOW ANALYSIS IN AC/DC SYSTEMS 9

PerunitsystemforDCQuantities-ModellingofDClinks-SolutionofDCloadflow-Solution of AC-DC power flow – Unified and Sequential methods.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will be able torefresh on basics of power transmission networks and need forFACTS controllers
- Learners will understand the significance about different voltage source converter based FACTS controllers
- Learnerswillunderstand thesignificanceofHVDCconverters andHVDC systemcontrol
- Learnerswillattain knowledgeonAC/DCpower flowanalysis

REFERENCES

Skill Development Employability Entrepreneurship

1. MohanMathur,R.,Rajiv.K.Varma,“Thyristor–BasedFactsControllersforElectrical Transmission Systems”, IEEE press and John Wiley & Sons, Inc.

2. K.R.Padiyar,“FACTSControllersinPowerTransmissionandDistribution”,NewAge International (P) Ltd., Publishers, New Delhi, Reprint 2008.

3. K.R.Padiyar,“HVDCPowerTransmissionSystems”,NewAgeInternational(P)Ltd., New Delhi, 2002.

4. J.Arrillaga,“High VoltageDirectCurrentTransmission”,PeterPregrinus, London,1983.

5. V.K.Sood,“HVDCandFACTScontrollers-ApplicationsofStaticConvertersinPower System”, Kluwer Academic Publishers 2004

22272L17-POWER SYSTEMSIMULATIONLABORATORY 0033

OBJECTIVES:

- Tohavehandsonexperienceonvarioussystemstudiesanddifferenttechniquesused
- forsystem planningusingSoftware packages
- Toperformthedynamicanalysisofpowersystem
-

LIST OFEXPERIMENTS

1. PowerflowanalysisbyNewton-RaphsonmethodandFastdecoupled method

2. Transientstabilityanalysisofsinglemachine-infinitebussystemusingclassicalmachine model

3. Contingencyanalysis: Generator shiftfactors and lineoutagedistribution factors

4. Economicdispatchusinglambda-iterationmethod

5. Unitcommitment:Priority-listschemesanddynamic programming

6. StateEstimation(DC)

7. Analysisof switchingsurgeusingEMTP: Energisationof alongdistributed-parameter line

8. Analysisof switchingsurge usingEMTP :Computation oftransient recoveryvoltage

9. Simulationand ImplementationofVoltageSource Inverter

10. DigitalOverCurrentRelaySettingandRelayCoordinationusingSuitablesoftware packages 11

Co-ordination of over-current and distance relays for radial line protection

TOTAL: 60 PERIODS

OUTCOMES:

- UponCompletionofthe course,thestudents willbeable to:
- Analyzethepower flow usingNewton-RaphsonmethodandFastdecoupled method.
- Performcontingencyanalysis&economic dispatch
- SetDigitalOverCurrent RelayandCoordinateRelay

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22272C21-EHVPOWERTRANSMISSION

3104

1. INTRODUCTION 9

Standard transmission voltages – different configurations of EHV and UHV lines – averagevaluesoflineparameters – powerhandlingcapacityand lineloss – costs oftransmission lines and equipment – mechanical considerations in line performance.

2. CALCULATIONOFLINEPARAMETERS 9

Calculation of resistance, inductance and capacitance for multi-conductor lines – calculation of sequence inductances and capacitances – line parameters for different modes of propagation – resistance and inductance of ground return, numerical example involving a typical 400/220kV line using line constant program.

3. VOLTAGEGRADIENTS OFCONDUCTORS 9

Charge-potential relations for multi-conductor lines – surface voltage gradient on conductors – gradient factors and their use – distribution of voltage gradient on sub conductorsof bundle - voltage gradients on conductors in the presence of ground wires on towers.

4. CORONAEFFECTS 9

Power losses and audible losses: I R loss and corona loss - audible noise generation and characteristics - limits for audible noise - Day-Night equivalent noise level- radio interference: corona pulse generation and properties - limits for radio interference fields

5. ELECTROSTATICFIELDOFEHVLINES 9

Effect of EHV line on heavy vehicles - calculation of electrostatic field of AC lines-effect of high field on humans, animals, and plants - measurement of electrostatic fields - electrostatic Inductionin unenergised circuitof a D/Cline -induced voltagesininsulated ground wires - electromagnetic interference

L = 45T = 15P =0C =4

REFERENCES

1. RakoshDasBegamudre,"ExtraHighVoltageACTransmissionEngineering",Second Edition, New Age International Pvt. Ltd., 1990.
2. PowerEngineer'sHandbook,RevisedandEnlarged6thEdition,TNEBEngineers'Association, October 2002.
3. MicrotranPowerSystemAnalysisCorporation,MicrotranReferenceManual,Vancouver Canada. (Website: www.microtran.com).

22272C22 POWERSYSTEM CONTROL 3104

1. AUTOMATICGENERATION CONTROL 9

Plant and system level control problem – ALFC of single area system modeling state and transient response – EDC control loop – ALFC of multi area system – modeling – static and transient response of two area system development of state variable model – two area system – AGC system design Kalman's method.

2. AUTOMATICVOLTAGECONTROL 9

Modeling of AVR loop – components – dynamic and static analysis – stability compensation – system level voltage control using OLTC, capacitor and generator voltages – expert system application for system voltage control.

3. SECURITYCONTROL CONCEPT 9

System operating states by security control functions – monitoring evaluation of system state by contingency analysis – corrective controls (preventive, emergency and restorative) – islanding scheme.

4. STATEESTIMATION 9

Least square estimation – basic solution – sequential form of solution – static state estimation of power system by different algorithms – tracking state estimation of power system-computation consideration – external equivalency. Treatment of bad data and on line load flow analysis.

5. COMPUTERCONTROLOFPOWERSYSTEM 9

Energy control center – various levels – national – regional and state level SCADA system – computer configuration – functions, monitoring, data acquisition and controls – EMS system–softwareinEMSsystem.Expertsystemapplicationsforpowersystemoperation.

L = 45T = 15P= 0C =4

REFERENCES

1. Kundur.P.,"powersystemstabilityandcontrol", McGrawHill,1994.
2. AndersonP.M.,andFouadA.A,"powersystemcontrolandstability",Galgotiapublication,New Delhi, 1981.
3. TaylorC.W.,"powersystemsvoltagestability",McGrawHill,NewDelhi,1993.
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7. ElgerdO.L.,"Elctricenergysystemstheory– anintroduction",McGrawHill,NewDelhi, 1971.

22272C23-ADVANCEDPOWERSYSTEMPROTECTION

3104

OBJECTIVES:

- Toillustrateconceptsoftransformerprotection
- Todescribeaboutthevarious schemesofOvercurrentprotection
- Toanalyzedistanceandcarrierprotection
- TofamiliarizetheconceptsofGeneratorprotectionandNumericalprotection

UNITI OVERCURRENT&EARTHFAULTPROTECTION 9

Zones of protection – Primary and Backup protection – operating principles and Relay Construction - Time – Current characteristics-Current setting – Time setting-Over current protective schemes –Concept of Coordination - Protection of parallel / ring feeders – Reverse power or directional relay –Polarisation Techniques – Cross Polarisation – Quadrature Connection -Earth fault and phase fault protection - Combined Earth fault and phase fault protection scheme - Phase fault protective - scheme directional earth fault relay - Static over currentrelays –Numericalover–currentprotection;numericalcoordinationexampleforaradial feeder

UNITII TRANSFORMER&BUSBAR PROTECTION 9

Types of transformers –Types of faults in transformers- Types of Differential Protection – High Impedance – External fault with one CT saturation – Actual behaviors of a protective CT – Circuit model of a saturated CT - Need for high impedance – Disadvantages - Percentage Differential Bias Characteristics – Vector group & its impact on differential protection - Inrush phenomenon – Zero Sequence filtering – High resistance Ground Faults in Transformers – Restricted Earth fault Protection - Inter-turn faults in transformers – Incipient faults in transformers - Phenomenon of overfluxing in transformers – Transformer protection application chart. Differential protection of busbars external and internal fault - Supervisoryrelay-protection of three – Phase busbars – Numerical examples on design of high impedance busbar differential scheme –Biased Differential Characteristics – Comparison between Transformer differential & Busbar differential.

UNITIII DISTANCEANDCARRIERPROTECTIONOFTRANSMISSIONLINES 9

Drawbackofover–Currentprotection–Introductiontodistancerelay–Simpleimpedancerelay – Reactance relay – mho relays comparison of distance relay – Distance protection of a three – Phaseline-reasons forinaccuracyofdistancerelayreach -ThreesteppeddistanceprotectionTrip contact configuration for the three - Stepped distance protection - Three-stepped protection f three-phase line against all ten shunt faults - Impedance seen from relay side - Three-stepped protection of double end fed lines-need for carrier – Aided protection – Various options for a carrier –Coupling and trapping the carrier into the desired line section - Unit type carrier aided directional comparison relaying – Carrier aided distance schemes for acceleration of zone II; numerical example for a typical distance protection scheme for a transmission line.

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UNITIV GENERATORPROTECTION

Electrical circuit of the generator –Various faults and abnormal operating conditions – Stator Winding Faults – Protection against Stator(earth) faults – third harmonic voltage protection – Rotor fault – Abnormal operating conditions - Protection against Rotor faults – Potentiometer Method – injection method – Pole slipping – Loss of excitation – Protection against Mechanical faults; Numerical examples for typical generator protection schemes

UNITVNUMERICALPROTECTION

Introduction–Blockdiagramofnumericalrelay-Samplingtheorem-Correlationwithareference (LES) technique-Digital filtering-numerical over - Current protection– Numerical transformer differential protection-Numerical distance protection of transmission line

L = 45T = 15P =0C =4

OUTCOMES:

- Learnerswillbeabletounderstandthevariousschemesavailablein Transformer
- protection
- LearnerswillhaveknowledgeonOvercurrentprotection.
- Learnerswillattain knowledgeabout Distanceand Carrierprotection intransmission lines.
- Learnerswillunderstand theconceptsof Generatorprotection.
- Learnerswillattainbasicknowledgeonsubstationautomation.

REFERENCES

1 Y.G. Paithankar and S.R Bhide, "Fundamentals of Power System Protection", Prentice-Hallof India, 2003

2 BadriRamandD.N.Vishwakarma,"PowerSystemProtectionandSwitchgear",Tata McGraw-Hill Publishing Company, 2002.

3 T.S.M.Rao,"DigitalRelay/Numericalrelays",TataMcGrawHill,New Delhi,1989.

4 P.Kundur,"PowerSystemStabilityandControl",McGraw-Hill,1993.

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22272L26ADVANCEDPOWERSYSTEMSIMULATION LABORATORY

LTPC

0 0 4 2

OBJECTIVES:

- ToanalyzetheeffectofFACTS controllers byperformingsteadystateanalysis.
- Tohavehandsonexperienceon different windenergyconversion technologies

LIST OFEXPERIMENTS

1. Small-signalstabilityanalysisofsinglemachine-infinitebussystemusingclassical machine model
2. Small-signalstabilityanalysisofmulti-machineconfigurationwithclassicalmachine model
3. Inductionmotorstartinganalysis
4. Load flowanalysisoftwo-bussystemwithSTATCOM
5. Transientanalysisoftwo-bussystemwithSTATCOM
6. AvailableTransfer Capabilitycalculation usingan existingloadflowprogram
7. Studyof variable speedwind energyconversion system- DFIG
8. Studyof variable speedwind energyconversion system- PMSG
9. Computation ofharmonic indices generated byarectifier feedingaR-Lload
10. Designofactive filterformitigatingharmonics

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22272C31-ELECTRICALTRANSIENTSINPOWERSYSTEMS

3104

1. TRAVELLINGWAVESONTRANSMISSION LINE 9

Lumped and Distributed Parameters – Wave Equation – Reflection, Refraction, Behavior of Travelling waves at the line terminations – Lattice Diagrams – Attenuation and Distortion – Multi-conductor system and Velocity wave.

2. COMPUTATIONOFPOWERSYSTEMTRANSIENTS 9

Principle of digital computation – Matrix method of solution, Modal analysis, Z transforms, Computation using EMTP – Simulation of switches and non-linear elements.

3. LIGHTNING,SWITCHINGANDTEMPORARYOVERVOLTAGES 9

Lightning: Physical phenomena of lightning – Interaction between lightning and power system – Factors contributing to line design – Switching: Short line or kilometric fault – Energizing transients - closing and re-closing of lines - line dropping, load rejection - Voltage induced by fault – Very Fast Transient Overvoltage (VFTO)

4. BEHAVIOUROFWINDINGUNDERTRANSIENT CONDITION 9

Initial and Final voltage distribution - Winding oscillation - traveling wave solution - Behavior of the transformer core under surge condition – Rotating machine – Surge in generator and motor

5. INSULATIONCO-ORDINATION 9

Principle of insulation co-ordination in Air Insulated substation (AIS) and Gas Insulated Substation (GIS), insulation level, statistical approach, co-ordination between insulation and protection level –overvoltage protective devices – lightning arresters, substation earthing.

L = 45T = 15P=0C =4

REFERENCES

1. PritindraChowdhari,“ElectromagnetictransientsinPowerSystem”,JohnWileyandSons Inc., 1996.
2. Allan Greenwood, “ElectricalTransientsinPower System”, Wiley&SonsInc.New York, 1991.
3. KlausRagaller,“SurgesinHighVoltageNetworks”,PlenumPress,NewYork,1980.
4. RakoshDasBegamudre,“ExtraHighVoltageACTransmissionEngineering”,(Secondedition) Newage International (P) Ltd., New Delhi, 1990.
5. NaiduMSandKamarajuV,“HighVoltageEngineering”,TataMcGraw-HillPublishing Company Ltd., New Delhi, 2004.
6. IEEEGuideforsafetyinACsubstationgroundingIEEEStandard80-2000.
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22272E16A– ANALYSISofINVERTERS **L T PC**
3 0 0 3

OBJECTIVES:

- Todeterminetheoperationandcharacteristicsofcontrolledrectifiers.
- Toapplyswitchingtechniques and basic topologies of DC-DC switchingregulators.
- Tointroducethedesignofpower convertercomponents.
- Toprovide anin depthknowledgeaboutresonantconverters.
- TocomprehendtheconceptsofAC-ACpower convertersandtheirapplications.

UNITI SINGLEPHASE&THREEPHASECONVERTERS 9

Principle of phase controlled converter operation – single-phase full converter and semi-converter(RL,RLEload)- singlephasedual converter – Threephaseoperation full converter and semi-converter (R,RL,RLE load) – reactive power – power factor improvement techniques – PWM rectifiers.

UNITII DC-DCCONVERTERS 9

Limitations of linear power supplies, switched mode power conversion, Non-isolated DC-DC converters: operation and analysis of Buck, Boost, Buck-Boost, Cuk& SEPIC – undercontinuous and discontinuous operation – Isolated converters: basic operation of Flyback, Forward and Push-pull topologies.

UNITIII DESIGNOFPOWERCONVERTERCOMPONENTS 9

Introduction to magnetic materials- hard and soft magnetic materials –types of cores , copper windings – Design of transformer –Inductor design equations –Examples of inductor design for buck/flyback converter-selection of output filter capacitors – selection of ratings for devices – input filter design.

UNITIV RESONANTDC-DC CONVERTERS 9

Switching loss, hard switching, and basic principles of soft switching- classification of resonant converters- load resonant converters – series and parallel – resonant switch converters – operation and analysis of ZVS, ZCS converters comparison of ZCS/ZVS-Introduction to ZVT/ZCT PWM converters.

UNITVAC-ACCONVERTERS 9

Principle of on-off and phase angle control – single phase ac voltage controller – analysis with R & RL load – Three phase ac voltage controller – principle of operation of cyclo converter – single phase and three phase cyclo converters – Introduction to matrix converters.

TOTAL : 45 PERIODS

OUTCOMES:

Atthe end ofthe coursethestudent will be able to:

- Analyzevarioussinglephaseandthreephasepower converters
- Selectanddesigndc-dcconvertertopologiesforabroadrangeofpowerconversion applications.
- Developimprovedpower convertersforanystringentapplicationrequirements.
- Design ac-acconvertersforvariablefrequencyapplications.

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TEXT BOOKS:

1 Ned Mohan,T.MUndeland and W.P Robbin, “Power Electronics: converters, Application and design” John Wiley and sons.Wiley India edition, 2006.

2 RashidM.H.,“PowerElectronicsCircuits,DevicesandApplications",PrenticeHall India, Third Edition, New Delhi, 2004.

3 P.C.Sen,“ModernPowerElectronics”,WheelerPublishingCo,FirstEdition,NewDelhi, 1998.

4 P.S.Bimbra,“PowerElectronics”,KhannaPublishers,EleventhEdition,2003

5 Simon Ang, Alejandro Oliva, “Power-Switching Converters, Second Edition, CRC Press, Taylor & Francis Group, 2010

6 V.Ramanarayanan, “CoursematerialonSwitched modepowerconversion”,2007

7 Alex Van den Bossche and VencislavCekovValchev, “Inductors and TransformersforPowerElectronics”, CRC Press, Taylor & Francis Group, 2005

8 W.G.HurleyandW.H.Wolfle,“TransformersandInductorsforPowerElectronics Theory, Design and Applications”, 2013 John Wiley & Sons Ltd.

9 Marian.K.KazimierczukandDariuszCzarkowski,“ResonantPowerConverters”,John Wiley & Sons limited, 2011

22272E16B-MODELLINGAND ANALYSIS OFELECTRICAL MACHINES

3104

UNITIPRINCIPLESOFELECTROMAGNETICENERGYCONVERSION
Generalexpressionofstoredmagneticenergy-co-energyandforce/torque-exampleusing single and doubly excited system.

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UNITII BASICCONCEPTSOFROTATING MACHINES
Calculation of air gap M.M.F. - per phase machine inductance using physical machine data - voltage and torque equation of D.C. machine - three phase symmetrical induction machine and salient pole synchronous machines in phase variable form.

UNITIIIINTRODUCTIONTOREFERENCEFRAMETHEORY
Static and rotating reference frames - transformation relationships - examples using static symmetrical three phase R, R-L, R-L-M and R-L-C circuits - application of reference frame theory to three phase symmetrical induction and synchronous machines - dynamic direct and quadrature axis model in arbitrarily rotating reference frames - voltage and torque equations - derivation of steady state phasor relationship from dynamic model - generalized theory of rotating electrical machine and Kron's primitive machine.

UNITIVDETERMINATIONOFSYNCHRONOUSMACHINEDYNAMIC EQUIVALENT CIRCUIT PARAMETERS
Standard and derived machine time constants - frequency response test - analysis and dynamic modeling of two phase asymmetrical induction machine and single phase induction machine.

UNITVSPECIALMACHINES
Permanent magnet synchronous machine - surface permanent magnet (square and sinusoidalback E.M.F. type) and interior permanent magnet machines - construction and operatingprinciple - dynamic modeling and self controlled operation - analysis of switch reluctancemotors.

L = 45T = 15P =0C =4

TEXT BOOKS

1. CharlesKingsley,A.E.FitzgeraldJr.andStephenD.Umans,'ElectricMachinery',Tata McGraw-Hill, Fifth Edition, 1992.
2. R.Krishnan,'ElectricMotor&Drives:Modelling,AnalysisandControl',PrenticeHallof India, 2001.

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1. C.V.Jones,'TheUnifiedTheoryof ElectricalMachines',Butterworth,1967.
2. T.J.E.Miller,'BrushlessPermanentMagnetandReluctanceMotorDrives'Clarendon Press, 1989.

22272E16CADVANCED POWER SYSTEM DYNAMICS LTPC

OBJECTIVES: 3003

- Toperformtransientstabilityanalysisusingunifiedalgorithm.
- Toimpartknowledgeonsub-synchronousresonanceand oscillations
- Toanalyzevoltagestabilityprobleminpower system.
- Tofamiliarizethemethodsoftransientstability enhancement

UNITITRANSIENTSTABILITYANALYSIS 9

Review of numerical integration methods: Euler and Fourth Order Runge-Kutta methods, Numerical stability and implicit methods, Interfacing of Synchronous machine (variable voltage) model to the transient stability algorithm (TSA) with partitioned – explicit and implicit approaches – Interfacing SVC with TSA-methods to enhance transient stability

UNIT II UNIFIEDALGORITHMFORDYNAMICANALYSISOFPOWER SYSTEMS 9

Need for unified algorithm- numerical integration algorithmic steps-truncation error-variable step size – handling the discontinuities- numerical stability- application of the algorithm for transient. Mid-term and long-term stability simulations

UNIT III SUBSYSNCHRONOUSRESONANCE(SSR)ANDOSCILLATIONS 9

Sub synchronous Resonance (SSR) – Types of SSR - Characteristics of series –Compensated transmission systems –Modeling of turbine-generator-transmission network- Self-excitation due to induction generator effect – Torsional interaction resulting in SSR – Methods of analyzing SSR – Numerical examples illustrating instability of subsynchronous oscillations – time-domain simulation of subsynchronous resonance – EMTP with detailed synchronous machine model- Turbine Generator Torsional Characteristics: Shaft system model – Examples of torsional characteristics – Torsional Interaction with Power System Controls: Interaction with generator excitationcontrols – Interactionwith speed governors – Interaction with nearby DC converters

UNIT IV TRANSMISSION, GENERATION AND LOAD ASPECTS OF VOLTAGE STABILITY ANALYSIS 9

Review of transmission aspects – Generation Aspects: Review of synchronous machine theory – Voltage and frequency controllers – Limiting devices affecting voltage stability – Voltage-reactive power characteristics of synchronous generators – Capability curves – Effect of machine limitation on deliverable power – Load Aspects – Voltage dependence of loads – Load restoration dynamics – Induction motors – Load tap changers – Thermostatic load recovery – General aggregate load models.

UNIT V ENHANCEMENTOFTRANSIENTSTABILITYANDCOUNTERMEASURES FOR SUB SYNCHRONOUS RESONANCE 9

Principle behind transient stability enhancement methods: high-speed fault clearing, reduction of transmission system reactance, regulated shunt compensation, dynamic braking, reactor switching, independent pole-operation of circuit-breakers, single-pole switching, fast-valving, high-speed excitation systems; NGH damper scheme.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will be able to understand the various schemes available in Transformerprotection
- LearnerswillhaveknowledgeonOvercurrent protection.
- LearnerswillattainknowledgeaboutDistanceandCarrierprotectionintransmission lines.
- LearnerswillunderstandtheconceptsofBusbarprotection.
- Learnerswillattainbasicknowledgeonnumericalprotectiontechniques

REFERENCES

1 R.Ramnujam,”PowerSystemDynamicsAnalysisandSimulation”,PHILearning Private Limited, New Delhi, 2009

2 T.V.CutsemandC.Vournas,“VoltageStabilityofElectricPowerSystems”,Kluwer publishers,1998

3 P.Kundur,“PowerSystemStabilityandControl”,McGraw-Hill, 1993.

4 H.W. Dommel and N.Sato, "Fast Transient Stability Solutions," IEEE Trans., Vol. PAS-91, pp, 1643-1650, July/August 1972.

5 Roderick J . Frowd and J. C. Giri, “Transient stability and Long term dynamics unified”, IEEE Trans., Vol 101, No. 10, October 1982.

6 M.Stubbe, A.Bihain,J.Deuse, J.C.Baader, “A New Unified software program for the study of the dynamic behaviour of electrical power system” IEEE Transaction,Power Systems, Vol.4.No.1,Feb:1989 Pg.129 to 138

22272E16D **ANALYSIS AND COMPUTATION OF ELECTROMAGNETICTRANSIENTSINPOWERSYSTEMS**

LTPC

OBJECTIVES: **3003**

- Tounderstandthevarioustypesoftransientsanditsanalysisinpower system.
- Tolearnaboutmodelingandcomputationalaspectstransients computation

UNITI REVIEWOFTRAVELLINGWAVE PHENOMENA 9

Lumped and Distributed Parameters – Wave Equation – Reflection, Refraction, Behaviourof Travelling waves at the line terminations – Lattice Diagrams – Attenuation and Distortion.

UNIT II LIGHTNING,SWITCHINGANDTEMPORARYOVERVOLTAGES 9

Lightning overvoltages: interaction between lightning and power system- ground wire voltage and voltage across insulator; switching overvoltage: Short line or kilometric fault, energizing transients - closing and re-closing of lines, methods of control; temporary overvoltages: line dropping, load rejection; voltage induced by fault; very fast transient overvoltage (VFTO).

UNIT III PARAMETERSANDMODELINGOFOVERHEADLINES 9

Review of line parameters for simple configurations: series resistance, inductance and shunt capacitance; bundle conductors : equivalent GMR and equivalent radius;modal propagation in transmission lines: modes on multi-phase transposed transmission lines, α-β-0 transformation and symmetrical components transformation, modal impedances; analysis of modes on untransposed lines; effect of ground return and skin effect; transposition schemes;

UNITV FASTTRANSIENTSPHENOMENONINAISANDGIS 9

Digital computation of line parameters: why line parameter evaluation programs? Salient features of a typical line parameter evaluation program; constructional features of that affect transmission line parameters;line parameters for physical and equivalent phase conductors elimination of ground wiresbundling of conductors; principle of digital computation oftransients:features andcapabilities ofelectromagnetictransientsprogram; steady state and time step solution modules: basic solution methods; case studies on simulation of various types of transients

TOTAL:45PERIODS

OUTCOMES:

- Learnerswillbeabletomodelover headlines,cablesandtransformers.
- Learnerswillbeabletoanalyzepowersystem transients.

REFERENCES

1 AllanGreenwood,“ElectricalTransientsinPowerSystem”,Wiley&SonsInc.NewYork, 1991.

2 R.Ramanujam,“ComputationalElectromagneticTransients:Modeling,SolutionMethods and Simulation”, I.K. International Publishing House Pvt. Ltd, New Delhi, 2014.

3 NaiduMSandKamarajuV,“HighVoltageEngineering”,TataMcGraw-HillPublishing Company Ltd., New Delhi, 2004.

22272E24A SMARTGRID LTPC

3003

OBJECTIVES:

- ToStudyaboutSmartGridtechnologies,differentsmartmetersandadvancedmetering infrastructure.
- TofamiliarizethepowerqualitymanagementissuesinSmartGrid.
- TofamiliarizethehighperformancecomputingforSmartGrid applications

UNIT IINTRODUCTIONTOSMART GRID 9

Evolution ofElectricGrid, Concept, Definitions andNeed forSmart Grid, Smart grid drivers, functions, opportunities, challenges andbenefits, Difference between conventional &Smart Grid, National and International Initiatives in Smart Grid.

UNIT II SMARTGRIDTECHNOLOGIES 9

Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/Var control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV).

UNIT III SMARTMETERSANDADVANCEDMETERINGINFRASTRUCTURE 9

Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU), Intelligent Electronic Devices (IED) & their application for monitoring & protection.

UNIT IV POWERQUALITYMANAGEMENTINSMART GRID 9

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

UNITV HIGHPERFORMANCECOMPUTINGFORSMART GRID APPLICATIONS 9

Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

TOTAL : 45 PERIODS

Skill Development Employability Entrepreneurship

OUTCOMES:

- LearnerswilldevelopmoreunderstandingontheconceptsofSmartGridand its present developments.
- LearnerswillstudyaboutdifferentSmartGrid technologies.
- Learnerswillacquireknowledgeaboutdifferentsmartmetersandadvanced metering infrastructure.
- LearnerswillhaveknowledgeonpowerqualitymanagementinSmartGrids
- LearnerswilldevelopmoreunderstandingonLAN,WANandCloud Computing for Smart Grid application

REFERENCES

1 StuartBorlase“SmartGrid:Infrastructure,TechnologyandSolutions”,CRCPress 2012.

2 JanakaEkanayake,NickJenkins,KithsiriLiyanage,JianzhongWu,AkihikoYokoyama, “Smart Grid: Technology and Applications”, Wiley 2012.

3 VehbiC.Güngör,DilanSahin,TaskinKocak,SalihErgüt,ConcettinaBuccella,Carlo Cecati, and Gerhard P. Hancke, “Smart Grid Technologies: Communication TechnologiesandStandards”IEEETransactionsOnIndustrialInformatics,Vol.7, No. 4, November 2011.

4 Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang “Smart Grid – The NewandImprovedPowerGrid:ASurvey”,IEEETransactiononSmartGrids,vol.14, 2012.

22272E24B SOLARANDENERGYSTORAGESYSTEMS LTPC

3003

OBJECTIVES:

- ToStudyaboutsolarmodulesandPVsystem designandtheirapplications
- ToDealwith gridconnectedPVsystems
- ToDiscussaboutdifferentenergystorage systems

UNITIINTRODUCTION 9

Characteristicsofsunlight–semiconductorsandP-Njunctions–behaviorofsolarcells– cell properties – PV cell interconnection

UNIT II STANDALONEPV SYSTEM 9

Solar modules – storage systems – power conditioning and regulation - MPPT- protection – stand alone PV systems design – sizing

UNIT III GRIDCONNECTEDPV SYSTEMS 9

PVsystemsinbuildings–designissuesforcentralpowerstations–safety–Economic aspect – Efficiency and performance - International PV programs

UNIT IV ENERGYSTORAGE SYSTEMS 9

Impact of intermittent generation – Battery energy storage – solar thermal energy storage– pumped hydroelectric energy storage

UNITV APPLICATIONS 9

Waterpumping–batterychargers–solarcar–direct-driveapplications–Space–Telecommunications.

TOTAL:45PERIODS

OUTCOMES:

- Studentswilldevelopmoreunderstandingonsolarenergystoragesystems
- Studentswilldevelopbasicknowledgeonstandalone PV system
- Studentswillunderstandtheissuesingridconnected PV systems
- Studentswillstudyaboutthemodelingofdifferentenergystoragesystems and their performances
- Studentswillattainmoreondifferentapplicationsofsolarenergy

REFERENCES

1 SolankiC.S.,"SolarPhotovoltaics:Fundamentals,TechnologiesAndApplications", PHI LearningPvt. Ltd.,2015.

Skill Development Employability Entrepreneurship

2 Stuart R.Wenham, Martin A.Green, Muriel E. Watt and Richard Corkish, “Applied Photovoltaics”, 2007,Earthscan, UK. Eduardo Lorenzo G. Araujo, “Solar electricity engineering of photovoltaicsystems”, Progensa,1994.

3 FrankS.Barnes&JonahG.Levine,“LargeEnergystorageSystemsHandbook”,CRC Press, 2011.

4 McNeils,Frenkel,Desai,“Solar&WindEnergyTechnologies”,WileyEastern, 1990

5 S.P.Sukhatme,“SolarEnergy”,TataMcGrawHill,1987.

22272E24C POWERSYSTEM RELIABILITY LTPC

OBJECTIVES: 3003

- TointroducestheobjectivesofLoad forecasting.
- TostudythefundamentalsofGenerationsystem,transmissionsystemand Distribution system reliability analysis
- ToillustratethebasicconceptsofExpansion planning

UNITI LOADFORECASTING 9

Objectivesofforecasting-Loadgrowthpatternsandtheirimportanceinplanning-Load forecasting Based on discounted multiple regression technique-Weather sensitive load forecasting-Determination of annual forecasting-Use of AI in load forecasting.

UNIT II GENERATIONSYSTEMRELIABILITYANALYSIS 9

Probabilisticgenerationandloadmodels-DeterminationofLOLPandexpectedvalueof demand not served –Determination of reliability of ISO and interconnected generation systems

UNIT III TRANSMISSIONSYSTEMRELIABILITYANALYSIS 9

Deterministic contingency analysis-probabilistic load flow-Fuzzy load flow probabilistic transmissionsystemreliabilityanalysis-DeterminationofreliabilityindiceslikeLOLPand expected value of demand not served

UNIT IV EXPANSIONPLANNING 9

Basicconceptsonexpansionplanning-procedurefollowedforintegratetransmission system planning, current practice in India-Capacitor placer problem in transmission system and radial distributions system.

UNITV DISTRIBUTIONSYSTEMPLANNINGOVERVIEW 9

Introduction, sub transmission lines and distribution substations-Design primary and secondarysystems-distributionsystemprotectionandcoordinationofprotectivedevices.

TOTAL:45 PERIODS

OUTCOMES:

- Studentswilldeveloptheabilitytolearnaboutloadforecasting.
- StudentswilllearnaboutreliabilityanalysisofISOandinterconnected systems.
- StudentswillunderstandtheconceptsotContingencyanalysisandProbabilistic Load flow Analysis
- StudentswillbeabletounderstandtheconceptsofExpansionplanning
- StudentswillhaveknowledgeonthefundamentalconceptsoftheDistribution system planning

Skill Development Employability Entrepreneurship

REFERENCES

1 RoyBillinton&RonaldN.Allan,“ReliabilityEvaluationofPowerSystems”Springer Publication,

2 R.L.Sullivan,“PowerSystemPlanning”,TataMcGrawHillPublishingCompanyLtd 1977.

3 X.Wang&J.R.McDonald,“ModernPowerSystemPlanning”,McGrawHillBook Company 1994.

4 T.Gonen,“ElectricalPowerDistributionEngineering”,McGrawHillBookCompany 1986.

5 B.R.Gupta,“GenerationofElectricalEnergy”,S.ChandPublications1983.

22272E24D DISTRIBUTEDGENERATIONANDMICROGRID **L TPC**

OBJECTIVES: **3003**

- Toillustratetheconceptofdistributedgeneration
- Toanalyzetheimpactofgridintegration.
- TostudyconceptofMicrogridandits configuration

UNITI INTRODUCTION 9

Conventional powergeneration:advantages and disadvantages, Energy crises, Non-conventional energy (NCE) resources: review of Solar PV, Wind Energy systems, Fuel Cells, micro-turbines, biomass, and tidal sources.

UNIT II DISTRIBUTEDGENERATIONS(DG) 9

Concept of distributed generations, topologies, selection of sources, regulatory standards/ framework, Standards forinterconnectingDistributedresources to electric power systems: IEEE 1547. DG installation classes, security issues in DG implementations. Energy storage elements: Batteries, ultra-capacitors, flywheels. Captive power plants

UNIT III IMPACTOFGRIDINTEGRATION 9

Requirements for grid interconnection, limits on operational parameters,: voltage, frequency,THD,responsetogridabnormaloperatingconditions,islandingissues.Impact of grid integration with NCE sources on existing power system: reliability, stability and power quality issues.

UNIT IV BASICSOFA MICROGRID 9

Concept and definition of microgrid, microgrid drivers and benefits, review of sources of microgrids, typical structure and configuration of a microgrid, AC and DC microgrids,Power Electronics interfaces in DC and AC microgrids

UNITV CONTROLANDOPERATIONOFMICROGRID 9

Modesofoperationandcontrolofmicrogrid:gridconnectedandislandedmode,Activeand reactive power control, protection issues, anti-islanding schemes: passive, active and communication based techniques, microgrid communication infrastructure, Power quality issues in microgrids, regulatory standards, Microgrid economics, Introduction to smart microgrids.

TOTAL:45PERIODS

OUTCOMES:

- Learnerswillattainknowledgeonthevariousschemesofconventionaland nonconventional power generation.

- Learnerswillhaveknowledgeonthetopologiesandenergysourcesofdistributed generation.
- Learnerswilllearnabouttherequirementsforgridinterconnectionanditsimpact with NCE sources
- Learnerswillunderstandthefundamentalconceptof Microgrid.

REFERENCES

1 AmirnaserYezdani,andRezaIravani,“VoltageSourceConvertersinPowerSystems: Modeling, Control and Applications”, IEEE John Wiley Publications, 2010.

2 DorinNeacsu,“PowerSwitchingConverters:MediumandHighPower”,CRCPress, Taylor & Francis, 2006

3 ChetanSinghSolanki,“SolarPhotoVoltaics”,PHIlearningPvt.Ltd.,NewDelhi,2009

4 J.F.Manwell,J.G.McGowan“WindEnergyExplained,theorydesignand applications”, Wiley publication 2010.

5 D.D.HallandR.P.Grover,“BiomassRegenerableEnergy”,JohnWiley,NewYork, 1987.

6 JohnTwidellandTonyWeir,“RenewableEnergyResources”TyalorandFrancis Publications, Second edition 2006.

22272E25A-WINDENERGYCONVERSIONSYSTEMS

3104

UNIT-IINTRODUCTION: **9**

Historyofwind Electric generation -Darrieus wind - Horizontal and vertical axis-Wind turbine - other modern developments - Future possibilities.

UNIT-IIWINDRESOURCEANDITSPOTENTIALFORELECVTRICPOWER GENERATION: **9**

PowerExtractedByAWindDrivenMachine -Natureandoccurrenceofwind characteristicsandpowerproduction-variationofmeanwindspeedwithtime.

UNIT-IIIWINDPOWERSITESANDWINDMEASUREMENTS: **9**

Average wind speed and other factors affectingchoice of the site- Effectof wind direction - Measurement of wind velocity - Personal estimation without instruments- anemometers - Measurement of wind direction.

UNIT-IVWIND TURBINES WITH ASYNCHRONOUS GENERATORS AND CONTROL ASPECTS: **9**

Asynchronoussystems-AcGenerators-SelfexcitationofInductionGenerator-SinglePhaseoperationofInductionGenerator-PermanenetmagnetGenerators- Basiccontrolaspects-fixedspeedratiocontrolscheme-fixedvsvariablespeed operation of WECS.

UNIT-VGENERATIONOFELECTRICITY **9**

Active and reactive power - P and Q transfer in power systems - Power converters - Characteristics of Generators - Variable Speed options - Economics.

L=45T=15P=0C=4

REFERENCES:

1. N.G.Calvert,'WindPowerPrinciples:TheirApplicationonsmallscale',Charles Friffin& co. Ltd, London, 1979.
2. Gerald W.Koeppel, "Pirnam's and Power from the wind", Van Nastran Reinhold Co., London, 1979.
3. GaryL.Johnson,"WindEnergySystem",PrenticehallInc.,EnglewoodCliffs,New Jersey, 1985.
4. WindenergyconversionsystembyL.Lfreris,Prenticehall(U.K)Ltd.,1990.

Skill Development Employability Entrepreneurship

22272E25B-AITECHNIQUESTOPOWERSYSTEMS

3104

1. INTRODUCTIONTONEURAL NETWORKS 9

Basics of ANN - perceptron - delta learning rule - back propagation algorithm -multilayer feed forward network - memory models - bi-directional associative memory - Hopfield network.

2. APPLICATIONSTOPOWERSYSTEM PROBLEMS 9

Applicationofneuralnetworkstoloadforecasting -contingencyanalysis -VARcontrol-economic load dispatch.

3. INTRODUCTIONTOFUZZYLOGIC 9

Crispness - vagueness - fuzziness - uncertainty - fuzzy set theory fuzzy sets - fuzzy set operations - fuzzy measures - fuzzy relations - fuzzy function - structure of fuzzy logic controller – fuzzification models - data base - rule base - inference engine defuzzification module.

4. APPLICATIONSTOPOWERSYSTEMS 9

Decision making in power system control through fuzzy set theory - use of fuzzy set models of LP in power systems scheduling problems - fuzzy logic based power system stabilizer.

5. GENETICALGORITHMANDITSAPPLICATIONSTOPOWERSYSTEMS 9

Introduction - simple genetic algorithm - reproduction - crossover - mutation – advanced operators in genetic search - applications to voltage control and stability studies.

L = 45T = 15P=0C =4

REFERENCES:

1. JamesA.FreemanandSkapura.B.M,„NeuralNetworks-AlgorithmsApplicationsand Programming Techniques‟, Addison Wesley, 1990.
2. GeorgeKlirandTinaFolger.A,„„Fuzzy sets,Uncertainty andInformation‟,PrenticeHallof India, 1993.
3. Zimmerman.H.J,„„FuzzySetTheoryanditsApplications‟,KluwerAcademicPublishers 1994.
4. IEEEtutorialon„„ApplicationofNeuralNetworktoPowerSystems‟,1996.
5. LoiLeiLai,„„IntelligentSystemApplicationsinPowerEngineering‟,JohnWiley&SonsLtd.,1998.

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Skill Development Employability Entrepreneurship

22272E25C ELECTRICAL DISTRIBUTION SYSTEM LTPC

OBJECTIVES: 3003

- Toprovideknowledgeaboutthedistributionsystemelectricalcharacteristics
- Togainknowledgeaboutplanninganddesigningofdistributionsystem
- Toanalyzepowerqualityindistributionsystem
- Toanalyzethepowerflowinbalancedandunbalancedsystem

UNITI INTRODUCTION 9

Distribution System-Distribution Feeder Electrical Characteristics-Nature of Loads : Individual Customer Load, Distribution Transformer Loading and Feeder Load -Approximate MethodofAnalysis:VoltageDrop,LineImpedance,"K"Factors,UniformlyDistributedLoads and Lumping Loads in Geometric Configurations.

UNITII DISTRIBUTIONSYSTEMPLANNING 9

Factors effecting planning, present techniques, planning models(Short term planning, long term planning and dynamic planning), planning in the future, future nature of distribution planning,RoleofcomputerinDistributionplanning.Loadforecast,Loadcharacteristicsand Load models.

UNITIII DISTRIBUTIONSYSTEMLINEMODEL 9

ExactLineSegmentModel-ModifiedLineModel-ApproximateLineSegmentModel-Modified "Ladder"IterativeTechnique-GeneralMatricesforParallelLines.

UNITIV VOLTAGEREGULATION 9

Standard Voltage Ratings-Two-Winding Transformer Theory-Two-Winding Autotransformer-Step-Voltage Regulators: Single-Phase Step-Voltage Regulators-Three-Phase Step-Voltage Regulators-ApplicationofcapacitorsinDistributionsystem.

UNITV DISTRIBUTIONFEEDERANALYSIS 9

Power-Flow Analysis- Ladder Iterative Technique -Unbalanced Three-Phase Distribution Feeder-ModifiedLadderIterativeTechnique-LoadAllocation-Short-CircuitStudies.

TOTAL:45PERIODS

OUTCOMES:

- Abilitytoapplytheconceptsofplanninganddesignofdistributionsystemforutility systems
- Abilitytoimplementtheconceptsofvolatagecontrolindistributionsystem.
- Abilitytoanalyzethepowerflowinbalancedandunbalancedsystem

REFERENCES

1. WilliamH.Kersting,"DistributionSystemModelingandAnalysis"CRCpress3rd edition,2012.

2. TuranGonen,“ElectricPowerDistributionSystemEngineering”,McGrawHillCompany. 1986
3. JamesNorthcote–Green,RobertWilson,“ControlandAutomationofElectricalPower Distribution Systems”, CRCPress,NewYork, 2007.
4. PablaHS,“ElectricalPowerDistributionSystems”,TataMcGrawHill.2004

22272E25DENERGYMANAGEMENT ANDAUDITINGLT PC

OBJECTIVES: 3003

- Tostudytheconceptsbehindeconomicanalysisand Loadmanagement.
- Toemphasizetheenergymanagementonvariouselectricalequipmentsandmetering.
- Toillustratetheconceptoflightingsystemsandcogeneration.

UNITI INTRODUCTION 9

Needforenergymanagement-energybasics-designingandstartinganenergymanagement program – energy accounting -energy monitoring, targeting and reporting-energy audit process.

UNITII ENERGYCOSTANDLOADMANAGEMENT 9

Importantconceptsinaneconomicanalysis-Economicmodels-Timevalueofmoney-Utility rate structures- cost of electricity-Loss evaluation- Load management: Demand control techniques-Utilitymonitoringandcontrolsystem-HVACandenergymanagement-Economic justification.

UNIT III ENERGYMANAGEMENTFORMOTORS,SYSTEMS,ANDELECTRICAL EQUIPMENT 9

Systems and equipment- Electric motors-Transformers and reactors-Capacitors and synchronous machines.

UNITIV METERINGFORENERGYMANAGEMENT 9

Relationships between parameters-Units of measure-Typical cost factors- Utility meters - Timing of meter disc for kilowatt measurement - Demand meters - Paralleling of current transformers - Instrument transformer burdens-Multitasking solid-state meters - Metering locationvs.requirements-Meteringtechniquesandpracticalexamples.

UNITV LIGHTINGSYSTEMS& COGENERATION 9

Concept of lighting systems - The task and the working space -Light sources - Ballasts - Luminaries - Lighting controls-Optimizing lighting energy - Power factor and effect of harmonics on power quality - Cost analysis techniques-Lighting and energy standards Cogeneration: Forms of cogeneration - feasibility of cogeneration- Electrical interconnection.

TOTAL:45PERIODS

OUTCOMES:

- Studentswilldeveloptheabilitytolearnabouttheneedforenergymanagementand auditingprocess
- Learnerswilllearnaboutbasicconceptsofeconomicanalysisandloadmanagement.
- Studentswillunderstandtheenergymanagementonvariouselectricalequipments.
- Studentswillhaveknowledgeontheconceptsofmeteringandfactorsinfluencingcost function

Skill Development Employability Entrepreneurship

- Studentswillbeabletolearnabouttheconceptoflightingsystems,lightsourcesand various forms of cogeneration

REFERENCES

1 BarneyL.Capehart,WayneC.Turner,andWilliamJ.Kennedy,“GuidetoEnergy Management”,FifthEdition,TheFairmontPress,Inc.,2006
2 EastopT.D&CroftD.R,“EnergyEfficiencyforEngineersandTechnologists”,Logman Scientific & Technical, 1990.
3 ReayD.A,“IndustrialEnergyConservation”,1stedition,PergamonPress,1977.
4 “IEEERecommendedPracticeforEnergyManagementinIndustrialandCommercial Facilities”, IEEE, 1996
5 AmitK.Tyagi,“HandbookonEnergyAuditsandManagement”,TERI,2003.

22272E32A-POWERELECTRONICSAPPLICATIONSINPOWERSYSTEMS

3104

UNIT:ISTATICCOMPENSATORCONTROL 9

Theoryofloadcompensation-voltageregulationandpowerfactorcorrection-phasebalanceandPFcorrectionofunsymmetricalloads-Propertyofstaticcompensator - Thyristor controlled rectifier (TCR) - Thyristor Controlled Capacitor (TSC) -Saturable corereactor - Control Strategies.

UNIT:IIHARMONICCONTROLANDPOWERFACTORIMPROVEMENT 9

Inputpowerfactorfordifferenttypesofconverters-powerfactorimprovementusing Load and forced commutated converters.

UNIT:IIIVOLTAGECONTROLUSINGSTATICTAP-CHANGERS 9

Conventionaltapchangingmethods,statictapchangersusingThyristor, different schemes -comparison.

UNIT:IVSTATICEXCITATIONCONTROL 9

Solid state excitation of synchronous generators - Different schemes - Generex excitation systems.

UNIT:VUNINTERRUPTABLEPOWERSUPPLYSYSTEM 9

Parallel, Redundant andnon-redundantUPS -Upsusingresonantpower converters - Switch mode power supplies.

L = 45T = 15P= 0C =4

TEXTBOOK

Miller.T.J.E,“Reactivepower controlinElectric systems”.Wiley interscience,NewYork, 1982.

REFRENCES

1. “StaticCompensatorforACpowersystems”,Proc.IEEvol.128Nov.1981.pp 362-406.
2 “AStaticalternativetothetransformeronloadtapchanging”,IEEETrans.On Pas, Vol.PAS-99, Jan. /Feb. 1980, pp86-89.
3. “ImprovementsinThyristorcontrolledstaticon-loadtapcontrollersfortransformers”,IEEETrans.onPAS,Vol.PAS-101,Sept.1982,pp3091-3095.
4. “ShuntThyristorrectifiersfortheGenerexExcitationsystems”,IEEETrans.On PAS.PAS -96, July/August, 1977, pp1219-1325.

Skill Development Employability Entrepreneurship

22272E32B-POWERSYSTEMDYNAMICS

3104

1. SYNCHRONOUSMACHINEMODELLING 9

Schematic Diagram, Physical Description: armature and field structure, machines withmultiple pole pairs, mmfwaveforms, direct and quadrature axes, Mathematical Description of a Synchronous Machine: Basic equations of a synchronous machine:stator circuit equations, stator self, stator mutual and stator to rotor mutual inductances, dq0 Transformation: flux linkage and voltageequations for stator and rotor in dq0 coordinates, electrical power and torque, physical interpretation of dq0 transformation,Per Unit Representations: L_{ad}-reciprocal per unit systemand that frompower- invariant form of Park's transformation; Equivalent Circuits for direct and quadrature axes, Steady- state Analysis: Voltage, current and flux-linkage relationships, Phasor representation, Rotor angle, Steady-state equivalent circuit, Computation of steady-state values, Equations of Motion: Swing Equation, calculation of inertia constant, Representation in system studies, Synchronous Machine RepresentationinStabilityStudies:Simplificationsforlarge-scalestudies:Neglectofstator$p\Psi$

terms and speed variations, Simplified model with amortisseurs neglected:two-axis model with amortisseur windings neglected, classical model.

2. MODELLINGOFEXCITATIONANDSPEEDGOVERNINGSYSTEMS 9

Excitation System Requirements; Elements of an Excitation System; Types of Excitation System;Control and protective functions;IEEE (1992) block diagram for simulation of excitation systems. Turbine and Governing System Modelling: Functional Block Diagram of Power Generation and Control, Schematic of a hydroelectric plant, classical transfer function of a hydraulic turbine (no derivation), special characteristic of hydraulic turbine, electrical analogue of hydraulic turbine, Governor for Hydraulic Turbine: Requirement for a transient droop, Block diagram of governor with transient droop compensation, Steam turbine modelling: Single reheat tandem compounded type only and IEEE block diagram for dynamic simulation; generic speed-governing system model for normal speed/load control function.

3. SMALL-SIGNALSTABILITYANALYSISWITHOUTCONTROLLERS 9

Classification of Stability, Basic Concepts and Definitions: Rotor angle stability, The Stability Phenomena. Fundamental Concepts of Stability of Dynamic Systems: State-space representation, stability of dynamic system, Linearisation, Eigen properties of the state matrix: Eigen values and eigenvectors, modal matrices, eigen value and stability, mode shape and participation factor. Single-Machine Infinite Bus (SMIB) Configuration:Classical Machine Model stability analysis with numericalexample, Effectsof Field Circuit Dynamics:synchronous machine, networkand linearised system equations, block diagram representation with K-constants; expression for K-constants (no derivation), effect of field flux variation on system stability: analysis with numerical example,

4. SMALL-SIGNALSTABILITYANALYSISWITHCONTROLLERS 9

Effects Of Excitation System: Equations with definitions of appropriate K-constants and simple thyristor excitation system and AVR, block diagram with the excitation system, analysis of effect of AVR on synchronizing and damping components using a numerical example, Power System Stabiliser: Block diagram with AVR and PSS, Illustration of principle of PSS application with numerical example, Block diagram of PSS with description, system state matrix including PSS, analysis of stability with numerical a example. Multi-Machine Configuration:Equations in a common reference frame, equations in individual machine rotor coordinates, illustration of formation of system state matrix for a two-machine system with classical models for synchronous machines, illustration of stability analysis using a numerical example. Principle behind small-signal stability improvement methods: delta-omega and delta P-omega stabilizers.

5. ENHANCEMENTOFSMALLSIGNALSTABILITY 9

Power System Stabilizer – Stabilizer based on shaft speed signal (delta omega) – Delta –P-Omega stabilizer-Frequency-based stabilizers – Digital Stabilizer – Excitation control design – Exciter gain – Phase lead compensation – Stabilizing signal washout stabilizer gain – Stabilizer limits

L = 45T = 15P= 0C =4

REFERENCES

1. P.Kundur,“PowerSystemStabilityandControl”,McGraw-Hill,1993.
2. IEEECommitteeReport,"DynamicModelsforSteamandHydroTurbinesin Power System Studies”, IEEE Trans., Vol.PAS-92, pp 1904-1915, November/December, 1973. on Turbine-Governor Model.
3. P.MAndersonandA.AFouad,“PowerSystemControlandStability”,IowaState University Press, Ames, Iowa, 1978.

22272E32C ELECTRICVEHICLESANDPOWERMANAGEMENTL

	L	T	P	C
	3	0	0	3

OBJECTIVES:

- Tounderstandtheconceptofelectricalvehiclesandits operations
- Tounderstandtheneedforenergystorageinhybridvehicles
- Toprovideknowledgeaboutvariouspossibleenergystoragetechnologiesthatcanbe used in electric vehicles

UNITI ELECTRICVEHICLESANDVEHICLEMECHANICS 9

Electric Vehicles (EV), Hybrid Electric Vehicles (HEV), Engine ratings, Comparisons of EV with internal combustion Engine vehicles, Fundamentals of vehicle mechanics

UNITII ARCHITECTUREOFEV'sANDPOWERTRAINCOMPONENTS 9

Architecture of EV's and HEV's – Plug-n Hybrid Electric Vehicles (PHEV)- Power traincomponents and sizing, Gears, Clutches, Transmission and Brakes

UNITIII CONTROLOFDCANDACDRIVES 9

DC/DC chopper based four quadrant operations of DC drives – Inverter based V/f Operation (motoring and braking) of induction motor drive system – Induction motor and permanentmotor based vector control operation – Switched reluctance motor (SRM) drives

UNITIV BATTERYENERGYSTORAGESYSTEM 9

BatteryBasics,Differenttypes,BatteryParameters,Batterymodeling,TractionBatteries

UNITV ALTERNATIVEENERGYSTORAGESYSTEMS 9

Fuelcell–Characteristics-Types–hydrogenStorageSystemsandFuelcellEV–Ultracapacitors

TOTAL:45PERIODS

OUTCOMES:

- Learnerswillunderstandtheoperationof Electricvehiclesandvariousenergystorage technologies for electrical vehicles

REFERENCES

1 IqbalHussain,"**ElectricandHybridVehicles:DesignFundamentals,Second Edition"** CRC Press, Taylor & Francis Group, Second Edition (2011).

2 AliEmadi,MehrdadEhsani,JohnM.Miller,"VehicularElectricPowerSystems",Special Indian Edition, Marcel dekker, Inc 2010.

22272E32D	ELECTROMAGNETICINTERFERENCEAND COMPATIBILITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Toprovidefundamentalknowledgeonelectromagneticinterferenceand electromagnetic compatibility.
- TostudytheimportanttechniquestocontrolEMIand EMC.
- ToexposetheknowledgeontestingtechniquesasperIndianandinternational standards in EMI measurement.

UNITI INTRODUCTION 9

Definitions of EMI/EMC -Sources of EMI- Intersystems and Intrasystem- Conducted and radiated interference- Characteristics - Designing for electromagnetic compatibility (EMC)- EMC regulation typicalnoisepath-EMIpredictions andmodeling,Cross talk -Methods ofeliminatinginterferences.

UNITII GROUNDINGANDCABLING 9

Cabling- types of cables, mechanism of EMI emission / coupling in cables –capacitive coupling inductive coupling- shielding to prevent magnetic radiation- shield transfer impedance, Grounding– safety grounds – signal grounds- single point and multipoint ground systems hybrid grounds- functional ground layout –grounding of cable shields- -guard shields- isolation, neutralizing transformers,shieldgroundingathighfrequencies,digitalgrounding-EarthmeasurementMethods

UNITIII BALANCING,FILTERINGANDSHIELDING 9

Power supply decoupling- decoupling filters-amplifier filtering –high frequency filtering- EMIfilters characteristics of LPF, HPF, BPF, BEF and power line filter design -Choice of capacitors, inductors, transformers and resistors, EMC design components -shielding – near and far fields shielding effectiveness - absorption and reflection loss- magnetic materials as a shield, shield discontinuities, slots and holes, seams and joints, conductive gaskets-windows and coatings - grounding of shields

UNITIV EMIINELEMENTSANDCIRCUITS 9

Electromagnetic emissions, noise from relaysand switches, non- linearitiesin circuits,passive inter modulation, transients in power supply lines, EMI from power electronic equipment, EMI as combination of radiation and conduction

UNITV ELECTROSTATICDISCHARGE,STANDARDSANDTESTING TECHNIQUES 9

Static Generation- human body model- static discharges- ESD versus EMC, ESD protection in equipment's- standards – FCC requirements – EMI measurements – Open area test site measurements and precautions- Radiated and conducted interference measurements, Control requirements and testing methods

TOTAL: 45 PERIODS

OUTCOMES:

- RecognizethesourcesofConductedandradiatedEMIinPowerElectronicConvertersand consumer appliances and suggest remedial measures to mitigate the problems
- AssesstheinsertionlossanddesignEMIfilterstoreducetheloss
- DesignEMIfilters,common-modechokesandRC-snubbercircuitsmeasurestokeepthe interference within tolerable limits

REFERENCES

1. V.P.Kodali,“EngineeringElectromagneticCompatibility”,S.Chand,1996
2. HenryW.Ott,“Noisereductiontechniquesinelectronicsystems”,JohnWiley& Sons, 1989
3. BernhardKeiser,“PrinciplesofElectro-magneticCompatibility”,ArtechHouse, Inc. (685 canton street, Norwood, MA 020062 USA) 1987
4. Bridges,J.EMilletaJ.andRicketts.L.W.,“EMPRadiationandProtective techniques”, John Wiley and sons, USA 1976
5. WilliamDuffG.,&DonaldWhiteR.J,“SeriesonElectromagneticInterference and Compatibility”, Vol.
6. WestonDavidA.,“ElectromagneticCompatibility,PrinciplesandApplications”, 1991.

ELECTIVES–V(semester-III)

22272E33A-POWERCONDITIONING

3104

1. INTRODUCTION 9

Introduction – Characterization of Electric Power Quality: Transients, short duration and long duration voltage variations, Voltage imbalance, waveform distortion, Voltage fluctuations, Power frequency variation, Power acceptability curves – power quality problems: poor load power factor, Non linear and unbalanced loads, DC offset in loads, Notching in load voltage, Disturbance in supply voltage – Power quality standards.

2. NON-LINEARLOADS 9

Single phase static and rotating AC/DC converters, Three phase static AC/DC converters, Battery chargers, Arc furnaces, Fluorescent lighting, pulse modulated devices, Adjustable speed drives.

3. MEASUREMENTANDANALYSIS METHODS 9

Voltage, Current, Power and Energy measurements, power factor measurements and definitions, event recorders, Measurement Error – Analysis: Analysis in the periodic steady state, Time domain methods, Frequency domain methods: Laplace′s, Fourier and Hartleytransform – The Walsh Transform – Wavelet Transform.

4. ANALYSISANDCONVENTIONALMITIGATION METHODS 9

Analysis of power outages, Analysis of unbalance: Symmetrical components of phasor quantities, Instantaneous symmetrical components, Instantaneous real and reactive powers, Analysis of distortion: On–line extraction of fundamental sequence components from measured samples – Harmonic indices – Analysis of voltage sag: Detorit Edison sag score, Voltage sag energy, Voltage Sag Lost Energy Index (VSLEI)- Analysis of voltage flicker, Reduced duration and customer impact of outages, Classical load balancing problem: Open loop balancing, Closed loop balancing, current balancing, Harmonic reduction, Voltage sag reduction.

5. POWERQUALITY IMPROVEMENT 9

Utility-Customer interface –Harmonic filters: passive, Active and hybridfilters –Custom power devices: Network reconfiguring Devices, Load compensation using DSTATCOM, Voltage regulation using DSTATCOM, protecting sensitiveloads using DVR, UPQC –control strategies: P- Q theory, Synchronous detection method – Custom power park –Status of application of custom power devices

L = 45T = 15P=0C =4

REFERENCES:

1. ArindamGhosh“PowerQualityEnhancementUsingCustomPowerDevices”, Kluwer Academic Publishers, 2002.
2. Heydt.G.T,“ElectricPowerQuality”,StarsinaCirclePublications,1994(2nd edition)
3. Dugan.R.C,“ElectricalPowerSystemQuality”,TMH,2008.
4. Arrillga.A.JandNevilleR.Watson,PowerSystemHarmonics,JohnWileysecond Edition,2003.
5. Derek A.Paice,“Powerelectronicconverterharmonics”,JohnWiley&sons,1999.

ELECTIVES–V(semester-III)

Skill Development Employability Entrepreneurship

22272E33B–DEREGULATEDPOWERSYSTEM

3104

1. FUNDAMENTALSANDARCHITECTUREOFPOWERMARKETS 9

Deregulation of Electric utilities: Introduction-Unbundling-Wheeling- Reform motivations- Fundamentals of Deregulated Markets – Types (Future, Day-ahead and Spot) – Participating in Markets (Consumer and Producer Perspective) – bilateral markets – pool markets. Independent System Operator (ISO)-components-types of ISO - role of ISO - Lessons and Operating Experiences of Deregulated Electricity Markets in various Countries (UK, Australia, Europe, US, Asia).

2. TECHNICALCHALLENGES 9

Total Transfer Capability – Limitations - Margins – Available transfer capability (ATC) – Procedure - Methods to compute ATC – Static and Dynamic ATC – Effectof contingency analysis – Case Study. Concept of Congestion Management – Bid, Zonal and Node Congestion Principles – Inter and Intra zonal congestion –Generation Rescheduling - Transmission congestion contracts – Case Study.

3. TRANSMISSIONNETWORKSANDSYSTEMSECURITYSERVICES9

Transmission expansion in the New Environment – Introduction – Role of transmission planning – Physical Transmission Rights – Limitations – Flow gate - Financial Transmission Rights – Losses – Managing Transmission Risks – Hedging – Investment. Ancillary Services – Introduction – Describing Needs – Compulsory and Demand-side provision – Buying and Selling Ancillary Services – Standards.

4. MARKET PRICING 9

Transmission pricing in open access system – Introduction – Spot Pricing – UniformPricing–ZonalPricing–LocationalMarginalPricing–CongestionPricing – Ramping and Opportunity Costs. Embedded cost based transmission pricing methods (Postage stamp, Contract path and MW-mile) – Incremental cost based transmission pricing methods (Short run marginal cost, Long run marginal cost) - Pricing of Losses on Lines and Nodes.

5. INDIANPOWERMARKET 9

Current Scenario – Regions – Restructuring Choices – Statewise Operating Strategies – Salient features of Indian Electricity Act 2003 – Transmission System Operator – Regulatory and Policy development in Indian power Sector –Opportunities for IPP and Capacity Power Producer. Availability based tariff – Necessity – Working Mechanism – Beneficiaries – Day Scheduling Process – Deviation from Schedule – Unscheduled Interchange Rate – System Marginal Rate – Trading Surplus Generation – Applications.

L = 45T = 15P=0C =4

REFERENCES

1. KankarBhattacharya,MathH.J.BollenandJaapE.Daalder,“OperationofRestructured Power Systems”, Kluwer Academic Publishers, 2001

2. LoiLeiLai,“PowersystemRestructuringandRegulation”,JohnWileysons, 2001.
3. Shahidehpour.MandAlomoush.M,“RestructuringElectricalPowerSystems”, Marcel Decker Inc., 2001.
4. StevenStoft,“PowerSystemEconomics”,Wiley–IEEEPress,2002
5. DanielS.KirschenandGoranStrbac,“FundamentalsofPowerSystemEconomics”, John Wiley& Sons Ltd., 2004.
6. ScholarlyTransaction PapersandUtilityweb sites

22272E33C	CONTROLSYSTEMDESIGNFOR POWER ELECTRONICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- ToexploreconceptualbridgesbetweenthefieldsofControlSystemsandPower Electronics
- ToStudyControltheoriesandtechniquesrelevanttothedesignoffeedback controllers in Power Electronics.

UNITI MODELLINGOFDC-TO-DCPOWERCONVERTERS 9

ModellingofBuckConverter,BoostConverter,Buck-BoostConverter,CukConverter ,Sepic Converter, Zeta Converter, Quadratic Buck Converter ,Double Buck-Boost Converter, Boost-Boost Converter General Mathematical Model for Power Electronics Devices.

UNITII SLIDINGMODECONTROLLERDESIGN 9

Variable Structure Systems. Single Switch Regulated Systems Sliding Surfaces, Accessibility of the Sliding Surface Sliding Mode Control Implementation of Boost Converter ,Buck-Boost Converter, Cuk Converter ,Sepic Converter, Zeta Converter, Quadratic Buck Converter ,Double Buck-Boost Converter, Boost-Boost Converter.

UNITIII APPROXIMATELINEARIZATIONCONTROLLERDESIGN 9

Linear Feedback Control, Pole Placement by Full State Feedback , Pole PlacementBased on Observer Design ,Reduced Order Observers , Generalized Proportional Integral Controllers, Passivity Based Control , Sliding Mode Control Implementation of Buck Converter , Boost Converter ,Buck-Boost Converter.

UNITIV NONLINEARCONTROLLERDESIGN 9

FeedbackLinearizationIsidori's Canonical Form, Input-Output FeedbackLinearization, State Feedback Linearization, Passivity Based Control , Full Order Observers , Reduced Order Observers.

UNITV PREDICTIVECONTROLOFPOWERCONVERTERS 9

BasicConcepts,Theory,andMethods,ApplicationofPredictiveControlinPower Electronics,AC-DC-ACConverterSystem,FaultsandDiagnosisSystemsinPower Converters.

TOTAL:45 PERIODS

OUTCOMES:

- Abilitytounderstandanoverviewonmodernlinearandnonlinearcontrol strategies for power electronics devices
- Abilitytomodelmodernpowerelectronicconvertersforindustrialapplications
- Abilitytodesignappropriatecontrollersformodernpowerelectronicsdevices.

REFERENCES

1. HeberttSira-Ramírez,RamónSilva-Ortigoza,"ControlDesignTechniquesin Power Electronics Devices", Springer 2012

2. MaheshPatil,PankajRodey,"ControlSystemsforPowerElectronics:A Practical Guide", Springer India, 2015.

3. BlaabjergJoséRodríguez,"AdvancedandIntelligentControlinPower Electronics and Drives" , Springer, 2014

4. EnriqueAcha,VassiliosAgelidis,OlimpoAnaya,TJEMiller,"PowerElectronic Control in Electrical Systems", Newnes, 2002

5. MarijaD.AranyaChakrabortty,Marija,"ControlandOptimizationMethodsfor Electric Smart Grids", Springer, 2012.

22272E33D PRINCIPLESOFEHVTRANSMISSION LT PC 3003

OBJECTIVES:

Toimpartknowledge on,

- Types ofpowertransmissionandconfigurationsvariousparametersandvoltage gradients of transmission line conductors.
- ThedesignrequirementsofEHVACandDC lines.

UNITI INTRODUCTION 9

Standard transmission voltages-AC and DC – different line configurations– average valuesof lineparameters –powerhandlingcapacityandlineloss –costsof transmission lines and equipment – mechanical considerations in line performance.

UNITII CALCULATIONOFLINEPARAMETERS 9

Calculation of resistance, inductance and capacitance for multi-conductor lines – calculation of sequence inductances and capacitances – line parameters for different modes of propagation – effect of ground return.

UNITIII VOLTAGEGRADIENTSOFCONDUCTORS 9

Charge-potential relations for multi-conductor lines – surface voltage gradient on conductors – gradient factors and their use – distribution of voltage gradient on sub conductors of bundle - voltage gradients on conductors in the presence of ground wires on towers-I2R loss and corona loss-RIV.

UNITIV ELECTROSTATICFIELDANDDESIGNOFEHVLINES 9

Effect of EHV line on heavy vehicles - calculation of electrostatic field of AC lines- effectof high field on humans, animals, and plants - measurement of electrostatic fields – electrostatic Induction in unenergised circuit of a D/C line - induced voltages ininsulated ground wires - electromagnetic interference, Design of EHV lines.

UNITV HVDC LINES

Introduction- Reliability and failure issues-Design-tower, ROW, clearances, insulators, electrical and mechanical protection-Maintenance-Control and protection-D.C Electric field band Magnetic field -Regulations and guide lines-underground line design.

TOTAL:45PERIODS

OUTCOMES:

- Abilitytomodelthetransmissionlinesandestimatethevoltagegradientsand losses
- AbilitytodesignEHVACandDCtransmissionlines

REFERENCES

1 Rakosh Das Begamudre, "Extra High Voltage AC Transmission Engineering", Second Edition, New Age International Pvt. Ltd., 2006.
2 Pritindra Chowdhari, "Electromagnetic transients in Power System", John Wiley and Sons Inc., 2009.
3 Sunil S.Rao, "EHV-AC, HVDC Transmission & Distribution Engineering", Third Edition, Khanna Publishers, 2008.
4 William H. Bailey, Deborah E. Weil and James R. Stewart, "A Review on HVDC Power Transmission Environmental Issues", Oak Ridge National Laboratory.
5 J.C Molburg, J.A. Kavicky, and K.C. Picel ,"A report on The design, Construction and operation of Long-distance High-Voltage Electricity Transmission Technologies" Argonne (National Laboratory) 2007.
6 "PowerEngineer'sHandbook",RevisedandEnlarged6thEdition,TNEBEngineers' Association, October 2002.

ELECTIVES–VI(semester-III)

22272E34A-SOFTWAREFORCONTROLSYSTEMDESIGN

3104

1. INTRODUCTIONTODESIGNANDCLASSICALPID CONTROL

Systems performance and specifications –Proportional, Integral and Derivative Controllers – Structure – Empirical tuning- Zeigler Nichols-Cohen Coon – RootLocus method– Openloopinversion-–TuningusingISE, IAE andotherperformance indices.

2. COMPENSATOR DESIGN

Design of lag, lead, lead-lag compensators – Design using bode plots – Polar plots – Nichols charts – root locus and Routh Hurwitz criterion.

3. MATLAB

Introduction – function description – Data types – Tool boxes – Graphical Displays – Programs for solution of state equations – Controller design –Limitations.-simulink-Introduction – Graphical user interface – Starting – Selectionof objects – Blocks – Lines -simulation – Application programs – Limitations.

4. MAPLE

Introduction – symbolic programming – Programming constructs – Data structure computation with formulae – Procedures – Numerical Programming.

5. MATLAB

ProgramsusingMATLAB software

L = 45T = 15P = 0C=4

REFERENCES

1. MAPLEVProgramming guide.
2. MATLABuser manual.
3. SIMULINKuser manual.
4. K.Ogatta,”ModernControlEngineering”,PHI,1997.
5. DorfandBishop,”ModerncontrolEngineering’,AddisonWesley, 1998.

ELECTIVES–VI(semester-III)

22272E34B-INDUSTRIALPOWERSYSTEMANALYSISAND DESIGN

31

04

1. MOTORSTARTINGSTUDIES 9

Introduction-Evaluation Criteria-Starting Methods-System Data-Voltage Drop Calculations-Calculation of Acceleration time-Motor Starting with Limited-Capacity Generators-Computer-Aided Analysis-Conclusions.

2. POWERFACTORCORRECTIONSTUDIES 9

Introduction-System Description and Modeling-Acceptance Criteria-Frequency Scan Analysis-Voltage Magnification Analysis-SustainedOvervoltages-Switching Surge Analysis-Back-to-Back Switching-Summary and Conclusions.

3. HARMONICANALYSIS 9

Harmonic Sources-System Response to Harmonics-System Model for Computer-Aided Analysis-Acceptance Criteria-Harmonic Filters-Harmonic Evaluation-Case Study-Summary and Conclusions.

4. FLICKERANALYSIS 9

SourcesofFlicker-FlickerAnalysis-FlickerCriteria-DataforFlickeranalysis-CaseStudy- Arc Furnace Load-Minimizing the Flicker Effects-Summary.

5. GROUNDGRIDANALYSIS 9

Introduction-Acceptance Criteria-Ground Grid Calculations-Computer-Aided Analysis - Improving the Performance of the Grounding Grids-Conclusions.

L = 45T = 15P= 0C =4

REFERENCES

1. RamasamyNatarajan,"Computer-AidedPowerSystemAnalysis",MarcelDekker Inc., 2002.

22272E34CSOFTCOMPUTINGTECHNIQUES LTPC

OBJECTIVES: **3003**

- Toexposetheconceptsoffeedforwardneuralnetworks.
- Toprovideadequateknowledgeaboutfeedbackneural networks.
- Toteachabouttheconceptoffuzzinessinvolvedinvarious systems.
- Toexposetheideasaboutgenetic algorithm
- ToprovideadequateknowledgeaboutofFLCandNNtoolbox

UNITIINTRODUCTIONANDARTIFICIALNEURAL NETWORKS 9

Introduction to intelligent systems- Soft computing techniques- Conventional Computing versus Swarm Computing - Classification of meta-heuristictechniques - Properties of Swarm intelligent Systems - Application domain - Discrete and continuous problems - Single objective and multi-objective problems -Neuron-Nerve structure and synapse- Artificial Neuron and itsmodel- activation functions- Neural network architecture- single layer and multilayer feed forward networks- Mc Culloch Pitts neuron model- perceptron model- Adaline and Madaline- multilayer perception model- back propogation learningmethods- effectoflearningrulecoefficient-backpropagationalgorithm- factors affecting back propagation training- applications.

UNITIIARTIFICIALNEURALNETWORKSANDASSOCIATIVE MEMORY 9

Counter propagation network- architecture- functioning & characteristics of counter Propagation network- Hopfield/ Recurrent network configuration - stability constraints associative memory and characteristics- limitations and applications- Hopfield v/s Boltzman machine- Adaptive Resonance Theory- Architecture- classifications- Implementation and training - Associative Memory.

UNIT III FUZZYLOGIC SYSTEM 9

Introduction to crisp sets and fuzzy sets- basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modeling and control- Fuzzification inferencing and defuzzification-Fuzzy knowledge and rule bases- Fuzzy modeling andcontrolschemes fornonlinearsystems. Selforganizingfuzzy logic control- Fuzzy logic control for nonlinear time delay system.

UNIT IV GENETICALGORITHM 9

Evolutionary programs – Genetic algorithms, genetic programming and evolutionary programming - Genetic Algorithm versus ConventionalOptimization Techniques - Genetic representations and selection mechanisms; Genetic operators- different types of crossover and mutation operators - Optimization problems using GA-discrete and continuous - Single objective and multi-objective problems - Procedures in evolutionary programming.

UNITV HYBRIDCONTROLSCHEMES 9

Fuzzification and rule base using ANN–Neuro fuzzy systems-ANFIS – Fuzzy Neuron-OptimizationofmembershipfunctionandrulebaseusingGenetic

Algorithm –Introduction to Support Vector Machine - Evolutionary Programming-Particle Swarm Optimization - Case study – Familiarization of NN, FLC and ANFIS Tool Box.

TOTAL:45PERIODS

OUTCOMES:

- WillbeabletoknowthebasicANNarchitectures,algorithmsandtheir limitations.
- Alsowillbeabletoknowthedifferentoperationsonthefuzzy sets.
- Will be capable of developing ANN based models and control schemes for non-linear system.
- WillgetexpertiseintheuseofdifferentANNstructuresandonlinetraining algorithm.
- Willbe knowledgeable to use Fuzzylogic formodelingandcontrolofnon-linear systems.
- Will be competent to use hybrid control schemes and P.S.O and supportvector Regressive.

TEXT BOOKS:

1. LaureneV.Fausett,"FundamentalsofNeuralNetworks:Architectures, Algorithms And Applications", Pearson Education.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India, 2008.
3. ZimmermannH.J."FuzzysettheoryanditsApplications"Springer international edition, 2011.
4. DavidE.Goldberg,"GeneticAlgorithmsinSearch,Optimization,and Machine Learning", Pearson Education, 2009.
5. W.T.Miller,R.S.SuttonandP.J.Webrose,"NeuralNetworksforControl" MIT Press", 1996.
6. T.Ross,"FuzzyLogicwithEngineeringApplications",TataMcGrawHill, New Delhi, 1995.
7. Ethem Alpaydin, "Introduction to Machine Learning (Adaptive Computation and Machine Learning Series)", MIT Press, 2004.
8. CorinnaCortesandV.Vapnik,"Support-VectorNetworks,Machine Learning " 1995.

22272E34D	**RESTRUCTURED POWER SYSTEM**	**LTPC**
OBJECTIVES:		**3003**

- Tointroducetherestructuringofpowerindustryandmarketmodels.
- To impart knowledge on fundamental concepts of congestion management.
- Toanalyzetheconceptsoflocationalmarginalpricingandfinancialtransmissi on rights.
- ToIllustrateaboutvariouspowersectorsinIndia

UNITIINTRODUCTIONTORESTRUCTURINGOFPOWERINDUSTRY 9

Introduction: Deregulation of power industry, Restructuring process, Issues involvedinderegulation,Deregulationofvariouspowersystems–Fundamentals of Economics: Consumer behavior, Supplier behavior, Market equilibrium, Short and long run costs, Various costs of production – Market models: Market models based on Contractual arrangements, Comparison of various market models, Electricity vis – a – vis other commodities, Market architecture, Case study.

UNIT II TRANSMISSIONCONGESTIONMANAGEMENT 9

Introduction: Definition of Congestion, reasons for transfer capability limitation, Importance of congestion management, Features of congestion management – Classification of congestion management methods – Calculation of ATC - Non – market methods – Market methods – Nodal pricing – Inter zonal and Intra zonal congestion management – Price area congestion management – Capacity alleviation method.

UNIT III LOCATIONAL MARGINAL PRICES AND FINANCIAL TRANSMISSION RIGHTS 9

Mathematical preliminaries: - Locational marginal pricing– Lossless DCOPF modelforLMPcalculation –LosscompensatedDCOPFmodelforLMPcalculation – ACOPF model for LMP calculation – Financial Transmission rights – Risk hedging functionality -Simultaneous feasibility test and revenue adequency –FTR issuance process: FTR auction, FTR allocation – Treatment of revenue shortfall– Secondary trading of FTRs–Flow gaterights–FTRandmarketpower -FTRandmerchanttransmission investment.

UNIT IV ANCILLARY SERVICE MANAGEMENT AND PRICING OF TRANSMISSION NETWORK 9

Introduction of ancillary services – Types of Ancillary services – Classification of Ancillary services – Load generation balancing related services – Voltage control and reactive power support devices – Black start capability service - How to obtain ancillary service –Co-optimization of energy and reserve services - Transmission pricing – Principles – Classification – Rolled in transmissionpricing methods – Marginal transmission pricing paradigm – Composite pricing paradigm – Merits and demerits of different paradigm.

UNITV REFORMSININDIANPOWER SECTOR 9

Introduction – Framework of Indian power sector – Reform initiatives - Availability based tariff – Electricity act 2003 – Open access issues – Power exchange – Reforms in the near future

TOTAL:45PERIODS

OUTCOMES:

- Learnerswillhaveknowledgeonrestructuringofpowerindustry
- Learnerswillunderstandbasicsofcongestionmanagement
- Learnerswillattainknowledgeaboutlocationalmarginpricesand financial transmission rights
- Learners will understand the significance ancillary services and pricing of transmission network
- Learnerswillhaveknowledgeonthevariouspowersectorsin India

REFERENCES

1 Mohammad Shahidehpour, Muwaffaq Alomoush, Marcel Dekker, “Restructured electrical power systems: operation, trading and volatility” Pub., 2001.

2 Kankar Bhattacharya, Jaap E. Daadler, Math H.J. Boolen, “Operation of restructured power systems”, Kluwer Academic Pub., 2001.

3 Paranjothi, S.R. , “Modern Power Systems” Paranjothi, S.R. , New Age International, 2017.

4 SallyHunt,”Makingcompetitionworkinelectricity”, JohnWilleyand Sons Inc. 2002.

5 StevenStoft,“Powersystemeconomics:designingmarketsforelectricity”, John Wiley & Sons, 2002.

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PONNAIYAH RAMAJAYAM INSTITUTE OF SCIENCE & TECHNOLOGY (PRIST)

Declared as DEEMED-TO-BE-UNIVERSITY
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SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

PROGRAM HANDBOOK

B.Tech PART TIME

[Regulation2022]

[for candidates admitted to B.Tech EEE program from June2022 onwards]

COURSE STRUCTURE

B.TECH PT EEE R 2022

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

B. Tech (PT) EEE R 22

SEMESTER I

Sl. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22148S11P	Transforms and Partial Differential Equations	3	1	0	4
2	22153C12P	Control System	3	1	0	4
3	22153C13P	Circuit Theory	3	1	0	4
4	22153C14P	Electronic circuits	3	0	0	3
5	22153C15P	Electrical Machines-I	4	0	0	4
Total No of Credits						**19**

SEMESTER II

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22148S21P	Numerical Methods	3	1	0	4
2	22153C22P	Optimization Techniques	3	0	0	3
3	22153C23P	Electrical Machines-II	3	1	0	4
4	22153C24P	Digital Electronics	3	1	0	4
5	22153C25P	Transmission and Distribution	4	0	0	4
Total No of Credits						**19**

SEMESTER III

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22148S31CP	Probability and Statistics	3	1	0	4
2	22153C32P	Linear Integrated Circuits and Applications	3	1	0	4
3	22153C33P	Power Electronics	4	0	0	4
4	22153C34P	Measurements and Instrumentation	4	0	0	4
5	22153L35P	DC and AC Electrical Machines Laboratory	0	0	3	2
Total No of Credits						**20**

SEMESTER IV

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22153C41P	Protection and switchgear	4	0	0	4
2	22153C42P	High Voltage DC Transmission	3	1	0	4
3	22153C43P	Solid State Drives	3	1	0	4
4	22153E44_P	Elective –I	4	0	0	4
5	22153L45P	Control and Instrumentation Laboratory	0	0	3	2
Total No of Credits						**18**

SEMESTER V

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22153C51P	Power System Analysis	3	1	0	4
2	22153C52P	Power Quality	3	1	0	4
3	22153C53P	Special Electrical Machines	4	0	0	4
4	22153E54_P	Elective –II	4	0	0	4
5	22153L55P	Power Electronics and Drives Lab	0	0	3	2
Total No of Credits						**18**

SEMESTER VI

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22153C61P	Utilization of Electrical Energy	3	1	0	4
2	22153C62P	Solid State Relays	4	0	0	4
3	22153C63P	Power System Operation and Control	4	0	0	4
4	22153E64_P	Elective –III	4	0	0	4
5	22153L65P	Power Systems Lab	0	0	3	2
Total No of Credits						**18**

SEMESTER VII

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22160S71P	Total Quality Management	3	0	0	3
2	22153C72P	Electrical Machine Design	3	1	0	4
3	22153C73P	Power Plant Engineering	4	0	0	4
4	22153E74_P	Elective –IV	3	0	0	3
5	22153P75P	Project Work	0	0	12	6
Total No of Credits						**20**

LIST OF ELECTIVES

ELECTIVE –I (IV SEMESTER)

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22153E44AP	Circuit Theory	4	0	0	4
2	22153E44BP	Fuzzy Logic and its Applications	4	0	0	4
3	22153E44CP	Bio Medical Instrumentation	4	0	0	4
4	22153E44DP	Modeling and Simulation of Solar Energy Systems	4	0	0	4
5	22153E44EP	Non conventional energy system & Applications	4	0	0	4

ELECTIVE –II (V SEMESTER)

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22153E54AP	Environmental Science and Engineering	4	0	0	4
2	22153E54BP	Artificial Neural Networks	4	0	0	4
3	22153E54CP	VLSI Design	4	0	0	4
4	22153E54DP	Robotics	4	0	0	4
5	22153E54EP	LT & HT Distribution System	4	0	0	4

ELECTIVE –III (VI SEMESTER)

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22153E64AP	Principles of Management	4	0	0	4
2	22153E64BP	Micro Electro Mechanical Systems	4	0	0	4
3	22153E64CP	Integrated opto-Electronic Devices	4	0	0	4
4	22153E64DP	Computer Aided Design of Electrical Apparatus	4	0	0	4
5	22153E64EP	Advanced DC-AC Power conversion	4	0	0	4

ELECTIVE –IV (VII SEMESTER)

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22153E74AP	Power system transients	3	0	0	3
2	22153E74BP	EHV AC and DC Transmission systems	3	0	0	3
3	22153E74CP	Fundamentals of Nanoscience	3	0	0	3
4	22153E74DP	Advanced Control systems	3	0	0	3
5	22153E74EP	Switched Mode Power supplies	3	0	0	3

HOD **DEAN**

DEAN ACADEMIC AFFAIRS

22148S11P-TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

3 1 0 4

(Common to all) **SEMESTER-1**

UNIT I FOURIER SERIES 9 + 3hrs

Periodic function-Graph of functions- Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval’s identity – Harmonic Analysis.

UNIT II FOURIER TRANSFORM 9 + 3hrs

Fourier integral theorem (without proof) – Sine and Cosine transforms – Properties (without Proof) – Transforms of simple functions – Convolution theorem – Parseval’s identity – Finite Fourier transform, Sine and Cosine transform.

UNIT III Z -TRANSFORM AND DIFFERENCE EQUATIONS 9 + 3hrs

Z-transform - Elementary properties (without proof) – Inverse Z – transform – Convolution theorem -Formation of difference equations – Solution of difference equations using Z –transform- Sampling of signals –an introduction.

UNIT IV PARTIAL DIFFERENTIAL EQUATIONS 9 + 3hrs

Formation of pde –solution of standard type first order equation- Lagrange’s linear equation – Linear partial differential equations of second order and higher order with Constant coefficients.

UNIT V BOUNDARY VALUE PROBLEMS 9 + 3hrs

Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two-dimensional heat equation (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates. **Total no of hrs: 60hrs**

COURSE OUTCOMES

- Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
- Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
- Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

TEXT BOOKS

1. Andrews, L.A., and Shivamoggi B.K., "Integral Transforms for Engineers and Applied
   Mathematicians", Macmillen , New York ,2288.
2. Grewal, B.S., "Higher Engineering Mathematics", Thirty Sixth Edition, Khanna Publishers,
   Delhi, 2001.
3. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Engineering Mathematics Volume
   III", S. Chand & Company ltd., New Delhi, 1996.

REFERENCE BOOKS

1. Narayanan, S., Manicavachagom Pillay, T.K. and Ramanaiah, G., "Advanced Mathematics for Engineering Students", Volumes II and III, S. Viswanathan (Printers and Publishers) Pvt. Ltd. Chennai, 2002.
2. Churchill, R.V. and Brown, J.W., "Fourier Series and Boundary Value Problems", Fourth Edition, McGraw-Hill Book Co., Singapore, 1987.
3. Advanced Modern Engineering mathematics – Glyn James

22153C12P- CONTROL SYSTEM 3 1 0 4

SEMESTER-1

AIM

To provide sound knowledge in the basic concepts of linear control theory and design of control system.

OBJECTIVES

i. To understand the methods of representation of systems and getting their transfer function models.
ii. To provide adequate knowledge in the time response of systems and steady state error analysis.
iii. To give basic knowledge is obtaining the open loop and closed–loop frequency responses of systems.
iv. To understand the concept of stability of control system and methods of stability analysis.
v. To study the three ways of designing compensation for a control system.

UNIT I: INTRODUCTION 12

Open-loop and closed –loop systems, servomechanisms and regulator systems; Transfer function; Block diagram reduction, Signal flow graphs.

UNIT II: MATHEMATICAL MODELS OF PHYSICAL SYSTEMS 12

Mechanical systems - Translational and Rotational systems, Gear trains, Electrical systems, Thermal systems and Fluid systems.

Components of feedback control systems - Potentiometers as error sensing devices, Synch, Servomotors, Stepper motors, Tachogenerators.

UNIT III: STABILITY 12

Concept of Stability, necessary and sufficient conditions of Stability, Closed-loop systems, merits and demerits, Routh-Hurwitz Criterion.

Transient Response: Typical inputs, convolution integral, Time domain specifications, steady state errors.

State equation – Solutions – Realization – Controllability – Observability – Stability Jury's test.

UNIT IV: FREQUENCY RESPONSE 12

Definition, equivalence between transient response and frequency response, Bode plots.

Nyquist Stability Criterion: Development of criterion, gain and phase margins, m- circles and Nichol's chart.

UNIT V: ROOT LOCUS METHOD 12

Rules for sketching of root loci, Root contours.

Synthesis: Lag and Lead networks, proportional, derivative and integral controllers.

MUTLI INPUT MULTI OUTPUT (MIMO) SYSTEM:

Models of MIMO system – Matrix representation – Transfer function representation – Poles and Zeros – Decoupling – Introduction to multivariable Nyquist plot and singular values analysis – Model predictive control.

Total = 60

COURSE OUTCOMES

At the end of the course, the student should have the :

- Ability to develop various representations of system based on the knowledge of
- Mathematics, Science and Engineering fundamentals.
- Ability to do time domain and frequency domain analysis of various models of linear system.
- Ability to interpret characteristics of the system to develop mathematical model.
- Ability to design appropriate compensator for the given specifications.
- Ability to come out with solution for complex control problem.
- Ability to understand use of PID controller in closed loop system.

TEXT BOOK:

1. I.J.Nagrath and M.Gopal, 'Control System Engineering', Wiley Eastern Ltd., Reprint 1995.

REFERENCES:

1. M.Gopal, 'Control System Principles and Design', Tata McGraw Hill, 1998.
2. Ogatta, 'Modern Control Engineering', Tata McGraw Hill 1997.

22153C13P- CIRCUIT THEORY

3 1 0 3
SEMESTER-1

AIM

To know about basic analysis and synthesis techniques used in electronics and communications.

OBJECTIVES

- To introduce electric circuits and its analysis
- To impart knowledge on solving circuits using network theorems
- To introduce the phenomenon of resonance in coupled circuits.
- To educate on obtaining the transient response of circuits.
- To Phasor diagrams and analysis of three phase circuits

UNIT-I BASIC CIRCUITS ANALYSIS (9)

Ohm's Law – Kirchoffs laws – DC and AC Circuits – Resistors in series and parallel circuits – Mesh current and node voltage method of analysis for D.C and A.C. circuits – Phasor Diagram – Power, Power Factor and Energy.

UNIT-II NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS (9)

Network reduction: voltage and current division, source transformation – star delta conversion. Thevenins and Novton & Theorem – Superposition Theorem – Maximum power transfer theorem –Reciprocity Theorem..

UNIT-III RESONANCE AND COUPLED CIRCUITS (9)

Series and paralled resonance – their frequency response – Quality factor and Bandwidth - Self andmutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

UNIT-IV TRANSIENT RESPONSE FOR DC CIRCUITS (9hrs)

Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input – Characterization of two port networks in terms of Z,Y and h parameters.

UNIT-V THREE PHASE CIRCUITS (9hrs)

Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits.

TOTAL 45

COURSE OUTCOMES

- Ability analyse electrical circuits
- Ability to apply circuit theorems
- Ability to analyse AC and DC Circuits

TEXT BOOKS:

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, “Engineering Circuits Analysis”, Tata McGraw Hill publishers,6 th edition, New Delhi, 2003.

2. Joseph A. Edminister, Mahmood Nahri, “Electric circuits”, Schaum’s series, Tata McGraw-Hill, New Delhi, 2001.

REFERENCES:

1. Paranjothi SR, “Electric Circuits Analysis,” New Age International Ltd., New Delhi, 1996.

2. Sudhakar A and Shyam Mohan SP, “Circuits and Network Analysis and Synthesis”, Tata McGraw Hill, 2007.

3. Chakrabati A, “Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, 1999.

4. Charles K. Alexander, Mathew N.O. Sadiku, “Fundamentals of Electric Circuits”, Second Edition, McGraw Hill, 2003.

22153C14P - ELECTRONIC CIRCUITS

3 0 0 3
SEMESTER-1

AIM:
To study the characteristics and applications of electronic devices.

OBJECTIVES:

- To acquaint the students with construction, theory and characteristics of the following electronic devices:
- Bipolar transistor, Field Effect transistor, Multivibrators, Power control/regulator devices, Feedback amplifiers and oscillators

UNIT I -RECTIFIER & POWER SUPPLY 12
Half & Full wave rectifier – filters – shunt , inductor, LC section & Ripple factor, P calculation for C, L and LC filters – Voltage regulators – Zener –Series voltage regulator – SMPS.

UNIT II- AMPLIFIERS 12
Amplifiers – Frequency response of RC coupled - Frequency Response of Emitter follower, gain band width product – FET amplifier at low and high frequency cascaded amplifiers.

UNIT III- FEEDBACK AMPLIFER & OSCILLATORS 12
Four basic types of feedback – effect of feedback on amplifier performance – condition for oscillation – Barkhunsen criteria – LC oscillators – Hartley & Colpitts – RC oscillators – Wein bridge, RC phase shift crystal oscillator.

UNIT IV- MULTIVIBRATORS 12
Collector coupled & Emitter coupled Astable multivibrator – Monostable, Bistable multivibrator – triggering methods – Storage delay and calculation of switching time – Schmitt triggering circuits – Speed up capacitor in switching.

UNIT V- POWER AMPLIFIER 12
Classification – class A, B, C & AB – Class B push pull – Class B Complimentary – symmetry – Class S, Power sections classification – Efficiency – Distortion in amplifiers.

L = 45 T = 15 P = 0 TOTAL =60

COURSE OUTCOMES

- Upon Completion of the course, the students will be ability to:
- Explain the structure and working operation of basic electronic devices.
- Able to identify and differentiate both active and passive elements
- Analyze the characteristics of different electronic devices such as diodes and transistors
- Choose and adapt the required components to construct an amplifier circuit. Employ the acquired knowledge in design and analysis of oscillators

REFERENCE BOOKS:
1. David.A.Bell, "Solid State Pulse Circuits", Prentice Hall of India, 4th Edition, 2001.
2. Millman Taub.H, "Pulse Digital & Switching waveform", Tata McGRaw Hill International 2001.
3. Jacob Millman Cristas C.Halkias, "Integrated Electronics", Tat Mc Graw Hill, Edition 1991.

22153C15P- ELECTRICAL MACHINES – I 4 0 0 4

AIM **SEMESTER-1**

To expose the students to the concepts of electromechanical energy conversions in D.C. Machines and energy transfer in transformers and to analyze their performance.

OBJECTIVES

i. To introduce the concept of rotating machines and the principle of electromechanical energy conversion in single and multiple excited systems.
ii. To understand the generation of D.C. voltages by using different type of generators and study their performance.
iii. To study the working principles of D.C. motors and their load characteristics, starting and methods of speed control.
iv. To familiarize with the constructional details of different type of transformers, working principle and their performance.
v. To estimate the various losses taking place in D.C. machines and transformers and to study the different testing method to arrive at their performance.

UNIT I: BASIC PRINCIPLES OF ROTATING MACHINES 12

Electrical machine types – Magnetic circuits – Magnetically induced EMF and force – AC operation of magnetic circuits - core losses. Principles of Electromechanical energy conversion: Energy conversion process – Energy in magnetic system – Field energy and mechanical force – Multiply excited magnetic field systems

UNIT II: GENERATORS 12

Constructional details – emf equation – Methods of excitation – Self and separately excited generators – Characteristics of series, shunt and compound generators – Armature reaction and commutation – Parallel operation of DC shunt and compound generators.

UNIT III: DC MOTORS 12

Principle of operation – Back emf and torque equation – Characteristics of series, shunt and compound motors – Starting of DC motors – Types of starters – Speed control of DC series and shunt motors.

UNIT IV: TRANSFORMERS 12

Constructional details of core and shell type transformers – Types of windings – Principle of operation – emf equation – Transformation ratio - Equivalent circuit – Losses –Testing – Efficiency and Voltage regulation . Transformer on load– Parallel operation of single phase transformers – Auto transformer – Three phase transformers

UNIT V: TESTING OF TRANSFORMERS AND DC MACHINES 12

Losses and efficiency in DC machines and transformers – Condition for maximum efficiency – Testing of DC machines – Brake test, Swinburne's test, Retardation test and Hopkinson's test – Testing of transformers – Polarity test, load test, open circuit and short circuit tests – All day efficiency.

TOTAL = 60

COURSE OUTCOMES

- Ability to analyze the magnetic-circuits.
- Ability to acquire the knowledge in constructional details of transformers. Ability to understand the concepts of electromechanical energy conversion. Ability to acquire the knowledge in working principles of DC Generator.
- Ability to acquire the knowledge in working principles of DC Motor
- Ability to acquire the knowledge in various losses taking place in D.C. Machines

TEXT BOOKS

1. D.P. Kothari and I.J. Nagrath, 'Electric Machines', Tata McGraw Hill Publishing Company Ltd, 2002.

2. P.S. Bimbhra, 'Electrical Machinery', Khanna Publishers, 2003.

REFERENCE BOOKS

1. A.E. Fitzgerald, Charles Kingsley, Stephen.D.Umans, 'Electric Machinery', Tata McGraw Hill publishing Company Ltd, 2003.

2. J .B.Gupta, 'Theory and Performance of Electrical Machines', S.K.Kataria and Sons, 2002.

3. K. Murugesh Kumar, 'Electric Machines', Vikas publishing house Pvt Ltd, 2002.

4. V.K.Mehta and Rohit Mehta, 'Principles of Power System', S.Chand and Company Ltd, third edition, 2003.

22148S21P-NUMERICAL METHODS

3 1 0 4
Semester II

UNIT I - SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS

9+3hrs

Solution of equations–Newton Raphson's method, Regula-falsi methods Solution of linear System of equations by Gaussian elimination and Gauss-Jordon methods- Iterative methods: Gauss Jacobi and Gauss-Seidel methods– Eigenvalue of a matrix by power method.

UNIT II- INTERPOLATION 9+3hrs

Newton's forward and backward difference formulas – Central difference formula: Bessels and Stirling's formula - Lagrangian Polynomials – Divided difference method.

UNIT III- NUMERICAL DIFFERENTIATION AND INTEGRATION

9+3hrs

Derivatives from difference tables – Divided differences and finite differences – Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Double integrals using trapezoidal and Simpson's rules.

UNIT IV - INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9+3hrs

Single step methods: Taylor series method – Euler and modified Euler methods – Fourth order Runge – Kutta method for solving first and second order equations – Multistep methods: Milne's and Adam's predictor and corrector methods.

UNIT V - BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9+3hrs

Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations.

Total no of hrs: 60hrs

COURSE OUTCOMES

- Understand the basic concepts and techniques of solving algebraic equations.
  - Appreciate the numerical techniques of interpolation and error approximations in various intervals in real life situations.
  - Apply the numerical techniques of differentiation and integration for engineering problems.
  - Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.

TEXT BOOKS

1. Gerald, C.F, and Wheatley, P.O, "Applied Numerical Analysis", Sixth Edition, Pearson Education Asia, New Delhi, 2002.
2. Kandasamy, P., Thilagavathy, K. and Gunavathy, K., "Numerical Methods", S.Chand Co. Ltd., New Delhi, 2003.

REFERENCES BOOKS

1. Burden, R.L and Faires, T.D., "Numerical Analysis", Seventh Edition, Thomson Asia Pvt. Ltd., Singapore, 2002.
2. Balagurusamy, E., "Numerical Methods", Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 1999.

22153C22P - OPTIMISATION TECHNIQUES

3 0 0 3
SEMESTER II

AIM:
To understand the architecture of different optimization techniques and its applications
OBJECTIVES:
To provide a clear understanding of

- To introduce the basic concepts of linear programming
- To educate on the advancements in Linear programming techniques
- To introduce non-linear programming techniques
- To introduce the interior point methods of solving problems
- To introduce the dynamic programming method

UNIT I LINEAR PROGRAMMING 9
Introduction - formulation of linear programming model-Graphical solution–solving LPP using simplex algorithm – Revised Simplex Method
UNIT II ADVANCES IN LPP 9
Dualit theory- Dual simplex method - Sensitivity analysis–-Transportation problems–Assignment problems-Traveling sales man problem -Data Envelopment Analysis..

UNIT III NON LINEAR PROGRAMMING 9
Classification of Non Linear programming – Lagrange multiplier method – Karush – Kuhn Tucker conditions–Reduced gradient algorithms–Quadratic programming method – Penalty and Barrier method.
UNIT IV INTERIOR POINT METHODS 9
Karmarkar's algorithm–Projection Scaling method–Dual affine algorithm–Primal affine algorithm Barrier algorithm.
UNIT V DYNAMIC PROGRAMMING 9
Formulation of Multi stage decision problem–Characteristics–Concept of sub-optimization and the principle of optimality–Formulation of Dynamic programming–Backward and Forward recursion– Computational procedure–Conversion offinal value problem in to Initial value problem.

TOTAL: 45 PERIODS

COURSE OUTCOMES

- To understand ethical issues, environmental impact and acquire management skills.

TEXT BOOKS:

1. Hillier and Lieberman "Introduction to Operations Research", TMH, 2000.
2. R.Panneerselvam, "Operations Research", PHI, 2006.
3. Hamdy ATaha, "Operations Research –An Introduction", Prentice Hall India, 2003.

REFERENCES:
1. Philips, Ravindran and Solberg, “Operations Research”, John Wiley, 2002.
2. Ronald L.Rardin, “Optimization in Operation Research” Pearson Education Pvt. Ltd. New Delhi, 2005.

Semester II

22153C23P-ELECTRICAL MACHINES-II

3 1 0 4

AIM:
To expose the students to the concepts of synchronous and asynchronous machines and
analyze their performance.

OBJECTIVES:
To impart knowledge on
i. Construction and performance of salient and non – salient type synchronous generators.
ii. Principle of operation and performance of synchronous motor.
iii. Construction, principle of operation and performance of induction machines.
iv. Starting and speed control of three-phase induction motors.
v. Construction, principle of operation and performance of single phase induction motors and special machines.

UNIT I: SYNCHRONOUS GENERATOR 12
Constructional details – Types of rotors – emf equation – Synchronous reactance – Armature reaction – Voltage regulation – e.m.f, m.m.f, z.p.f and A.S.A methods – Synchronizing and parallel operation – Synchronizing torque - Change of excitation and mechanical input – Two reaction theory – Determination of direct and quadrature axis synchronous reactance using slip test – Operating characteristics - Capability curves.

UNIT II: SYNCHRONOUS MOTOR 12
Principle of operation – Torque equation – Operation on infinite bus bars - V-curves – Power input and power developed equations – Starting methods – Current loci for constant power input, constant excitation and constant power developed.

UNIT III: THREE PHASE INDUCTION MOTOR 12
Constructional details – Types of rotors – Principle of operation – Slip – Equivalent circuit – Slip-torque characteristics - Condition for maximum torque – Losses and efficiency – Load test - No load and blocked rotor tests - Circle diagram – Separation of no load losses – Double cage rotors

UNIT IV: STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR 12
Need for starting – Types of starters – Stator resistance and reactance, rotor resistance, autotransformer and star-delta starters – Speed control – Change of voltage, torque, number of poles and slip – Cascaded connection – Slip power recovery scheme.

UNIT V: SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINE 12

Constructional details of single phase induction motor – Double revolving field theory and operation – Equivalent circuit – No load and blocked rotor test –– Starting methods of single-phase induction motors - Special machines - Shaded pole induction motor, reluctance motor, repulsion motor, hysteresis motor, stepper motor and AC series motor.

Total = 60

COURSE OUTCOMES

Ability to understand the construction and working principle of Synchronous Generator

- Ability to understand MMF curves and armature windings.
- Ability to acquire knowledge on Synchronous motor.
- Ability to understand the construction and working principle of Three phase Induction Motor
- Ability to understand the construction and working principle of Special Machines
- Ability to predetermine the performance characteristics of Synchronous Machines.

TEXT BOOKS

1. D.P. Kothari and I.J. Nagrath, 'Electric Machines', Tata McGraw Hill Publishing Company Ltd, 2002.

2. P.S. Bhimbhra, 'Electrical Machinery', Khanna Publishers, 2003.*REFERENCE BOOKS*

1. A.E. Fitzgerald, Charles Kingsley, Stephen.D.Umans, 'Electric Machinery', Tata McGraw Hill publishing Company Ltd, 2003.
2. J.B. Gupta, 'Theory and Performance of Electrical Machines', S.K.Kataria and Sons, 2002.
3. K. Murugesh Kumar, 'Electric Machines', Vikas publishing house Pvt Ltd, 2002.
4. Sheila.C.Haran, 'Synchronous, Induction and Special Machines', Scitech Publications, 2001.

semester II

22153C24P-DIGITAL ELECTRONICS

3 1 0 4

AIM:

To introduce the fundamentals of Digital Circuits, combinational and sequential circuit.

OBJECTIVES:

i. To study various number systems and to simplify the mathematical expressions using Boolean functions simple problems.
ii. To study implementation of combinational circuits
iii. To study the design of various synchronous and asynchronous circuits.
iv. To expose the students to various memory devices.

UNIT I NUMBER SYSTEMS

12

Review of Binary, Octal and Hexa-decimal number systems – Conversions, Binary Arithmetic magnitude form – 1's, 2's complement representation, Codes: -BCD, Excess – 3, Graycode, ASCII codes, Error detecting codes (Hamming code)

UNIT II BOOLEAN ALGEBRA

12

Boolean Algebra - De Morgan's law – Simplifications of Boolean expression – sum of Products and product of sums – Karnaugh Map – Quince McClusky method of simplification (Including Don't care conditions)

UNIT III Combinational Logic

12

Design of Logic gates- Design of adder, subtractor, comparators, code converters, encoders, decoders, multiplexers and demultiplexers. Function realization using gates & multiplexers.

UNIT IV Sequential Logic Design **12**

Building blocks of Sequential logic – RS, JK, Master – Slave, D and T flip- flop, Asynchronous and synchronous counters – Binary and BCD counters – shift registers – Design and Implementation of Sequential synchronous circuits

UNIT V Logic Families **12**

Memories: ROM, PROM, EPROM, PLA, PLD, FPGA, digital logic families: TTL, ECL, CMOS.

TOTAL = 60Hrs

COURSE OUTCOMES

- Ability to design combinational and sequential Circuits.
- Ability to simulate using software package.
- Ability to study various number systems and simplify the logical expressions using
- Boolean functions
- Ability to design various synchronous and asynchronous circuits.
- Ability to introduce asynchronous sequential circuits and PLDs
- Ability to introduce digital simulation for development of application oriented logic circuits.

TEXT BOOK:

1. Albert Paul, Malvino and Donald.P.Leach , "Digital Principles and Applications", McGraw Hill Publications.
2. Floyd, "Digital Fundamentals", Universal Book Stall, New Delhi,1993.
3. Moris Mano, "Digital Electronics and Design ", Prentice Hall of India, 2000.

REFERENCE:

1. "Digital Logic & Computer Design", Prentice Hall of India, 2000.

22153C25P-TRANSMISSION AND DISTRIBUTION 4 0 0 4

Semester II

AIM

To become familiar with the function of different components used in Transmission and Distribution levels of power systems and modeling of these components.

OBJECTIVES

i. To develop expression for computation of fundamental parameters of lines.
ii. To categorize the lines into different classes and develop equivalent circuits for these classes.
iii. To analyze the voltage distribution in insulator strings and cables and methods to improve the same.

UNIT I: INTRODUCTION 12

Structure of electric power system: Various levels such as generation, transmission and distribution; HVDC and EHV AC transmission: comparison of economics of transmission, technical performance and reliability.

Radial and ring-main distributors; interconnections; AC distribution: AC distributor with concentrated load; three-phase, four-wire distribution system; sub-mains; stepped and tapered mains.

UNITII:TRANSMISSION LINE PARAMETERS 12

Resistance, Inductance and Capacitance of single and three phase transmission lines - Stranded and Bundled conductors -Symmetrical and unsymmetrical spacing - Transposition -Application of self and mutual GMD -Skin and Proximity effect - Inductive interference with neighboring circuits.

UNIT III: MODELLING AND PERFORMANCE OF TRANSMISSION LINES 12

Classification of lines: Short line, medium line and long line; equivalent circuits, attenuation constant, phase constant, surge impedance; transmission efficiency and voltage regulation; real and reactive power flow in lines: Power-angle diagram; surge-impedance loading, loadability limits based on thermal loading, angle and voltage stability considerations; shunt and series compensation; Ferranti effect and corona loss.

UNIT IV: INSULATORS AND CABLES 12

Insulators: Types, voltage distribution in insulator string and grading, improvement of string efficiency. Underground cables: Constructional features of LT and HT cables, capacitance, dielectric stress and grading, thermal characteristics.

UNIT V: DESIGN OF TRANSMISSION LINES 12

Introduction, calculation of sag and tension .Equivalent span length and sag, Effect of ice and wind loading ,Stringing chart, sag template, conductor vibrations and vibrations dampers

TOTAL =60

COURSE OUTCOMES

To understand the importance and the functioning of transmission line parameters.

- To understand the concepts of Lines and Insulators.
- To acquire knowledge on the performance of Transmission lines.
- To acquire knowledge on Underground Cabilitys

TEXT BOOKS

1. B.R.Gupta, 'Power System Analysis and Design', S.Chand, New Delhi, 2003.
2. S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall of India Pvt. Ltd, New Delhi, 2002.

REFERENCE BOOKS

1. Luces M.Fualkenberry ,Walter Coffer, 'Electrical Power Distribution and Transmission', Pearson Education, 1996.
2. Hadi Saadat, 'Power System Analysis,' Tata McGraw Hill Publishing Company', 2003.
3.Central Electricity Authority (CEA), 'Guidelines for Transmission System Planning', New Delhi.
4.'Tamil Nadu Electricity Board Handbook', 2003.

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22148S31CP -PROBABILITY AND STATISTICS **3 1 0 4**

(Common to Mech, Civil, EEE)

SEMESTER-III

UNIT I PROBABILITY AND RANDOM VARIABLE 9+3hrs

Axioms of probability - Conditional probability - Total probability - Bayes theorem - Random variable - Probability mass function - Probability density functions -Properties-Moments - Moment generating functions and their properties.

UNIT II TWO DIMENSIONAL RANDOM VARIABLES 9+3hrs

Joint distributions - Marginal and conditional distributions – Covariance - Correlation and Regression - Transformation of random variables - Central limit theorem.

UNIT III STANDARD DISTRIBUTIONS 9+3hrs

Binomial, Poisson, Geometric, Negative Binomial, Uniform, Exponential, Gamma, Weibull and Normal distributions and their properties - Functions of a random variable.

UNIT IV TESTING OF HYPOTHESIS 9+3hrs

Sampling distributions – Testing of hypothesis for mean, variance, proportions and differences using Normal, t, Chi-square and F distributions - Tests for independence of attributes and Goodness of fit.

UNIT V DESIGN OF EXPERIMENTS 9+3hrs

Analysis of variance – One way classification – Complete randomized design - Two – way classification –Randomized block design - Latin square.

Note : Use of approved statistical table permitted in **Total no of hrs: 60hrs**

COURSE OUTCOMES

- Eigenvalues and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.
- Gradient, divergence and curl of a vector point function and related identities.
- Evaluation of line, surface and volume integrals using Gauss, Stokes and

Green’s theorems and their verification.

- Analytic functions, conformal mapping and complex integration.
- Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients

TEXT BOOKS

1. Ross. S., “A first Course in Probability”, Fifth Edition, Pearson Education, Delhi 2002. (Chapters 2 to 8)
2. Johnson. R. A., “Miller & Freund’s Probability and Statistics for Engineers”, Sixth Edition, Pearson Education, Delhi, 2000. (Chapters 7, 8, 9, 12)

REFERENCES BOOKS

1) Walpole, R. E., Myers, R. H. Myers R. S. L. and Ye. K, “Probability and Statistics for Engineers and Scientists”, Seventh Edition, Pearsons Education, Delhi, 2002.
2) Lipschutz. S and Schiller. J, “Schaum’s outlines - Introduction to Probability and Statistics”, McGraw-Hill, New Delhi, 1998.
3) Gupta, S.C, and Kapur, J.N., “Fundamentals of Mathematical Statistics”, Sultan Chand, Ninth Edition , New Delhi ,1996.

Semester III

22153C32P- LINEAR INTEGRATED CIRCUITS AND APPLICATIONS

3 1 0 4

AIM

To introduce the concepts for realizing functional building blocks in ICs, fabrications & application of ICs.

OBJECTIVES

- To study the IC fabrication procedure.
- To study characteristics; realize circuits; design for signal analysis using
- To study the applications of Op-amp.
- To study internal functional blocks and the applications of special ICs like circuits, regulator Circuits, ADCs.

UNIT I: IC FABRICATION 9

IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realisation of monolithic ICs and packaging. Fabrication of diodes, capacitance, resistance and FETs.

UNIT II: CHARACTERISTICS OF OPAMP 9

Ideal OP-AMP characteristics, DC characteristics, AC characteristics,, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – Inverting and Non-inverting Amplifiers-V/I & I/V converters ,summer, differentiator and integrator.

UNIT III: APPLICATIONS OF OPAMP 9

Instrumentation amplifier, Log and Antilog Amplifiers, first and second order active filters, comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R- 2R ladder and weighted resistor types), A/D converters using opamps.

UNIT IV: SPECIAL ICs 9

Functional block, characteristics & application circuits with 555 Timer Ic-566 voltage controlled oscillator Ic; 565-phase lock loop Ic ,Analog multiplier ICs.

UNIT V: APPLICATION ICs

IC voltage regulators –LM78XX,79XX Fixed voltage regulators - LM317, 723 Variable voltage regulators, switching regulator- SMPS- LM 380 power amplifier- ICL 8038 function generator IC.

TOTAL = 45

COURSE OUTCOMES

- Ability to understand and analyse, linear and digital electronic circuits.

TEXT BOOKS

1. David A.Bell, ‘Op-amp & Linear ICs’, Oxford, 2013.
2. D.Roy Choudhary, Sheil B.Jani, ‘Linear Integrated Circuits’, II edition, New Age, 2003.
3. Ramakant A.Gayakward, ‘Op-amps and Linear Integrated Circuits’, IV edition, Pearson Education, 2003 / PHI. 2000.

REFERENCE BOOKS

1. Fiore,”Opamps & Linear Integrated Circuits Concepts & Applications”,Cengage,2010.
2. Floyd ,Buchla,”Fundamentals of Analog Circuits, Pearson, 2013.
3. Jacob Millman, Christos C.Halkias, ‘Integrated Electronics - Analog and Digital circuits system’,Tata McGraw Hill, 2003.
4. Robert F.Coughlin, Fredrick F. Driscoll, ‘Op-amp and Linear ICs’, PHI Learning, 6th edition,2012.

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SEMESTER-III

22153C33P - POWER ELECTRONICS 4 0 0 4

AIM:

To understand the various applications of electronic devices for conversion, control and conditioning of the electrical power.

OBJECTIVES:

- To get an overview of different types of power semiconductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers
- To study the operation, switching techniques and basics topologies of DC-DC switching regulators.
- To learn the different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
- To study the operation of AC voltage controller and Matrix converters.

UNIT I- POWER SEMI-CONDUCTOR DEVICES : 12

Overview of switching devices – Driver and snubber circuit of SCR TRIAC, GTO, GBT, MOSFET – Computer simulation of PE circuits.

UNIT II-PHASE CONTROLLED CONVERTERS

12

2 pulse / 3 pulse and 6 pulse converters – Effect of source inductance – performance parameters – Reactive power control of converters – Dual converters.

UNIT III -DC TO DC CONVERTERS 12

Stepdown and stepup chopper – Forced commutation techniques – Time ratio control and current limit control – Switching mode regulators Buck, Boost, Buck-Boost – concept of resonant switching.

UNIT IV- INVERTERS 12

Single phase and three phase [120& 180mode] inverters – PWM techniques –Sinusoidal PWM, Modified sinusoidal PWM and multiple PWM – Voltage and harmonic control – Series resonant inverter – current source inverter.

UNIT V- AC TO AC CONVERTERS

12

Single phase AC voltage controllers – Multistage sequence control – single phase andthree phase cycloconverters – power factor control – Matrix converters.

L: 45 T: 15 TOTAL: 60 PERIODS

COURSE OUTCOMES

- Ability to analyse AC-AC and DC-DC and DC-AC converters.
- Ability to choose the converters for real time applications.

TEXT BOOKS:

1. Rashid M.H., "Power Electronics Circuits, Devices and Applications", Prentice Hall India, 3rd Edition, New Delhi, 2004.
2. Ned Mohan, T.M.Undeland, W.P.Robbins, "Power Electronics: Converters, applications and design", John wiley and Sons, 3rd Edition, 2006.

REFERENCES:

1. Cyril.W.Lander, "Power Electronics", McGraw Hill International, Third Edition, 1993.
2. P.S.Bimbra "Power Electronics", Khanna Publishers, third Edition 2003.
3. Philip T.Krein, "Elements of Power Electronics" Oxford University Press, 2004 Edition.

22153C34P-MEASUREMENTS AND INSTRUMENTATION

4 0 0 4

Semester III

AIM

To provide adequate knowledge in electrical instruments and measurements techniques.

OBJECTIVES

To make the student have a clear knowledge of the basic laws governing the operation of the instruments, relevant circuits and their working.

i. Introduction to general instrument system, error, calibration etc.
ii. Emphasis is laid on analog and digital techniques used to measure voltage, current, energy and power etc.
iii. To have an adequate knowledge of comparison methods of measurement.
iv. Elaborate discussion about storage & display devices.
v. Exposure to various transducers and data acquisition system.

UNIT I: INTRODUCTION 10

Functional elements of an Instrument -Static and Dynamic characteristics -Errors in measurement -Statistical evaluation of measurement data -Standard and Calibration.

UNIT II: ELECTRICAL AND ELECTRONICS INSTRUMENTS 12

Construction and principle of operation of moving coil, moving Iron, Principle and types analog and digital ammeters and voltmeters -Single and three phase Wattmeter and Energy meter - magnetic measurements - -Instruments for measurement of frequency and phase.

UNIT III: SIGNAL CONDITIONING CIRCUITS 12

Bridge circuits – Differential and Instrumentation amplifiers -Filter circuits - V/f and f/V converters – P/I and I/P converters – S/H Circuit, A/D and D/A converters -Multiplexing and De-multiplexing -Data acquisition systems –Grounding techniques.

UNIT IV: STORAGE AND DISPLAY DEVICES 12

Magnetic disc and Tape Recorders -Digital plotters and printers -CRT displays -Digital CRO – LED, LCD and Dot matrix displays.

UNIT V: TRANSDUCERS 14

Classification of Transducers -Selection of Transducers –Resistive, Capacitive and Inductive Transducers -Piezo electric Transducers -Transducers for measurement of displacement, temperature, level, flows, pressure, velocity, acceleration, torque, speed, viscosity and moisture.

Total = 60

COURSE OUTCOMES

To acquire knowledge on Basic functional elements of instrumentation

- To understand the concepts of Fundamentals of electrical and electronic instruments
- Ability to compare between various measurement techniques
- To acquire knowledge on Various storage and display devices
- To understand the concepts Various transducers and the data acquisition systems
- Ability to model and analyze electrical and electronic Instruments and understand the operational features of display Devices and Data Acquisition System.

TEXT BOOKS

1. E.O. Doebelin, 'Measurement Systems – Application and Design', Tata McGraw Hill publishing company, 2003.
2. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2004.

REFERENCE BOOKS

1. A.J. Bouwens, 'Digital Instrumentation', Tata McGraw Hill, 1997.
2. D.V.S. Moorthy, 'Transducers and Instrumentation', Prentice Hall of India Pvt Ltd, 2003.
3. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw Hill, 1995.
4. Martin Reissland, 'Electrical Measurements', New Age International (P) Ltd., Delhi, 2001.
5. J. B. Gupta, 'A Course in Electronic and Electrical Measurements', S. K. Kataria & Sons, Delhi, 2003.

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22153L35P- DC AND AC ELECTRICAL MACHINES LABORATORY **0 0 3 2**

Semester III

OBJECTIVES:

- To impart hands on experience in verification of circuit laws and theorems, measurement of circuit parameters, study of circuit characteristics and simulation of time response.
- To expose the students to the basic operation of electrical machines and help them to develop experimental skills.

LIST OF EXPERIMENTS

1. Open circuit characteristics of D.C. shunt generator.
2. Load characteristics of D.C. shunt generator.
3. Load test on D.C. shunt and Compound Motor.
4. Load test on D.C. series motor.
5. Swinburne's test and speed control of D.C. shunt motor
6. Hopkinson's test on D.C. motor generation set.
7. Load test on single phase and three phase transformer
8. open circuit and short circuit tests on single phase and three phase transformer (Determination of equivalent circuit parameters).
9. Load test on single phase induction motor.
10. No load and blocked rotor tests on three phase induction motor (Determination of equivalent circuit parameters)
11. Load test on Three phase induction motor.
12. Study of Starters **TOTAL: 45**

COURSE OUTCOMES

At the end of the course, the student should have the :

- Ability to conduct performance tests on DC and AC machines
- Ability to understand and analyze EMF and MMF methods
- Ability to analyze the characteristics of V and Inverted V curves
- Ability to understand the importance of Synchronous machines
- Ability to understand the importance of Induction Machines

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. DC Shunt Motor with Loading Arrangement – 3 nos
2. Single Phase Transformer – 4 nos
3. DC Series Motor with Loading Arrangement – 1 No.

4. Three Phase Induction Motor with Loading Arrangement – 2 nos
5. Single Phase Induction Motor with Loading Arrangement – 1 No
6. DC Shunt Motor Coupled With DC Compound Generator – 2 nos
7. DC Shunt Motor Coupled With DC Shunt Generator – 1 No.
8. Tachometer -Digital/Analog – 8 nos
9. Single Phase Auto Transformer – 2 nos
10. Three Phase Auto Transformer – 1 No.
11. Single Phase Resistive Loading Bank – 2 nos
12. Three Phase Resistive Loading Bank. – 2 nos
13. SPST switch – 2 nos
14. Single Phase Transformer - 1 No.
15. Three Phase Transformer - 1 No.

SEMESTER-IV

22153C41P- PROTECTION AND SWITCHGEAR

4 0 0 4

AIM

To expose the students to the various faults in power system and learn the various methods of protection scheme.
To understand the current interruption in Power System and study the various switchgears.

OBJECTIVES

i. Discussion on various earthling practices usage of symmetrical components to estimate fault current and fault MVA.
ii. Study of Relays & Study of protection scheme, solid state relays.
iii. To understand instrument transformer and accuracy.
iv. To understand the method of circuit breaking various arc theories Arcing phenomena – capacitive and inductive breaking.
v. Types of circuit breakers.

UNIT I: INTRODUCTION 12

Principles and need for protective schemes – nature and causes of faults – types of faults – fault current calculation using symmetrical components – Power system earthing - Zones of protection and essential qualities of protection – Protection scheme.

UNIT II: OPERATING PRINCIPLES AND RELAY CONSTRUCTIONS 12

Need for protection – essential qualities of protective relays – Electromagnetic relays, Induction relays – Over current relays - Directional, Distance, Differential and negative sequence relays. Static relays

UNIT III: APPARATUS PROTECTION 12

Apparatus protection transformer, generator, motor, protection of bus bars, transmission lines – CTs and PTs and their applications in protection schemes.

UNIT IV: THEORY OF CIRCUIT INTERRUPTION 12

Physics of arc phenomena and arc interruption. Restricting voltage & Recovery voltage, rate of rise of recovery voltage, resistance switching, current chopping, and interruption of capacitive current – DC circuit breaking.

UNIT V: CIRCUIT BREAKERS 12

Types of Circuit Breakers – Air blast, Air break, oil SF_6 and Vacuum circuit breakers – comparative merits of different circuit breakers – Testing of circuit breakers

COURSE OUTCOMES

- Ability to understand and analyze Electromagnetic and Static Relays.
- Ability to suggest suitability circuit breaker.
- Ability to find the causes of abnormal operating conditions of the apparatus and system.
- Ability to analyze the characteristics and functions of relays and protection schemes. Ability to study about the apparatus protection, static and numerical relays.
- Ability to acquire knowledge on functioning of circuit breaker.

TEXT BOOKS

1. B. Ravindranath, and N. Chander, 'Power System Protection & Switchgear', Wiley Eastern Ltd., 1977.

REFERENCE BOOKS

1. Sunil S. Rao, 'Switchgear and Protection', Khanna publishers, New Delhi, 1986 .
2. C.L. Wadhwa, 'Electrical Power Systems', Newage International (P) Ltd., 2000.
3. M.L. Soni, P.V. Gupta, V.S. Bhatnagar, A. Chakrabarti, 'A Text Book on Power System Engineering', Dhanpat Rai & Co., 1998.
4. Badri Ram, Vishwakarma, 'Power System Protection and Switchgear', Tata McGraw hill, 2001.
5. Y.G. Paithankar and S.R. Bhide, 'Fundamentals of Power System Protection', Prentice Hall of India Pvt. Ltd., New Delhi – 110001, 2003.

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22153C42P -HIGH VOLTAGE DC TRANSMISSION

3 1 0 4

Semester IV

AIM:
To learn the HVDC modelling and control strategy.

OBJECTIVES:
 To study the performance of converters and modeling of DC line with controllers.
 To study about converter harmonics and its mitigation using active and passive filters.

UNIT I- DC POWER TRANSMISSION TECHNOLOGY 9
Introduction-comparison of AC and DC transmission application of DC transmission – Description of DC transmission system planning for HVDC transmission-modern trends In DC transmission.

UNIT II- ANALYSIS OF HVDC CONVERTERS 9
Pulse number, choice of converter configuration-simplified analysis of Graetz circuit converter bridge characteristics – characteristics of a twelve pulse converter-detailed analysis of converters.

UNIT III- CONVERTER AND HVDC SYSTEM CONTROL 9
General principles of DC link control-converter control characteristics-system control Hierarchy-firing angle control-current and extinction angle control-starting and stopping of DC link-power control-higher level controllers-telecommunication requirements.

UNIT IV -HARMONICS AND FILTERS 9
Introduction-generation of harmonics-design of AC filters-DC filters-carrier frequency and RI noise.

UNIT V -SIMULATION OF HVDC SYSTEMS 9
Introduction-system simulation: Philosophy and tools-HVDC system simulation-modeling of HVDC systems for digital dynamic simulation.

TOTAL: 45 PERIODS

COURSE OUTCOMES

- Ability to understand Generation and measurement of high voltage.
- Ability to understand High voltage testing.
- Ability to understand various types of over voltages in power system. Ability to measure over voltages.
- Ability to test power apparatus and insulation coordination

TEXT BOOKS:

1. Padiyar, K.R., HVDC power transmission system, Wiley Eastern Limited, New Delhi 1990.First edition.
2. P.Kundur, ‘Power System Stability and Control’, Tata McGraw Hill Publishing Company Ltd., USA, 1994.
3. Arrillaga, J., High Voltage direct current transmission, Peter Pregrinus, London, 1983.

REFERENCES:

1. Edward Wilson Kimbark, Direct Current Transmission, Vol. I, Wiley interscience, New York, London, Sydney, 1971.
2. Rakosh Das Begamudre, Extra high voltage AC transmission engineering New

22153C43P- SOLID STATE DRIVES

3 1 0 4
Semester IV

AIM
To study and understand the operation of electric drives controlled from a power electronic converter and to introduce the design concepts of controllers.

OBJECTIVES
i. To understand the stable steady-state operation and transient dynamics of a motor-load system.
ii. To study and analyze the operation of the converter / chopper fed dc drive and to solve simple problems.
iii. To study and understand the operation of both classical and modern induction motor drives.
iv. To understand the differences between synchronous motor drive and induction motor drive and to learn the basics of permanent magnet synchronous motor drives.
v. To analyze and design the current and speed controllers for a closed loop solid-state d.c motor drive.

UNIT I DRIVE CHARACTERISTICS **9**

Equations governing motor load dynamics - Equilibrium operating point and its steady state stability - Mathematical condition for steady state stability and problems - Multi quadrant dynamics in the speed torque plane - Basics of regenerative braking - Typical load torque characteristics - Acceleration, deceleration, starting and stopping.

UNIT II DC MOTOR DRIVE **9**

Steady state analysis of the single and three phase fully controlled converter fed separately excited D.C motor drive: Continuous and discontinuous conduction mode - Chopper fed D.C drive: Time ratio control and current limit control - Operation of four quadrant chopper.

UNIT III STATOR CONTROLLED INDUCTION MOTOR DRIVES **9**

Variable terminal voltage control – Variable frequency control – V/f control - AC voltage controllers – Four-quadrant control and closed loop operation - Frequency controlled drives- VSI and CSI fed drives – closed loop control.

UNIT IV ROTOR CONTROLLED INDUCTION MOTOR DRIVES **9**

Rotor resistance control – slip power recovery schemes - sub synchronous and super synchronous operations – closed loop control – Braking in induction motors.

UNIT V- SYNCHRONOUS MOTOR DRIVES 9

Wound field cylindrical rotor motor – operation from constant voltage and frequency source – operation from current source – operation from constant frequency – Brushless excitation – Permanent magnet synchronous motor.

Self-controlled Synchronous motor drives – Brushless dc and ac motor drives – CSI with load commutation – Cycloconverter with load commutation.

TOTAL = 45

COURSE OUTCOMES

- Ability to understand and suggest a converter for solid state drive.
- Ability to select suitability drive for the given application.
- Ability to study about the steady state operation and transient dynamics of a motor load system. Ability to analyze the operation of the converter/chopper fed dc drive.
- Ability to analyze the operation and performance of AC motor drives.
- Ability to analyze and design the current and speed controllers for a closed loop solid

TEXT BOOKS

1. R. Krishnan, 'Electric Motor & Drives: Modelling, Analysis and Control', Prentice Hall of India, 2001.
2. Bimal K. Bose. 'Modern Power Electronics and AC Drives', Pearson Education, 2002.

REFERENCE BOOKS

1. G.K. Dubey, 'Power Semi-conductor Controlled Drives', Prentice Hall of India, 1989.
2. Vedam Subrahmanyam, "Electric drives concepts and applications", TMH Pub. Co.Ltd., 1994.
3. Murphy, J.M.D and Turnbull.F.G. , "Thyristor control of AC Motors", Pergamon Press, 1988.
4. Sen. P.C., "Thyristor D.C. Drives", John Wiley and Sons, 1981.

22153L45P CONTROL AND INSTRUMENTATION LABORATORY

0 0 3 2

Semester IV

AIM

To provide knowledge on analysis and design of control and instrumentation

LIST OF EXPERIMENTS

CONTROLSYSTEMS:

1. P, PI and PID controllers
2. Stability Analysis
3. Modeling of Systems – Machines, Sensors and Transducers
4. Design of Lag, Lead and Lag-Lead Compensators
5. Position Control Systems
6. Synchro-Transmitter- Receiver and Characteristics
7. Simulation of Control Systems by Mathematical development tools.

INSTRUMENTATION:

8. Bridge Networks –AC and DC Bridges
9. Dynamics of Sensors/Transducers

a. Temperature
b. Pressure
c. Displacement
d. Optical
e. Strain f. Flow

10. Power and Energy Measurement
11. Signal Conditioning

a. Instrumentation Amplifier
b. Analog – Digital and Digital –Analog converters (ADC and DACs)

12. Process Simulation. **P = 45**

Total = 45

COURSE OUTCOMES

Ability to understand and apply basic science, circuit theory, Electro-magnetic field theory control theory and apply them to electrical engineering problems.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CONTROLSYSTEMS:

1. PID kit – 1 No.

DSO – 1 No.

CRO Probe – 2 nos

Personal computers

3. DC motor – 1 No.

Generator – 1 No. Rheostats – 2 nos

Ammeters Voltmeters

Connecting wires (3/20)
4. CRO 30MHz – 1 No.
2MHz Function Generator – 1No.
5. Position Control Systems Kit (with manual) – 1 No., Tacho Generator Coupling set
6. AC Synchro transmitter& receiver – 1No.
Digital multi meters

INSTRUMENTATION:
7. R, L, C Bridge kit (with manual)
8. a) Electric heater – 1No.
Thermometer – 1No.Thermistor (silicon type) RTD nickel type – 1No.

b) 30 psi Pressure chamber (complete set) – 1No. Current generator (0 – 20mA)
Air foot pump – 1 No. (with necessary connecting tubes)
c) LVDT20mm core length movable type – 1No. CRO 30MHz – 1No.
d) Optical sensor – 1 No. Light source
e) Strain Gauge Kit with Handy lever beam – 1No.
100gm weights – 10 nos
f) Flow measurement Trainer kit – 1 No.
(1/2 HP Motor, Water tank, Digital Milliammeter, complete set)
9. Single phase Auto transformer – 1No.
Watthour meter (energy meter) – 1No. Ammeter
Voltmeter Rheostat Stop watch
Connecting wires (3/20)
10. IC Transistor kit – 1No.

22153C51P-POWER SYSTEM ANALYSIS

3 1 0 4
Semester V

AIM
To become familiar with different aspects of modeling of components and system and different methods of analysis of power system planning and operation.

OBJECTIVES

i. To model steady-state operation of large-scale power systems and to solve the power flow problems using efficient numerical methods suitable for computer simulation.
ii. To model and analyse power systems under abnormal (fault) conditions.
iii. To model and analyse the dynamics of power system for small-signal and large signal disturbances and o design the systems for enhancing stability.

UNIT I- THE POWER SYSTEM AN OVER VIEW AND MODELLING 12

Moder n Power System - Basic Components of a power system - Per Phase Analysis Generator model - Transformer model - line model. The per unit system -Change of base.

UNIT II- POWER FLOW ANALYSIS 12
Introduction - Bus Classification - Bus admittance matrix - Solution of non-linear Algebraic equations - Gauss seidal method - Newton raphson method - Fast decoupled method - Flow charts and comparison of the three methods.

UNIT III-FAULT ANALYSIS-BALANCED FAULT 12
Introduction – Balanced three phase fault – short circuit capacity – systematic fault analysis using bus impedance matrix – algorithm for formation of he bus impedance matrix.

UNIT IV-FAULT ANALYSIS – SYMMETRICAL COMPONENTS AND UNBALANCED FAULT 12
Introduction – Fundamentals of symmetrical components – sequence impedances – sequence networks – single line to ground fault – line fault - Double line to ground fault – Unbalanced fault analysis using bus impedance matrix.

UNIT V-POWER SYSTEM STABILITY 12
Dynamics of a Synchronous machine – Swing equation and Power angle equation – Steady state Stability and Transient state Stability - Equal area criterion – Cearing angle and time- Numerical solution of Swing equation for single machine

Total = 60 Hrs
<u>COURSE OUTCOMES</u>

- Ability to model the power system under steady state operating condition

  Ability to understand and apply iterative techniques for power flow analysis

  Ability to model and carry out short circuit studies on power system

- Ability to model and analyze stability problems in power system

- Ability to acquire knowledge on Fault analysis.
- Ability to model and understand various power system components and carry out power flow, short circuit and stability studies

TEXT BOOKS:

1. Hadi Saadat "Power system analysis", Tata McGraw Hill Publishing Company, New Delhi, 2002 (Unit I, II, III, IV)

2. P.Kundur, "Power System Stability and Control", Tata McGraw Hill Publishing Company, New Delhi, 1994 (Unit V)

REFERENCE BOOKS:

1. I.J.Nagrath and D.P.Kothari, 'Modern Power System Analysis', Tata McGraw-Hill publishing company, New Delhi, 1990.

2. M.A. Pai, 'Computer Techniques in power system Analysis', Tata McGraw – Hill publishing company, New Delhi, 2003.

3. John J. Grainger and Stevenson Jr. W.D., 'Power System Analysis', McGraw Hill International Edition, 1994

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22153C52P - POWER QUALITY

3 1 0 4
Semester V

UNIT I INTRODUCTION TO POWER QUALITY 3

Terms and definitions: Overloading, under voltage, sustained interruption; sags and swells; waveform distortion, Total Harmonic Distortion (THD), Computer Business Equipment Manufacturers Associations (CBEMA) curve.

UNIT II VOLTAGE SAGS AND INTERRUPTIONS 7

Sources of sags and interruptions, estimating voltage sag performance, motor starting sags, estimating the sag severity, mitigation of voltage sags, active series compensators, static transfer switches and fast transfer switches.

UNIT III OVER VOLTAGES 10

Sources of over voltages: Capacitor switching, lightning, ferro resonance; mitigation of voltage swells: Surge arresters, low pass filters, power conditioners – Lightning protection, shielding, line arresters, protection of transformers and cables.

UNIT IV HARMONICS 12

Harmonic distortion: Voltage and current distortion, harmonic indices, harmonic sources from commercial and industrial loads, locating harmonic sources; power system response characteristics, resonance, harmonic distortion evaluation, devices for controlling harmonic distortion, passive filters, active filters, IEEE and IEC standards.

UNIT V POWER QUALITY MONITORING 17

Monitoring considerations: Power line disturbance analyzer, per quality measurement equipment, harmonic/spectrum analyzer, flicker meters, disturbance analyzer, applications of expert system for power quality monitoring.

L=45 Total=45

COURSE OUTCOMES

- Ability to understand and analyze power system operation, stability, control and protection.
- The students able to understand the over voltage protection & analysis tools used for analyzing the transients.
- They are fully trained in designing and evaluating the devices of harmonic distortion.

REFERENCE BOOKS

1. Roger.C.Dugan, Mark.F.McGranagham, Surya Santoso, H.Wayne Beaty, 'Electrical Power Systems Quality' McGraw Hill, 2003.
2. PSCAD User Manual.

22153C53P- SPECIAL ELECTRICAL MACHINES **4 0 0 4**

Semester V

AIM

To expose the students to the construction, principle of operation and performance of special electrical machines as an extension to the study of basic electrical machines.

OBJECTIVES

To impart knowledge on

i. Construction, principle of operation and performance of synchronous reluctance motors.

ii. Construction, principle of operation and performance of stepping motors.

iii. Construction, principle of operation and performance of switched reluctance motors.

iv. Construction, principle of operation and performance of permanent magnet brushless D.C. motors.

v. Construction, principle of operation and performance of permanent magnet synchronous motors.

UNIT I-SYNCHRONOUS RELUCTANCE MOTORS **9**

Constructional features – types – axial and radial air gap motors – operating principle – reluctance – phasor diagram - characteristics – Vernier motor.

UNIT II -STEPPING MOTORS **9**

Constructional features – principle of operation – variable reluctance motor – Hybrid motor – single and Multi stack configurations – theory of torque predictions – linear and non-linear analysis – characteristics – drive circuits.

UNIT III-SWITCHED RELUCTANCE MOTORS **9**

Constructional features – principle of operation – torque prediction – power controllers – Nonlinear analysis – Microprocessor based control - characteristics – computer control.

UNIT IV-PERMANENT MAGNET BRUSHLESS D.C. MOTORS **9**

Principle of operation – types – magnetic circuit analysis – EMF and Torque equations – Power Controllers – Motor characteristics and control.

UNIT V-PERMANENT MAGNET SYNCHRONOUS MOTORS **9**

Principle of operation – EMF and torque equations – reactance – phasor diagram – power controllers - converter - volt-ampere requirements – torque speed characteristics - microprocessor based control.

L=45 Total=45

COURSE OUTCOMES

- Ability to analyze and design controllers for special Electrical Machines.
- Ability to acquire the knowledge on construction and operation of stepper motor.
- Ability to acquire the knowledge on construction and operation of stepper switched reluctance motors.
- Ability to construction, principle of operation, switched reluctance motors.

- Ability to acquire the knowledge on construction and operation of permanent magnet brushless D.C. motors.
- Ability to acquire the knowledge on construction and operation of permanent magnet synchronous motors.

TEXT BOOKS

1. Miller, T.J.E., 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press, Oxford, 2289.

2. Aearnley, P.P., 'Stepping Motors – A Guide to Motor Theory and Practice', Peter Perengrinus, London, 1982.

REFERENCES

1. Kenjo, T., 'Stepping Motors and their Microprocessor Controls', Clarendon Press London, 1984.

2. Kenjo, T., and Nagamori, S., 'Permanent Magnet and Brushless DC Motors', Clarendon Press, London, 1988.

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22153L55P - POWER ELECTRONICS AND DRIVES LAB

Semester V

0 0 3 2

AIM

To study the characteristics of switching devices and its applications in rectifier inverter, chopper and resonant converter.

1. Study Of V-I Characteristics Of An SCR.
2. Study Of V-I Characteristics Of A TRIAC.
3. Study Of Different Trigerring Circuits For Thyristor.
4. Study Of Uni- Junction Transistor (UJT) Trigerring Circuit.
5. Study Of A Firing Circuit Suitable For Single Phase Half Controlled Convertor.
6. Simulation On the Single Phase Ac-Dc Uncontrolled Convertor with & without the source Inductance.
7. Simulation Of A Single Phase Ac To Controlled Dc Convertor with & without the source Inductance.
8. Single Phase Half Controlled Bridge Convertor With Two Thyristors & Two Diodes.
9. Single Phase Fully Controlled Bridge Convertor Using Four Thyristors.
10. Pspice or MATH LAB Simulation Of Dc to Dc Step Down Chopper.
11. Pspice or MATH LAB Simulation Of Single Phase Controller with R-L Load.
12. Pspice or MATH LAB Simulation Of PWM Bridge Invertor Of R-L Load Using MOSFET.

COURSE OUTCOMES

- Ability to practice and understand converter and inverter circuits and apply software for engineering problems.
- Ability to analyze about AC to DC converter circuits.
- Ability to analyze about DC to AC circuits.
- Ability to acquire knowledge on AC to AC converters
- Ability to acquire knowledge on simulation software.

22153C61P- UTILIZATION OF ELECTRICAL ENERGY

3 1 0 4
Semester VI

AIM
To plan and design using basic principles and handbooks
To select equipment, processes and components in different situations.

OBJECTIVES

i. To ensure that the knowledge acquired is applied in various fields as per his job requirements.

ii. To orient the subject matter in the proper direction, visits to industrial establishments are recommended in order to familiarize with the new developments in different areas.

UNIT I ELECTRIC LIGHTING 12

Production of light – Definition of terms – Lighting calculations – Types of lamps – Interior and Exterior illumination systems – Lighting schemes – Design of Lighting schemes – Factory lighting – Flood lighting – Energy saving measures.

UNIT II ELECTRIC HEATING 12

Resistance heating – Induction heating – Dielectric heating – Arc furnace – Control equipment, efficiency, and losses – Energy conservation in Arc Furnace Industry.

UNIT III ELECTRIC WELDING 12

Welding equipment – Characteristics of carbon and metallic arc welding – Butt welding – Spot welding – Energy conservation in welding.

UNIT IV ELECTRIC VEHICLE 12

Traction: System of track electrification, train movement and energy consumption (speed time curves, crest speed, average speed and schedule speed) rective effort, factors affecting energy consumption (dead weight, acceleration weight and adhesion weight) starting and braking of traction motors, protective devices

UNIT V ELECTRO CHEMICAL PROCESS 12

Electrolysis – Electroplating – Electro deposition – Extraction of metals – Current, efficiency – Batteries – Types – Charging methods.

Total = 60

COURSE OUTCOMES

- To understand the main aspects of generation, utilization and conservation.
- To identify an appropriate method of heating for any particular industrial application.
- To evaluate domestic wiring connection and debug any faults occurred.
- To construct an electric connection for any domestic appliance like refrigerator as well as to design a battery charging circuit for a specific household application.

Text Books:

1. Tripathy,S.C., “Electric Energy Utilization & Conservation” – Tata McGraw Hill Publishing Company.
2. Uppal,S.L., “Electric Power”, Khanna Publishers.
3. Soni,M.L., P.V.Gupta & Bhatnagar , “A course in Electric Power”, Dhanpat Rai & Sons.

Reference Books:

1. Partab,H., “Art & Science Utilization of Electrical Energy” – Dhanpat Rai & Sons.
2. Wadhwa,C.L., “Generation, Utilization & Distribution” - Wilsey Eastern Ltd.
3. Wadha C L - Utilization of Electric Power; New Age International
4. Suryanarayana . N.V., “Utilization of Electric Power” - Wilsey Eastern Ltd.

22153C62P SOLID STATE RELAYS **4 0 0 4**

Semester VI

UNIT 1 **9**

Advantages of Static Relays – Generalized Characteristics and Operational Equations of Relays – Steady State and Transient Performance of Signal Driving Elements – Signal Mixing Techniques and Measuring Techniques – CT's and PT's in Relaying Schemes – Saturation Effects.

UNIT 2 **9**

Static Relay Circuits (Using Analog and Digital IC's) for Over Current, Inverse Time Characteristics, Differential Relay and Directional Relay.

UNIT 3 **9**

Static Relay Circuits for Generator Loss of Field, Under Frequency Distance Relays, Impedance, Reactance, MHO, Reverse Power Relays.

UNIT 4 **9**

Static Relay Circuits for Carrier Current Protection – Steady State and Transient Behavior of Static Relays – Testing and Maintenance – Tripping Circuits using Thyristor.

UNIT 5 **9**

Microprocessor Based Relays – Hardware and Software for the Measurement of Voltage, Current, Frequency, Phase Angle – Microprocessor Implementation of Over Current Relays – Inverse Time Characteristics – Impedance Relay – Directional Relay – MHO Relay.

Total=45

COURSE OUTCOMES

- Ability to suggest suitability circuit breaker.
- Ability to find the causes of abnormal operating conditions of the apparatus and system.

Text Books:

1. Badriram and Vishwakarma D.N., Power System Protection and Switchgear, Tata McGraw Hill, New Delhi, 1995.
2. Rao T.S.M., Power System Protection – Static Relays, McGraw Hill, 1979.

Reference Books:

1. Van C.Warrington, "Protection Relays – Their Theory and Practice", Chapman and Hall.
2. Ravindranath B. and Chander M., "Power System Protection and Switchgear", Wiley Eastern, 1992.
3. Russel C.Mason, "The Art and Science of Protective relays".

22153C63P- POWER SYSTEM OPERATION AND CONTROL

4 0 0 4

Semester VI

AIM

To become familiar with the preparatory work necessary for meeting the next day's operation and the various control actions to be implemented on the system to meet the minute-to-minute variation of system load.

OBJECTIVES

i. To get an overview of system operation and control.
ii. To understand & model power-frequency dynamics and to design power-frequency controller.
iii. To understand & model reactive power-voltage interaction and different methods of control for maintaining voltage profile against varying system load.

UNIT I INTRODUCTION 12

System load variation: System load characteristics, load curves - daily, weekly and annual, load-duration curve, load factor, diversity factor. Reserve requirements: Installed reserves, spinning reserves, cold reserves, hot reserves. Overview of system operation: Load forecasting, unit commitment, load dispatching. Overview of system control: Governor Control, LFC, EDC, AVR, system voltage control, security control.

UNIT II REAL POWER - FREQUENCY CONTROL 12

Fundamentals of Speed Governing mechanisms and modeling - Speed-Load characteristics-regulation of two Synchronous Machines in parallel - Control areas - LFC of single & Multi areas - Static & Dynamic Analysis of uncontrolled and controlled cases –Tie line with frequency bias control – Steady state instabilities.

UNIT III REACTIVE POWER–VOLTAGE CONTROL 12

Typical excitation system, modeling, static and dynamic analysis, stability compensation; generation and absorption of reactive power: Relation between voltage, power and reactive power at a node; method of voltage control: Injection of reactive power. Tap-changing transformer, numerical problems - System level control using generator voltage magnitude setting, tap setting of OLTC transformer.

UNIT IV UNIT COMMITMENT AND ECONOMIC DISPATCH 12

Statement of Unit Commitment (UC) problem; constraints in UC: spinning reserve, thermal unit constraints, hydro constraints, fuel constraints and other constraints; UC solution methods: Priority-list methods, forward dynamic programming approach, numerical problems only in priority-list method using full-load average production cost. Incremental cost curve, co-ordination equations without loss and with loss, solution by direct method and λ-iteration method. (No derivation of loss coefficients.) Base point and participation factors.

UNIT V COMPUTER CONTROL OF POWER SYSTEMS 12

Energy control centre: Functions – Monitoring, data acquisition and control. System hardware configuration – SCADA and EMS functions: Network topology determination, state estimation, security analysis and control. Various operating states: Normal, alert, emergency, in extremis and restorative. State transition diagram showing various state transitions and control strategies. **Total = 60**

COURSE OUTCOMES

- Ability to understand the day-to-day operation of electric power system.
- Ability to analyze the control actions to be implemented on the system to meet the minute- to-minute variation of system demand.
- Ability to understand the reactive power-voltage interaction.

TEXT BOOKS

1. Olle. I. Elgerd, 'Electric Energy Systems Theory – An Introduction', Tata McGraw Hill Publishing Company Ltd, New Delhi, Second Edition, 2003.
2. Allen.J.Wood and Bruce F.Wollenberg, 'Power Generation, Operation and Control', John Wiley & Sons, Inc., 2003.
3. P. Kundur, 'Power System Stability & Control', McGraw Hill Publications, USA, 1994.

REFERENCE BOOKS

1. D.P. Kothari and I.J. Nagrath, 'Modern Power System Analysis', Third Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.
2. L.L. Grigsby, 'The Electric Power Engineering, Hand Book', CRC Press & IEEE Press, 2001.

22153L65P **POWER SYSTEMS LAB**

0 0 3 2

AIM

To simulate analysis and planning cases for a practical power system.

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List Of Experiments:

1. Formation of Y-Bus Matrix by Inspection and Singular transformation methods.

2. Load flow solution using Gauss Seidal method

3. Load flow solution using Newton-Raphson method

4. Load flow solution by Fast Decoupled method

5. Symmetrical short circuit analysis

6. Unsymmetrical Fault analysis

7. Solution of swing Equation using modified Euler method

8. Power Electronic Circuits, design and simulation using Pspice

9. Simulation of Electrical drives using MATLAB, PSCAD

10.Control system design using MATLAB

P = 45 Total = 45

COURSE OUTCOMES

- Ability to understand power system planning and operational studies.
- Ability to acquire knowledge on Formation of Bus Admittance and Impedance Matrices and Solution of Networks.
- Ability to analyze the power flow using GS and NR method
- Ability to find Symmetric and Unsymmetrical fault

Semester VII

22160S71P TOTAL QUALITY MANAGEMENT 3 0 0 3

UNIT – I: BASICS OF TQM 9

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT – II: PRINCIPLES OF TQM 9

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Performance Measures – Basic Concepts, Strategy, Performance Measure.

UNIT – III: QUALITY CONCEPTS 9

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Concept of six sigma,

UNIT – IV: TQM TOOLS 9

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, FMEA – Stages of FMEA.

UNIT – V: ISO STANDARDS 9

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, ISO 14000 – Concept, Requirements and Benefits.

TOTAL : 45

<u>COURSE OUTCOMES</u>

- Upon completion of the course, students will be ability to have clear understanding of managerial functions like planning,
- organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

TEXT BOOKS:

1. Dale H. Besterfiled, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6.
2. Basker, " TOTAL QUALITY MANAGEMENT", Anuradha Agencies.

REFERENCES:

1. Feigenbaum.A.V. "Total Quality Management", McGraw Hill, 1991.

2. Oakland.J.S. “Total Quality Management”, Butterworth – Hcinemann Ltd., Oxford. 1989.
3. Narayana V. and Sreenivasan, N.S. “Quality Management – Concepts and Tasks”, New Age International 1996

22153C72P - ELECTRICAL MACHINE DESIGN 3 1 0 4

Semester VII

AIM

To expose the students to the construction, principle of operation and performance of special electrical machines as an extension to the study of basic electrical machines.

OBJECTIVES

To impart knowledge on

i. Construction, principle of operation and performance of DC machine.
ii. Construction, operating Characteristics of single and three phase transformer.
iii. Design and operating characteristics of Induction motors.
iv Construction, principle of operation, Design of synchronous machines and to have knowledge of machine design in CAD

UNIT I INTRODUCTION 12

Major considerations – Limitations – Electrical Engineering Materials – Space factor – temperature gradient – Heat flow in two dimensions – thermal resistivity of winding – Temperature gradient in conductors placed in slots – Rating of machines – Eddy current losses in conductors – Standard specifications

UNIT II DC MACHINES 12

Constructional details – output equation – main dimensions - choice of specific loadings – choice of number of poles – armature design – design of field poles and field coil – design of commutator and brushes – losses and efficiency calculations.

UNIT III TRANSFORMERS 12

KVA output for single and three phase transformers – Window space factor – Overall dimensions – Operating characteristics – Regulation – No load current – Temperature rise of Transformers – Design of Tank with & without cooling tubes – Thermal rating – Methods of cooling of Transformers.

UNIT IV INDUCTION MOTORS 12

Magnetic leakage calculations – Leakage reactance of polyphase machines- Magnetizing current – Output equation of Induction motor – Main dimensions –Length of air gap- Rules for selecting rotor slots of squirrel cage machines – Design of rotor bars & slots – Design of end rings – Design of wound rotor-Operating characteristics –Short circuit current – circle diagram – Dispersion co-efficient – relation between D & L for best power factor.

UNIT V SYNCHRONOUS MACHINES 12

Runaway speed – construction – output equations – choice of loadings – Design of salient pole machines – Short circuit ratio – shape of pole face – Armature design – Armature parameters – Estimation of air gap length – Design of rotor –Design of damper winding – Determination of full load field m.m.f – Design of field winding – Design of turbo alternators – Rotor design - Introduction to computer aided design – Program to design main dimensions of Alternators.

Total = 60

COURSE OUTCOMES

- Ability to understand basics of design considerations for rotating and static electrical machines
- Ability to design of field system for its application.
- Ability to design sing and three phase transformer.
- Ability to design armature and field of DC machines.

REFERENCE BOOKS:

1. Sawhney, A.K., 'A Course in Electrical Machine Design', Dhanpat Rai & Sons, New Delhi, 1984.
2. Sen, S.K., 'Principles of Electrical Machine Designs with Computer Programmes', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1987.

22153C73P- POWER PLANT ENGINEERING

4 0 0 4
Semester VII

UNIT I -THERMAL POWER PLANTS 9

Basic thermodynamic cycles – Various components of steam power plant – Layout – Pulverized coal burners – Fluidized bed combustion – Coal handling systems – Ash handling systems – Forced draft and induced draft fans – Boilers – Feed pumps – Super heater – Regenerator – Condenser – Deaerators – Cooling tower

UNIT II - HYDRO ELECTRIC POWER PLANTS 9

Layout – Dams – Selection of water turbines – Types – Pumped storage hydel plants

UNIT III - NUCLEAR POWER PLANTS 9

Principles of nuclear energy – Fission reactions – Nuclear reactor – Nuclear power plants

UNIT IV- GAS AND DIESEL POWER PLANTS 9

Types – Open and closed cycle gas turbine – Work output and thermal efficiency – Methods to improve performance – Reheating, intercoolings, regeneration – Advantage and disadvantages – Diesel engine power plant – Component and layout

UNIT V- NON – CONVENTIONAL POWER GENERATION 9

Solar energy collectors – OTEC – Wind power plants – Tidal power plants and geothermal resources – Fuel cell – MHD power generation – Principle – thermoelectric power generation – Thermionic power generation.

L: 45 T: 15 Total: 60

COURSE OUTCOMES

- Ability to create awareness about renewable Energy Sources and technologies.
- Ability to get adequate inputs on a variety of issues in harnessing renewable Energy.
- Ability to recognize current and possible future role of renewable energy sources.

TEXT BOOKS

1. Arora and Domkundwar, "A Course in Power Plant Engineering", Dhanpat Rai.
2. Nag, P.K., "Power Plant Engineering", 2nd Edition, Tata McGraw Hill, 2003.

REFERENCES

1. Bernhardt, G.A., Skrotzki and William A. Vopat, "Power Station Engineering and Economy", 20th Reprint, Tata McGraw Hill, 2002.
2. Rai, G.D., "An Introduction to Power Plant Technology", Khanna Publishers.
3. El-Wakil, M.M., "Power Plant Technology", Tata McGraw Hill, 198

ELECTIVE-I

22153E44AP- ELECTROMAGNETIC THEORY

3 1 0 4
Semester-IV

AIM
To expose the students to the fundamentals of electromagnetic fields and their applications in Electrical Engineering.

OBJECTIVES:

- To introduce the basic mathematical concepts related to electromagnetic vector fields
- To impart knowledge on the concepts of electrostatics, electrical potential, energy density and their applications.
- To impart knowledge on the concepts of magneto statics, magnetic flux density, scalar and vector potential and its applications.
- To impart knowledge on the concepts of Faraday's law, induced Emf and Maxwell's equations
- To impart knowledge on the concepts of Concepts of electromagnetic waves and Pointing vector.

UNIT I: ELECTROSTATICS – I 12

Sources and effects of electromagnetic fields – Coordinate Systems – Vector fields – Gradient, Divergence, Curl – theorems and applications - Coulomb's Law – Electric field intensity – Field due to discrete and continuous charges – Gauss's law and applications

UNIT II: ELECTROSTATICS – II 12

Electric potential – Electric field and equipotential plots, Uniform and Non-Uniform field, Utilization factor – Electric field in free space, conductors, dielectrics - Dielectric polarization – Dielectric strength - Electric field in multiple dielectrics – Boundary conditions, Poisson's and Laplace's equations, Capacitance, Energy density, Applications.

UNIT III: MAGNETOSTATICS 12

Lorentz force, magnetic field intensity (H) – Biot–Savart's Law - Ampere's Circuit Law – H due to straight conductors, circular loop, infinite sheet of current, Magnetic flux density (B) – B in free space, conductor, magnetic materials – Magnetization, Magnetic field in multiple media – Boundary conditions, scalar and vector potential, Poisson's Equation, Magnetic force, Torque, Inductance, Energy density, Applications

UNIT IV: ELECTRODYNAMIC FIELDS 12

Magnetic Circuits - Faraday's law – Transformer and motional EMF – Displacement current - Maxwell's equations (differential and integral form) – Relation between field theory and circuit theory – Applications

UNIT V: ELECTROMAGNETIC WAVES 12

Electromagnetic wave generation and equations – Wave parameters; velocity, intrinsic impedance, propagation constant – Waves in free space, lossy and lossless dielectrics, conductors- skin depth - Poynting vector – Plane wave reflection and refraction – Standing Wave – Applications.

TOTAL = 45

COURSE OUTCOMES

- Ability to understand and apply basic science, circuit theory, Electro-magnetic field theory control theory and apply them to electrical engineering problems.

TEXT BOOKS

1. Mathew N. O. Sadiku, 'Principles of Electromagnetics', 4 th Edition ,Oxford University Press Inc, First India edition, 2009.
2. Ashutosh Pramanik, 'Electromagnetism – Theory and Applications', PHI Learning Private Limited, New Delhi, Second Edition-2009.
3. K.A. Gangadhar, P.M. Ramanthan ' Electromagnetic Field Theory (including Antennaes and wave propagation', 16th Edition, Khanna Publications, 2007..

REFERENCE BOOKS

1. Joseph. A.Edminister, 'Schaum's Outline of Electromagnetics, Third Edition Schaum's Outline Series), Tata McGraw Hill, 2010.
2. William H. Hayt and John A. Buck, 'Engineering Electromagnetics', Tata McGraw Hill 8th Revised edition, 2011.
3. Kraus and Fleish, 'Electromagnetics with Applications', McGraw Hill International Editions, Fifth Edition, 2010.
4. Bhag Singh Guru and Hüseyin R. Hiziroglu "Electromagnetic field theory Fundamentals", Cambridge University Press; Second Revised Edition, 2009

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ELECTIVE-I

22153E44BP- FUZZY LOGIC AND ITS APPLICATIONS

3 1 0 4

Semester-IV

UNIT I -FUZZY LOGIC 7

Fuzzy sets – Fuzzy operation – Fuzzy arithmetic – Fuzzy relational equations – Fuzzy measure – Fuzzy functions – approximate reasoning – Fuzzy proposition – Fuzzy quantifiers-if-then rules.

UNIT II- FUZZY LOGIC IN CONTROL 8

Structure of Fuzzy logic controller – Fuzzification models – database – rule base – inference engine – defuzzification modules – Non-Linear fuzzy control – PID like FLC – Sliding mode FLC – Sugeno FLC – adaptive fuzzy control applications – case studies.

UNIT III- NEURAL NETWORKS IN CONTROL 8

Neural Network for Non-Linear systems – schemes of Neuro control-system identification forward model and inverse model – indirect learning neural network control applications – Case studies.

UNIT IV- MODELING AND CONTROL OF FACTS DEVICES NEURAL AND FUZZY TECHNIQUE 10

FACTS-concept and general system considerations, types of FACTS devices – special purpose FACTS devices, generalized and multifunctional FACTS devices – General comments on transient stability programs.Neuro – Fuzzy based FACTS controller for improvement of Transient stability systems – GA for Adaptive fuzzy system – case study.

UNIT V- STABILITY STUDIES UNDER MULTIPLE FACTS ENVIRONMENT 12

Introduction to small signal analysis – simulation and modeling of FACTS controllers for small signal analysis. Comparison between dynamic and transient stability results. Introduction to EMTP – (Electromagnetic Transient programme / Package), Modeling of FACTS controllers for power system studies using EMTP.

TOTAL=45

COURSE OUTCOMES

- Ability to design combinational and sequential Circuits.
- Ability to simulate using software package.
- Ability to study various number systems and simplify the logical expressions using Boolean functions
- Ability to design various synchronous and asynchronous circuits.
- Ability to introduce asynchronous sequential circuits and PLDs

- Ability to introduce digital simulation for development of application oriented logic circuits.

REFERENCES:

1. KOSKO. B. “Neural Networks and Fuzzy systems”, Prentice-Hall of India Pvt.Ltd., 1994.
2. Driankov, Hellendroon, “Introduction to Fuzzy control” Narosa Publisher.
3. Ronald R.Yager and Dimitar P.Filev “Essential of fuzzy modeling and control “ John Wiley & Sons, Inc.
4. Enrique Acha, Claudio R.Fuerte-Esqivel, Hugo Ambriz-Perez, Cesar Angeles-Camacho” FACTS – Modeling and simulation in Power Networks” John Wiley & Sons.
5. Kundur P., “Power system stability and control”, McGraw Hill, 1994.

ELECTIVE-I

22153E44CP - BIOMEDICAL INSTRUMENTATION

4 0 0 4

Semester-IV

AIM

The course is designed to make the student acquire an adequate knowledge of the physiological systems of the human body and relate them to the parameters that have clinical importance. The fundamental principles of equipment that are actually in use at the present day are introduced.

OBJECTIVES

i. To provide an acquaintance of the physiology of the heart, lung, blood circulation and circulation respiration. Methods of different transducers used.
ii. To introduce the student to the various sensing and measurement devices of electrical origin.
iii. To provide the latest ideas on devices of non-electrical devices.
iv. To bring out the important and modern methods of imaging techniques.
v. To provide latest knowledge of medical assistance / techniques and therapeutic equipments.

UNIT I BASIC PHYSIOLOGY 9

Cells and their structures – Transport of ions through cell membrane – Resting and excited state – Tran membrane potential – Action potential – Bio-electric potential – Nervous system – Physiology of muscles – Heart and blood circulation – Respiratory system – Urinary system.

UNIT II BASIC TRANSDUCER PRINCIPLES AND ELECTRODES 9

Transducer principles - Active transducers - Passive transducers -Transducer for Bio-medical application -Electrode theory- Bio-potential electrode - Bio - chemical transducer.

UNIT III CARDIOVASCULAR SYSTEM 9

The heart and cardiovascular system – Blood pressure – Characteristics of blood flow – Heart sounds - Electro cardiography – Measurements of blood pressure – Measurement of blood flow and cardiac O/P Plethysmography – Measurements of heart sounds.

UNIT IV X-RAY AND RADIOISOTOPE INSTRUMENTATION 9

X-ray imaging radiography – Fluoroscopy – Image intensifiers – Angiography - Medical use of radioisotopes – Beta radiations – Detectors – Radiation therapy.

UNIT V BIO-TELEMETRY 9

Introduction to biotelemetry – Physiological parameters adaptable to biotelemetry – the components of biotelemetry systems – Implantable units – Applications of telemetry in patient care – Application of computer in Bio-medical instrumentation, Anatomy of Nervous system – Measurement from the nervous system – EEG – EMG.

Total = 45

COURSE OUTCOMES

- Ability to understand fundamentals of Bio medical instrumentation.
- To acquire knowledge on Bio-Medical and Non-Electrical parameter measurements.

- To know the various medical imaging equipment.

REFERENCE BOOKS:

1. Lesis Cromwell Fred, J.Werbell and Erich A.Pfraffer, Biomedical instrumentation and Measurements – Prentice Hall of India, 1990.
2. M.Arumugam, Bio-medical Instrumentation – Anuradha Agencies Publishers, 1992.
3. Khandpur, Handbook on Biomedical Instrumentation – Tata McGraw Hill Co Ltd., 1989.

ELECTIVE-I
Semester-IV

22153E44DP - MODELING AND SIMULATION OF SOLAR ENERGY SYSTEMS

4 0 0 4

UNIT I: SOLAR RADIATION AND COLLECTORS 9

Solar angles - day length, angle of incidence on tilted surface - Sunpath diagrams - shadow determination - extraterrestrial characteristics - measurement and estimation on horizontal and tilted surfaces - flat plate collector thermal analysis - heat capacity effect - testing methods-evacuated tubular collectors - concentrator collectors – classification - design and performance parameters - tracking systems - compound parabolic concentrators - parabolic trough concentrators - concentrators with point focus - Heliostats – performance of the collectors.

UNIT I: APPLICATIONS OF SOLAR THERMAL TECHNOLOGY 9

Principle of working, types - design and operation of - solar heating and cooling systems - solar water heaters – thermal storage systems – solar still – solar cooker – domestic, community – solar pond – solar drying.

UNIT III: SOLAR PV FUNDAMENTALS 9

Semiconductor – properties - energy levels - basic equations of semiconductor devices physics. Solar cells - p-n junction: homo and hetro junctions - metal-semiconductor interface - dark and illumination characteristics - figure of merits of solar cell – efficiency limits - variation of efficiency with band-gap and temperature - efficiency measurements - high efficiency cells - preparation of metallurgical, electronic and solar grade Silicon - production of single crystal Silicon: Czokralski (CZ) and Float Zone (FZ) method - Design of a complete silicon – GaAs- InP solar cell - high efficiency III-V, II-VI multi junction solar cell; a-Si-H based solar cells-quantum well solar cell -thermophotovoltaics.

UNIT IV: SOLAR PHOTOVOLTAIC SYSTEM DESIGN AND APPLICATIONS 9

Solar cell array system analysis and performance prediction- Shadow analysis: reliability - solar cell array design concepts - PV system design - design process and optimization - detailed array design - storage autonomy - voltage regulation - maximum tracking – use of computers in array design - quick sizing method - array protection and trouble shooting - centralized and decentralized SPV systems - stand alone - hybrid and grid connected system - System installation - operation and maintenances - field experience - PV market analysis and economics of SPV systems.

UNIT V: SOLAR PASSIVE ARCHITECTURE 9

Thermal comfort - heat transmission in buildings- bioclimatic classification – passive heating concepts: direct heat gain - indirect heat gain - isolated gain and sunspaces - passive cooling concepts: evaporative cooling - radiative cooling - application of wind, water and earth for cooling; shading - paints and cavity walls for cooling - roof radiation traps - earth air-tunnel. – energy efficient landscape design - thermal comfort – concept of solar temperature and its significance - calculation of instantaneous heat gain through building envelope.

TOTAL: 45

COURSE OUTCOMES

- Basic knowledge in Power system planning, operation and modeling of large scale power systems.
- Ability to understand the various faults occurring in power system and to solve load flow problems using numerical methods.
- Ability to analyze the power system transients and faults and select the rating for protective devices.

TEXT BOOKS:

1. Sukhatme S P, Solar Energy, Tata McGraw Hill, 1984.
2. Kreider, J.F. and Frank Kreith, Solar Energy Handbook, McGraw Hill, 1981.
3. Goswami, D.Y., Kreider, J. F. and & Francis., Principles of Solar Engineering, 2000.

REFERENCES:

1. Garg H P., Prakash J., Solar Energy: Fundamentals & Applications, Tata BMcGraw Hill, 2000.
2. Duffie, J. A. and Beckman, W. A., Solar Engineering of Thermal Processes, John Wiley, 1991.
3. Alan L Fahrenbruch and Richard H Bube, Fundamentals of Solar Cells: PV Solar Energy Conversion, Academic Press, 1983.
4. Larry D Partain, Solar Cells and their Applications, John Wiley and Sons, Inc, 1995.
5. Roger Messenger and Jerry Vnetre, Photovoltaic Systems Engineering, CRC Press, 2004.
6. Sodha, M.S, Bansal, N.K., Bansal, P.K., Kumar, A. and Malik, M.A.S. Solar Passive Building, Science and Design, Pergamon Press, 1986.
7. Krieder, J and Rabi, A., Heating and Cooling of Buildings: Design for Efficiency, McGraw-Hill, 1994.

22153E44EP NON-CONVENTIONAL ENERGY SYSTEMS AND APPLICATIONS 2 0 2 4

AIM

To learn about the Renewable energy system and conversion technologies related to various aspects of non-conventional systems.

OBJECTIVES

- to identify suitable utility for the solar and wind energy systems,
- to conduct a site survey for installation of a windmill during Sixth Expedition ,
- to study the structural and foundation aspects for installing a windmill at Maitree station in Schirmacher hills

UNIT-I 9

Introduction to renewable energy various aspects of energy conversion-Principle of renewable energy systems environment and social implications.
Indian energy scenario in various sectors— Present conventional and renewable energy status- Global energy status-Per capita energy consumption-Future energy plans.

UNIT-II 9

Solar energy: Solar radiation components- measurements-estimation-solar collectors-solar water heaters- Calculation-Types-analysis-economics-Applications Solar thermal power generation Solar Photovoltaics- energy conversion principle-classifications-equivalent circuit-characteristics-Cell efficiency- Limitations-PV modules-MPPT algorithms

UNIT-III 9

Wind energy: Basics of wind-wind turbines-power and energy from wind turbine-characteristics- types of electric generators for wind power generation. Dynamics matching- performance of wind generators - applications- economics of wind power

UNIT-IV 9

Storage Devices: Super capacitor-SMES- Battery storage-flywheel storage- compressed air storage- Fuel cells–types and applications; MHD generators – backup -System design-industrial and domestic applications.

UNIT-V 9

Bioenergy: Bio fuels-classification-biomass conversion technologies-applications; Ocean Energy: Tidal energy-wave energy-ocean thermal energy conversion systems-applications; - mini, micro and pico hydel power

Total : 45

TEXT/REFERENCE BOOKS:

1. Godfrey Boyle, “Renewable Energy: Power for a sustainable future”, Oxford University press, Second edition.

2. Rai G D, “Solar Energy Utilization”, Khanna Publishers, 1997.
3. B H Khan, “Non-Conventional Energy Resources”, The McGraw-Hill Companies, Second Edition.
4. Sukhatme, S.P, “Solar Energy -Principles of Thermal Collection and Storage”, Tata
5. McGraw-Hill, 2 ed., 1997.
6. Sammes, Nige, “Fuel Cell Technologies-State and Perspectives”, Springer publication, 2005
7. Kreith, F., and Kreider, J.F., “Principles of Solar Engineering”, Mc-Graw-Hill Book Co, 1978.
8. S.L.Soo , “Direct Energy Conversion” , Prentice Hall Publication, 1968
9. James Larminie, Andrew Dicks, **“**Fuel Cell Systems”, Wiley & Sons Ltd, 2ed, 2003.

Referance from Reputed University

Percentage of syllabus revised 10%

Syllabus Focus on Environment

ELECTIVE-II
SEMESTER-V

22153E54AP ENVIRONMENTAL SCIENCE AND ENGINEERING **4 0 0 4**

UNIT I- INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES **10**

Definition, scope and importance – need for public awareness – forest resources: use and over-exploitation, deforestation,. Timber extraction, mining, dams-benefits and problems – mineral resources: use and effects on forests and tribal people – water resources: use and over-utilization of surface and exploitation, environmental effects of extracting and using mineral resources, case studies – food resources: world food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – energy resources: growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies – land resources: land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources.

UNIT II-ECOSYSTEMS AND BIODIVERSITY **14**

Concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem. Introduction to biodiversity – definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity –endangered and endemic species of India – conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

UNIT III -ENVIRONMENTAL POLLUTION **8**

Definition – causes, effects and control measures of: (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards –– role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.

UNIT IV-SOCIAL ISSUES AND THE ENVIRONMENT **7**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management
environmental ethics: issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents. environment production act – air (prevention and control

of pollution) act – water (prevention and control of pollution) act – wildlife protection act – forest conservation act – issues involved in enforcement of environmental legislation – public awareness

UNIT V-HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – hiv / aids – women and child welfare – role of information technology in environment and human health – case studies.

TOTAL : 45

COURSE OUTCOMES

- Play a important role in transferring a healthy environment for future generations
- Analyze the impact of engineering solutions in a global and societal context
- Discuss contemporary issues that results in environmental degradation and would attempt to provide solutions to overcome those problems

TEXT BOOKS

1. Gilbert M .Masters, "Introduction to Environmental Engineering and Science", Pearson Education Pvt., Ltd., Second Edition, ISBN 81-297-0277-0, 2004.
2. Miller T.G. Jr., "Environmental Science", Wadsworth Publishing Co.

REFERENCES

1. Bharucha Erach, "The Biodiversity of India", Mapin Publishing Pvt. Ltd., Ahmedabad India.
2. Trivedi R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media.
3. Cunningham, W.P.Cooper, T.H.Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
4. Wager K.D. "Environmental Management", W.B. Saunders Co., Philadelphia, USA, 1998.
5. Townsend C., Harper J and Michael Begon, "Essentials of Ecology, Blackwell Science.
6. Trivedi R.K. and P.K. Goel, Introduction to Air Pollution, Techno-Science Publications.

ELECTIVE-II
Semester-v

22153E54BP -ARTIFICIAL NEURAL NETWORKS 4 0 0 4

UNIT I : INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS 12
Biological neural networks - Pattern analysis tasks: Classification, Regression, Clustering - Computational models of neurons - Structures of neural networks - Learning principles

UNIT II: LINEAR MODELS FOR REGRESSION AND CLASSIFICATION 12
Polynomial curve fitting - Bayesian curve fitting - Linear basis function models - Bias-variance decomposition - Bayesian linear regression - Least squares for classification - Logistic regression for classification- Bayesian logistic regression for classification

UNIT III: FEEDFORWARD NEURAL NETWORKS 12
Pattern classification using preceptor - Multilayer feed forward neural networks (MLFFNNs) - Pattern classification and regression using MLFFNNs - Error back propagation learning - Fast learning methods: Conjugate gradient method – Auto associative neural networks - Bayesian neural networks

UNIT III: RADIAL BASIS FUNCTION NETWORKS 12
Regularization theory - RBF networks for function approximation - RBF networks for pattern classification

UNIT IV: KERNEL METHODS FOR PATTERN ANALYSIS 12
Statistical learning theory- Support vector machines for pattern classification- Support vector regression for function approximation- Relevance vector machines for classification and regression

UNIT V: SELF-ORGANIZING MAPS 12
Pattern clustering- Topological mapping- Kohonen's self-organizing map

FEEDBACK NEURAL NETWORKS

Pattern storage and retrieval- Hopfield model- Boltzmann machine- Recurrent neural networks

TOTAL=60

COURSE OUTCOMES

- Analysis of transients using various parametric & non parametric methods.
- Analysis of various control schemes usend for controlling applications
- study about the adaptive control systems for various applications & study of issues in it.

Text Books:

1. B.Yegnanarayana, Artificial Neural Networks, Prentice Hall of India, 1999
2. Satish Kumar, Neural Networks – A Classroom Approach, Tata McGraw-Hill, 2003
3. S.Haykin, Neural Networks – A Comprehensive Foundation, Prentice Hall, 1998
4. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006

ELECTIVE-II
Semester-v

22153E54CP-VLSI DESIGN 3 1 0 4

OBJECTIVES:

- In this course, the MOS circuit realization of the various building blocks that is common to any
- microprocessor or digital VLSI circuit is studied.
- Architectural choices and performance tradeoffs involved in designing and realizing the circuits in
- CMOS technology are discussed.
- The main focus in this course is on the transistor circuit level design and realization for digital

UNIT I MOS TRANSISTOR PRINCIPLE 9

NMOS and PMOS transistors, Process parameters for MOS and CMOS, Electrical properties of CMOS circuits and device modeling, Scaling principles and fundamental limits, CMOS inverter scaling, propagation delays, Stick diagram, Layout diagrams

UNIT II COMBINATIONAL LOGIC CIRCUITS 9

Examples of Combinational Logic Design, Elmore's constant, Pass transistor Logic, Transmission gates, static and dynamic CMOS design, Power dissipation – Low power design principles

UNIT III SEQUENTIAL LOGIC CIRCUITS 9

Static and Dynamic Latches and Registers, Timing issues, pipelines, clock strategies, Memory architecture and memory control circuits, Low power memory circuits, Synchronous and Asynchronous design

UNIT IV DESIGNING ARITHMETIC BUILDING BLOCKS 9

Data path circuits, Architectures for ripple carry adders, carry look ahead adders, High speed adders, accumulators, Multipliers, dividers, Barrel shifters, speed and area tradeoff

UNIT V IMPLEMENTATION STRATEGIES 9

Full custom and Semi custom design, Standard cell design and cell libraries, FPGA building block architectures, FPGA interconnect routing procedures.

TOTAL 45

COURSE OUTCOMES

Upon completion of the course, students should

- Explain the basic CMOS circuits and the CMOS process technology.
- Discuss the techniques of chip design using programmable devices.
- Model the digital system using Hardware Description Language.

TEXTBOOKS:

1. Jan Rabaey, Anantha Chandrakasan, B.Nikolic, "Digital Integrated Circuits: A Design Perspective", Second Edition, Prentice Hall of India, 2003.
2. M.J. Smith, "Application Specific Integrated Circuits", Addisson Wesley, 1997

REFERENCES:

1. N.Weste, K.Eshraghian, “Principles of CMOS VLSI Design”, Second Edition, Addision Wesley 1993
2. R.Jacob Baker, Harry W.LI., David E.Boyee, “CMOS Circuit Design, Layout and Simulation”, Prentice Hall of India 2005
3. A.Pucknell, Kamran Eshraghian, “BASIC VLSI Design”, Third Edition, Prentice Hall of India, 2007.

ELECTIVE-II
Semester-v

22153E54DP- ROBOTICS

3 1 0 4

UNIT I: INTRODUCTION 9

Robot ,its evaluation; definition and aes of robotics, present application status.

UNIT II: ROBOT ANATOMY 9
configuration, robot motions, work volume. Robot drives, actuators and control; Functions and types of drives and actuators; concept of basic control systems, open loop, close loop, different type of controllers, ON-OFF, proportional, integral, PI, PD, PID.

UNIT III: ROBOT END EFFECTORS: **9**
Types of end effecters, mechanical gripper, tools and end effectors. Robot sensors: Transducers and sensors; analog and digital transducers; types of sensors, tachfile sensors, proximity and rough sensors ; miscellaneous sensors; vision systems; use of sensors in robotics.

UIT IV: ROBOT KINEMATICS 9
Position representations; forward and reverse kinematics of three and four degrees of freedom; robot arm; homogeneous transformations and robot kinematics; kinematics equations using homogeneous transformation .

UNIT V: INDUSTRIAL APPLICATION 9
Capabilities of robots; robot applications; materials handling; pick and place operation; palletiging and depalletiging; machine loading and unloading; machine casting; welding;painting,assembly; inspection; maintenance.

COURSE OUTCOMES

- Ability to understand and develop MFC windows applications with inputs and drawing features and implement menus using VC++
- Ability to understand document/view architecture and develop classic controls using VC++
- Ability to understand and design event driven programming and activeX controls and manage database using visual basic

BOOKS RECOMMENDED:
1.Schilling-Fundamental of robotics; PH
2.Yoshikawa- Fundamental of robotics; PH
3. S.R.Deb-Robotics Technology and Flexible Automation
4. Introduction to Robotics, John J Craig; Pearson Education

22153E54EP LT & HT DISTRIBUTION SYSTEMS 2 0 2 4

AIM

To become familiar with the function of different components used in Transmission and Distribution levels of power systems and modeling of these components.

OBJECTIVES

- To develop expression for computation of fundamental parameters of Power system analysis.
- To categorize the lines into different classes and develop equivalent circuits for these classes.
- To analyze the voltage distribution in Architectures and user interface.

UNIT-I **9**

Power system-general concepts-distribution of power, load and energy forecasting-factors in power system loading, Power system analysis-load flow-fault studies-voltage control.

UNIT-II **9**

Optimization of distribution system network cost modeling-economic loading of distribution transformers. Distribution system reliability-reliability assessment techniques

UNIT-III **9**

Consumer services-maximum demand, diversity and load factor-consumer load control for power shortages, Tariffs-costing and pricing –economically efficient tariff structure. Overhead and underground lines-optimum design considerations, Power capacitors-size of capacitor for power factor improvement- HT and LT capacitor installation requirements.

UNIT-IV **9**

Distribution System Design- Electrical Design Aspects of Industrial, Commercials Buildings- Design, estimation and costing of outdoor and indoor Substations, Electrical Safety and Earthing Practices at various voltage levels- Lightning protection.-Regulations and standards.

UNIT-V **9**

Distribution Automation System : Necessity, System Control Hierarchy- Basic Architecture and implementation Strategies for SCADA and DAC systems -Basic Distribution Management System Functions. Communication Systems for Control and Automation- Wireless and wired Communications- SCADA and DAC communication Protocols, Architectures and user interface

Total: 45

Text/References:

1. Turan Gonen, “Electric Power Distribution system Engineering” Mc Graw-hill ,Inc,1987
2. A.S. Pabla, “ Electric Power Distribution systems” Tata Mc Graw-hill Publishing company
limited, 4th edition, 1997.
3. Alexander Eigeles Emanuel, “Power Definitions and the Physical Mechanism of Power Flow”, John Wiley & Sons, October 2009.
4. “Handbook of International Electrical Safety Practices”, John Wiley & Sons, PERI June 2009.
5. Ali A. Chowdhury, Don O. Koval, “Power distribution system reliability-Practical methods and applications” John Wiley & sons Inc., *IEEE Press* 2009
6. Richard E.Brown, “Electric power distribution reliability” Taylor & Francis Group,LLC,2009.
7. James Northcote-Green, Robert Wilson, “Control and automation of electrical power distribution system”, Taylor & Francis Group, LLC,2007.
8. S.Sivanagaraju, V.Sankar, Dhanpat Rai & Co, “Electrical Power Distribution and Automation”,2006.
9. Pansini,Anthony J, “Guide to electrical power distribution system”,Fairmont press, inc., 6th edition,2006.
10. Stuart A. Boyer, “SCADA-Supervisory Control and Data Acquisition” Instrument Society of America Publication,2004
11. Leveque, Francois , “Transport Pricing of Electricity Networks” Springer 2003
13. Lakervi & E J Holmes, “Electricity distribution network design”, Peter Peregrimus Ltd. 2nd Edition,2003
13. William H. Kersting, “Distribution system modeling and analysis” CRC press LLC, 2002.
14. Michael Wiebe, “A Guide to Utility Automation: Amr, Scada, and It Systems for Electric Power” PennWell,1999.
15. IEEE Press: IEEE Recommended practice for Electric Power Distribution for Industrial Plants, publish

ELECTIVE III
Semester VI

22153E64AP- PRINCIPLES OF MANAGEMENT 4 0 0 4

OBJECTIVE

i. To understand the Total Quality Management concept and principles and the various tools available to achieve Total Quality Management.

ii. To understand the statistical approach for quality control.

iii. To create an awareness about the ISO and QS certification process and its need for the industries

UNIT I HISTORICAL DEVELOPMENT 12

Definition of Management – Science or Art – Management and Administration – Development of Management Thought – Contribution of Taylor and Fayol – Functions of Management – Types of Business Organisation.

UNIT II PLANNING 12

Nature & Purpose – Steps involved in Planning – Objectives – Setting Objectives – Process of Managing by Objectives – Strategies, Policies & Planning Premises- Forecasting – Decision-making.

UNIT III ORGANISING 12

Nature and Purpose – Formal and informal organization – Organization Chart – Structure and Process – Departmentation by difference strategies – Line and Staff authority – Benefits and Limitations – De-Centralization and Delegation of Authority – Staffing – Selection Process - Techniques – HRD – Managerial Effectiveness.

UNIT IV DIRECTING 12

Scope – Human Factors – Creativity and Innovation – Harmonizing Objectives – Leadership – Types of Leadership Motivation – Hierarchy of needs – Motivation theories – Motivational Techniques –Job Enrichment – Communication – Process of Communication – Barriers and Breakdown –Effective Communication – Electronic media in Communication.

UNIT V CONTROLLING 12

System and process of Controlling – Requirements for effective control – The Budget as Control Technique – Information Technology in Controlling – Use of computers in handling the information – Productivity – Problems and Management – Control of Overall Performance – Direct and Preventive Control – Reporting – The Global Environment – Globalization and Liberalization – International Management and Global theory of Management.

TOTAL = 60

COURSE OUTCOMES

- Basic Knowledge on management, business, organization culture, environment and planning process.
- Ability to organize business activities, motivational techniques and effective communication.
- Ability to understand the management control and budgetary techniques.

TEXT BOOKS

1. Harold Kooritz & Heinz Weihrich "Essentials of Management", Tata Mcgraw Hill,1998.
2. Joseph L Massie "Essentials of Management", Prentice Hall of India, (Pearson) Fourth Edition, 2003.

REFERENCE BOOKS

1. Tripathy PC And Reddy PN, " Principles of Management", Tata Mcgraw Hill,1999.
2. Decenzo David, Robbin Stephen A, "Personnel and Human Reasons Management", Prentice Hall of India, 1996.
3. JAF Stomer, Freeman R. E and Daniel R Gilbert Management, Pearson Education, Sixth Edition, 2004.
4. Fraidoon Mazda, " Engineering Management", Addison Wesley,-2000.

ELECTIVES-III
SEMESTER VI

22153E64BP- MICRO ELECTRO MECHANICAL SYSTEMS 4 0 0 4

AIM :

- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- To educate on the rudiments of Micro fabrication techniques.
- To introduce various sensors and actuators
- To introduce different materials used for MEMS
- To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

UNIT I INTRODUCTION 9

Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis –
Flexural beam bending- Torsional deflection.

UNIT II SENSORS AND ACTUATORS-I 9

Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors - Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph - Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys.

UNIT III SENSORS AND ACTUATORS-I 9

Piezoresistive sensors – Piezoresistive sensor materials - Stress analysis of mechanical elements –Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators –
piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

UNIT IV MICROMACHINING 9

Silicon Anisotropic Etching – Anisotrophic Wet Etching – Dry Etching of Silicon – Plasma Etching –Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies - Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process..

UNIT V POLYMER AND OPTICAL MEMS 9

Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

Total = 45

COURSE OUTCOMES

- Ability to understand the operation of micro devices, micro systems and their applications.
- Ability to design the micro devices, micro systems using the MEMS fabrication process.

TEXT BOOKS

1. Chang Liu, ‘Foundations of MEMS’, Pearson Education Inc., 2012.
2. Stephen D Senturia, ‘Microsystem Design’, Springer Publication, 2000.
3. Tai Ran Hsu, “MEMS & Micro systems Design and Manufacture” Tata McGraw Hill, New Delhi, 2002.

REFERENCE BOOKS

1. Nadim Maluf,“An Introduction to Micro Electro Mechanical System Design”, Artech House, 2000.
2. Mohamed Gad-el-Hak, editor, “The MEMS Handbook”, CRC press Baco Raton, 2001.
3. Julian w. Gardner, Vijay K. Varadan, Osama O. Awadelkarim, Micro Sensors MEMS and Smart Devices, John Wiley & Son LTD, 2002.
4. James J.Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005.
5. Thomas M.Adams and Richard A.Layton, “Introduction MEMS, Fabrication and Application,” Springer, 2010.

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ELECTIVES-III
SEMESTER-VI

22153E64CP INTEGRATED OPTO-ELECTRONIC DEVICES

3 1 0 4

AIM

To learn different types of optical emission, detection, modulation and opto electronic integrated circuits and their applications.

OBJECTIVE

• To know the basics of solid state physics and understand the nature and characteristics of light.
• To understand different methods of luminescence, display devices and laser types and their applications.
• To understand different light modulation techniques and the concepts and applications of optical switching.

UNIT I: ELEMENTS OF LIGHT AND SOLID STATE PHYSICS 9

Wave nature of light, Polarization, Interference, Diffraction, Light Source, review of Quantum Mechanical concept, Review of Solid State Physics, Review of Semiconductor Physics and Semiconductor Junction Device.

UNIT II: DISPLAY DEVICES AND LASERS 9

Introduction, Photo Luminescence, Cathode Luminescence, Electro Luminescence, Injection Luminescence, Injection Luminescence, LED, Plasma Display, Liquid Crystal Displays, Numeric Displays, Laser Emission, Absorption, Radiation, Population Inversion, Optical Feedback, Threshold condition, Laser Modes, Classes of Lasers, Mode Locking,laserapplications.

UNIT III: OPTICAL DETECTION DEVICES 9

Photo detector, Thermal detector, Photo Devices, Photo Conductors, Photo diodes, Detector Performance.

UNIT IV OPTOELECTRONIC MODULATOR 9

Introduction, Analog and Digital Modulation, Electro-optic modulators, Magneto Optic Devices, Acoustoptic devices, Optical, Switching and Logic Devices.

UNIT V OPTOELECTRONIC INTEGRATED CIRCUITS 9

Introduction, hybrid and Monolithic Integration, Application of Opto Electronic Integrated circuits, integrated transmitters and Receivers, Guided wave devices.

COURSE OUTCOMES

- Ability to understand and analyze Instrumentation systems and their applications to various industries.
- Ability to know the basic properties of laser and to apply for industry.
- Recognize the importance of laser in medicinal and industry applications.

TEXTBOOK

1. J. Wilson and J.Haukes, “Opto Electronics – An Introduction”, Prentice Hall of India Pvt. Ltd.,NewDelhi,1995.

REFERENCES

1. Bhattacharya “Semiconductor Opto Electronic Devices”, Prentice Hall of India Pvt., Ltd., NewDelhi,1995.

2. Jasprit Singh, “Opto Electronics – As Introduction to materials and devices”, McGraw-Hill International Edition, 1998.

ELECTIVES-III
SEMESTER-VI

22153E64DP -COMPUTER AIDED DESIGN OF ELECTRICAL APPARATUS

3 1 0 4

AIM

To introduce the basics of Computer Aided Design technology for the design of Electrical
Machines.

OBJECTIVE

At the end of this course the student will be able to

- Learn the importance of computer aided design method.
- Understand the basic electromagnetic field equations and the problem formulation for CAD applications.
- Become familiar with Finite Element Method as applicable for Electrical Engineering.
- Know the organization of a typical CAD package.
- Apply Finite Element Method for the design of different Electrical apparatus.

UNIT I: INTRODUCTION **12**

Conventional design procedures – Limitations – Need for field analysis based design – Review of Basic principles of energy conversion – Development of Torque/Force.

UNIT II: MATHEMATICAL FORMULATION OF FIELD PROBLEMS **12**

Electromagnetic Field Equations – Magnetic Vector/Scalar potential – Electrical vector /Scalar potential – Stored energy in Electric and Magnetic fields – Capacitance - Inductance- Laplace and Poisson's Equations – Energy functional.

UNIT III: PHILOSOPHY OF FEM **12**

Mathematical models – Differential/Integral equations – Finite Difference method – Finite element method – Energy minimization – Variation method- 2D field problems – Discretisation – Shape functions – Stiffness matrix – Solution techniques.

UNIT IV: CAD PACKAGES **12**

Elements of a CAD System –Pre-processing – Modeling – Meshing – Material properties- Boundary Conditions – Setting up solution – Post processing.

UNIT V: DESIGN APPLICATIONS **12**

Voltage Stress in Insulators – Capacitance calculation - Design of Solenoid Actuator – Inductance and force calculation – Torque calculation in Switched Reluctance Motor.

COURSE OUTCOMES

- The students will obtain the knowledge of basic electric and magnetic materials and design of rotating electrical Machines and Transformers.
- The students will be able to overall design the machines and transformers.

- The students will gain knowledge about the various types of electrical machines and design of both ac & dc Machines and many application.

TEXT BOOKS

1. S.J Salon, ‘Finite Element Analysis of Electrical Machines’, Kluwer Academic Publishers, London, 1995.
2. Nicola Bianchi, ‘Electrical Machine Analysis using Finite Elements’, CRC Taylor& Francis, 2005.

REFERENCES

1. Joao Pedro, A. Bastos and Nelson Sadowski, ‘Electromagnetic Modeling by Finite Element Methods’, Marcell Dekker Inc., 2003.
2. P.P.Silvester and Ferrari, ‘Finite Elements for Electrical Engineers’, Cambridge University Press, 1983.
3. D.A.Lowther and P.P Silvester, ‘Computer Aided Design in Magnetics’, Springer Verlag, New York, 1986.
4. S.R.H.Hoole, ‘Computer Aided Analysis and Design of Electromagnetic Devices’, Elsevier, New York, 1989.
5. User Manuals of MAGNET, MAXWELL & ANSYS Softwares.

22153E64EP ADVANCED DC-AC POWER CONVERSION 2 0 2 4

AIM

To study advanced DC-AC power conversion technologies

OBJECTIVE

To provide conceptual knowledge in modern power electronic converters and its applications in electric power utility.

UNIT-I TWO-LEVEL VOLTAGE SOURCE INVERTER 9

Introduction **- Sinusoidal PWM** - Modulation Scheme - Harmonic Content – Over-modulation – Third Harmonic Injection PWM **- Space Vector Modulation** - Switching States - Space Vectors - Dwell Time Calculation - Modulation Index - Switching Sequence - Spectrum Analysis - Even-Order Harmonic Elimination - Discontinuous Space Vector Modulation

UNIT-II CASCADED H-BRIDGE (CHB) MULTILEVEL INVERTERS 9

Introduction **- H-Bridge Inverter** - Bipolar Pulse-Width Modulation - Unipolar Pulse-Width Modulation –**Multilevel Inverter Topologies -** CHB Inverter with Equal dc Voltage - H-Bridges with Unequal dc Voltages.

Carrier Based PWM Schemes - Phase-Shifted Multicarrier Modulation - Level-Shifted Multicarrier Modulation - Comparison Between Phase- and Level-Shifted PWM Schemes - Staircase Modulation.

UNIT-III DIODE-CLAMPED MULTILEVEL INVERTERS 9

Introduction **-Three-Level Inverter -** Converter Configuration - Switching State - Commutation - Space Vector Modulation - Stationary Space Vectors - Dwell Time Calculation - Relationship Between *Vref* Location and Dwell Times - Switching Sequence Design -Inverter Output Waveforms and Harmonic Content - Even-Order Harmonic Elimination - **Neutral-Point Voltage Control** - Causes of Neutral-Point Voltage Deviation – Effect of Motoring and Regenerative Operation - Feedback Control of Neutral-Point Voltage

UNIT-IV 9

Other Space Vector Modulation Algorithms - Discontinuous Space Vector Modulation - SVM Based on Two-level Algorithm **High-Level Diode-Clamped Inverters** - Four- and Five-Level Diode-Clamped Inverters - Carrier-Based PWM– **Other Multilevel Voltage Source Inverters – Introduction - NPC/H-Bridge Inverter - Inverter** Topology - Modulation Scheme - Waveforms and Harmonic Content - **Multilevel Flying-Capacitor Inverters** – Inverter Configuration - Modulation Schemes

UNIT-V PWM CURRENT SOURCE INVERTERS 9

Introduction **-** PWM Current Source Inverter - Trapezoidal Modulation - Selective Harmonic Elimination -**Space Vector Modulation** - Switching States - Space Vectors - Dwell Time Calculation - Switching Sequence -Harmonic Content - SVM Versus TPWM and SHE - **Parallel Current Source Inverters** - Inverter Topology -Space Vector Modulation for Parallel Inverters - Effect of Medium Vectors on dc Currents - dc Current Balance Control - Load-Commutated Inverter (LCI) **Total: 45**

TEXT/REFERENCE BOOKS:

1. B. Woo, “High Power Converters and AC Drives”, John Wiley & Sons, 2006
2. Ned Mohan et.al , “Power Electronics” ,John Wiley and Sons,2006
3. Rashid, “Power Electronics, Circuits Devices and Applications”, Pearson Education, 3rd edition, 2004.
4. G.K.Dubey, Thyristorised Power Controllers, Wiley Eastern Ltd, 1993.
5. Dewan & Straughen, Power Semiconductor Circuits, John Wiley & Sons, 1975.
6. Cyril W Lander, Power Electronics, Mc Graw Hill, 3rd edition, 1993.

ELECTIVES-IV
SEMESTER-VII

22153E74AP - POWER SYSTEM TRANSIENTS

3 0 0 3
Semester VII

AIM
To understand generation of switching and lighting transients, their propagation, reflection and refraction a on the grid ad their impact on the grid equipment.

OBJECTIVES
i. To study the generation of switching transients and their control using circuit – theoretical concept.
ii. To study the mechanism of lighting strokes and the production of lighting surges.
iii. To study the propagation, reflection and refraction of travelling waves.
iv. To study the impact of voltage transients caused by faults, circuit breaker action, load rejection on integrated power system.

UNIT I INTRODUCTION AND SURVEY 7
Various types of power system transients - effects of transients on power systems.

UNIT II LIGHTNING AND SWITCHING SURGES 19
Electrification of thunder clouds – lightning current surges, parameters – closing and reclosing of lines – load rejection – fault clearing – short line faults – ferro-resonance – temporary over voltages – harmonics.

UNIT III MODELLING OF POWER SYSTEM EQUIPMENT 14
Surge parameters of power systems equipment, equivalent circuit representation, lumped and distributed circuit transients.

UNIT IV COMPUTATION OF TRANSIENT OVERVOLTAGES 14
Computation of transients – traveling wave method, Bewley's lattice diagram – analysis in time and frequency domain, EMTP for transient computation.

UNIT V INSULATION COORDINATION 12
Insulation co-ordination – over voltage protective devises principles of recent co-ordination and design of EHV lines. **Total = 60**

COURSE OUTCOMES

- Ability to understand and analyze power system transients and types of switching transients.
- To get knowledge about lightening transients and high voltage transient behavior travelling on line.
- To get knowledge about transients in integrated power systems.

TEXT BOOKS

1. Allan Greenwood, 'Electrical Transients in Power Systems', Wiley Inter science, New York, 2nd edition 1991**.**

2. R.D Begamudre, 'Extra High Voltage AC Transmission Engineering', Wiley Eastern Limited, 1986.

REFERENCES

1. Klaus Ragaller, 'Surges in High Voltage Networks', Plenum Press, New York, 1980.

2. Diesengrof, W., 'Overvoltages on High Voltage Systems', Rensealer Bookstore, Troy, New York, 1971.

22153E74BP -EHV AC and DC TRANSMISSION SYSTEMS

3 0 0 3

UNIT I TRANSMISSION ENGINEERING 9

Transmission line trends – Standard transmission voltages – Power handling capacity and line losses Cost of transmission lines and equipment – Mechanical consideration – Transmission Engineering principles.

UNIT II LINE PARAMETER 9

Calculation of line and ground parameters - Resistance, capacitance and Inductance calculation – Bundle conductors – modes propagation – Effect of earth.

UNIT III POWER CONTROL 9

Power frequency and voltage control – voltage control – Over voltages – Power circle diagram – Voltage control using shunt and series compensation – Static VAR compensation – Higher Phase order system – FACTs.

UNIT IV EHV AC Transmission 9

Design of EHV lines based in steady state limits and transient over voltages – Design of extra HV cable transmission – XLPE cables – Gas insulated cable – Corona and RIV.

UNIT V HVDC TRANSMISSION 9

HVDC Transmission principles – Comparison of HVAC and HVDC transmission – Economics – types of Converters – HVDC links – HVDC control – Harmonics – Filters – Multi terminal DC System – HVDC cables and HVDC circuit breakers.

Total=45

COURSE OUTCOMES

- Basic knowledge of HVDC Transmission, its components, types and applications
- Ability to analyze and design the Converter circuits, System Control Techniques
- Ability to design filters for harmonic control and perform power flow analysis using Per unit system for DC Quantities.

Reference Books:

1. Rakosh Das Begamudre, ‘Extra HVDC Transmission Engineering’, Wiley Eastern Ltd, 1990.
2. Padiyar K.R., ‘HVDC Power Transmission systems’, Wiley Eastern Ltd, 1993.
3. Allan Greenwood, ‘Electrical transients in power Systems’, John Eastern Ltd, New York, 1992.
4. Arrilaga J., ‘HVDC transmission’, Peter Perengrinus Ltd, London, 1983.

ELECTIVES-IV
SEMESTER-VII

22153E74CP - Fundamentals of Nanoscience 3 0 0 3

OBJECTIVES:
To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION 9
Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thin films multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic,

UNIT II GENERAL METHODS OF PREPARATION 9
Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS 9
Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO_2,MgO, ZrO_2, NiO, nano alumina, CaO, $AgTiO_2$, Ferrites, Nano clays functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications..

UNIT IV CHARACTERIZATION TECHNIQUES 9
X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nano indentation.

UNIT V APPLICATIONS 9
NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery.

L= 45 Total = 45

COURSE OUTCOMES

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS

1. A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.

2. N John Dinardo, “Nanoscale charecterisation of surfaces & Interfaces”, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

REFERENCE BOOKS

1. G Timp, “Nanotechnology”, AIP press/Springer, 1999.
2. Akhlesh Lakhtakia,“The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations”. Prentice-Hall of India (P) Ltd, New Delhi, 2007.

22153E74DP - ADVANCED CONTROL SYSTEMS 3 0 0 3

AIM

To gain knowledge in analysis of non-linear system and digital control of linear system.

OBJECTIVES

i. To study the description and stability of non-linear system.
ii. To study the conventional technique of non-linear system analysis.
iii. To study the analysis discrete time systems using conventional techniques.
iv. To study the analysis of digital control system using state-space formulation.
v. To study the formulation and analysis of multi input multi output (MIMO) system.

UNIT I NON-LINEAR SYSTEM – DESCRIPTION & STABILITY 9

Linear vs non-linear – Examples – Incidental and Intentional – Mathematical description - Equilibria and linearisation - Stability – Lyapunov function – Construction of Lyapunov function.

UNIT II PHASE PLANE AND DESCRIBING FUNCTION ANALYSIS 9

Construction of phase trajectory – Isocline method – Direct or numerical integration – Describing function definition – Computation of amplitude and frequency of oscillation.

UNIT III Z-TRANSFORM AND DIGITAL CONTROL SYSTEM 9

Z transfer function – Block diagram – Signal flow graph – Discrete root locus – Bode plot. Design of Discrete PID controller – discrete state feedback controller and discrete compensator.

UNIT IV STATE-SPACE DESIGN OF DIGITAL CONTROL SYSTEM 9

State equation – Solutions – Realization – Controllability – Observability – Stability Jury's test.

UNIT V MUTLI INPUT MULTI OUTPUT (MIMO) SYSTEM: 9

Models of MIMO system – Matrix representation – Transfer function representation – Poles and Zeros – Decoupling – Introduction to multivariable Nyquist plot and singular values analysis – Model predictive control. **L = 45 Total = 45**

COURSE OUTCOMES

- Develop mathematical models and understand the mathematical relationships between
- the sensitivity functions and how they govern the fundamentals in control systems.
- Design and fine tune PID controllers and understand the roles of P, I and D in feedback control and develop state-space models

- Advanced filters design for various control applications with proper error estimation techniques.

TEXT BOOKS

1. Benjamin C. Kuo, ‘Digital Control Systems’, Oxford University Press, 1992.
2. George J. Thaler, ‘Automatic Control Systems’, Jaico Publishers, 1993.

REFERENCE BOOKS

1. I.J. Nagrath and M. Gopal, ‘Control Systems Engineering’, New Age International Publishers, 2003.
2. Raymond T. Stefani & Co., ‘Design of feed back Control systems’, Oxford University, 2002.
3. William L. Luyben and Michael L. Luyben, ‘Essentials of Process Control’, McGraw Hill International Editions, Chemical Engineering Series, 1997.

Reference from Reputed University
Percentage of syllabus revised 10%
Syllabus focus on Employability and Innovation

22153E74EP SWITCHED MODE POWER SUPPLIES 2 0 2 4

AIM

To study low power SMPS and UPS technologies

OBJECTIVE

To provide conceptual knowledge in modern power electronic converters and its applications in electric power utility.

UNIT-I Introduction 9

Linear regulator Vs. Switching regulator – Topologies of SMPS – isolated and non isolated topologies – Buck – Boost – Buck boost – Cuk – Polarity inverting topologies – Push pull and forward converters half bridge and full bridge – Fly back converters Voltage fed and current fed topologies. EMI issues.

UNIT-II Design Concepts 9

Magnetic Circuits and design – Transformer design - core selection – winding wire selection – temperature rise calculations - Inductor design. Core loss – copper loss – skin effect - proximity effect. Power semiconductor selection and its drive circuit design – snubber circuits. Closing the feedback loop – Control design – stability considerations

UNIT-III Control Modes 9

Voltage Mode Control of SMPS.. Transfer Function and Frequency response of Error Amp. Transconductance Error Amps. PWM Control ICs (SG 3525,TL 494,MC34060 etc.) Current Mode Control and its advantages. Current Mode Vs Voltage Mode. Current Mode PWM Control IC(eg.UC3842).

UNIT-IV Applications of SMPS 9

Active front end – power factor correction – High frequency power source for fluorescent lamps - power supplies for portable electronic gadgets.

UNIT-V Resonant converters 9

Principle of operation – modes of operation – quasi resonant operation- advantages.

Total : 45

Text/Reference Books:

1. Abraham I Pressman - Switching power supply design – 2nd edition 1998 Mc-Graw hill Publishing Company.
2. Keith H Billings - Switch mode power supply handbook – 1st edition 1989 Mc-Graw hill Publishing Company.
3. Sanjaya Maniktala - Switching power supplies A to Z. – 1st edition 2006, Elsevier Inc.
4. Daniel M Mitchell : DC-DC Switching Regulator Analysis. McGraw Hill Publishing Company
5. Ned Mohan et.al : Power Electronics. John Wiley and Sons.
6. Otmar Kilgenstein : Switched Mode Power Supplies in Practice. John Wiley and Sons.
7. Mark J Nave : Power Line Filter Design for Switched-Mode Power Supplies. Van Nostrand Reinhold, New York.

22153P75P Project Work

- The student will use their ability to design electrical, electronic systems and signals through modeling, simulation, experimentation, interpretation and analysis to build, test, and debug prototype circuits and systems and analyze results using the principles of design to solve open-ended engineering problems.
- The students will be able to take professional decisions based on the impact of socio- economic issues by their self-confidence, a high degree of personal integrity, and the belief that they can each make a difference by developing persuasive communication skills in a variety of media by engaging them in team-based activities, and by strengthening their interpersonal skills. This will lead to develop the leadership qualities by making the students to identify their personal values and demonstrate the practice of ethical leadership.
- The students will be able to appreciate the importance of optimization, commercialization, and innovation as the desired features of the designed system

PONNAIYAH RAMAJAYAM INSTITUTE OF SCIENCE & TECHNOLOGY (PRIST)

Declared as DEEMED-TO-BE-UNIVERSITY
U/s 3 of UGC Act, 1956

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

PROGRAM HANDBOOK

B.Tech FULL TIME

[Regulation 2021]
[for candidates admitted to B.Tech EEE program from June 2021 onwards]

PROGRAMME EDUCATIONAL OBJECTIVES:

PEO1: To enable graduates to pursue research, or have a successful career in academia or industries associated with Electronics and Communication Engineering, or as entrepreneurs.

PEO2: To provide students with strong foundational concepts and also advanced techniques and tools in order to enable them to build solutions or systems of varying complexity.

PEO3: To prepare students to critically analyze existing literature in an area of specialization and ethically develop innovative and research oriented methodologies to solve the problems identified.

PROGRAMME OUTCOMES:

Engineering Graduates will be able to:

A. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

B. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

C. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

D. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

E. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

F. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

G. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

H. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

I. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

J. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

K. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

L. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMM OUTCOMES												
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**
1	3	3	2	3	2	1	1	2	1	1	3	1	3
2	3	3	3	3	3	1	1	1	1	1	1	2	2
3	3	3	3	3	3	2	2	3	1	2	2	2	2

1-Reasonable: 2- Significant: 3- Strong

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

COURSE STRUCTURE

B. TECH-EEE
R 2021

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

SEMESTER I

S.No	Course Code	Course Title	L	T	P	C
1	**21147IP**	Induction Programme	-	-	-	0
2	**21147S11**	Professional English – I	3	0	0	3
3	**21148S12**	Matrices and Calculus	3	1	0	4
4	**21149S13**	Engineering Physics	3	0	0	3
5	**21149S14**	Engineering Chemistry	3	0	0	3
6	**21150S15**	Problem Solving and Python programming	3	0	0	3
7	**21150L16**	Problem Solving and Python Programming Laboratory	0	0	4	2
8	**21149L17**	Physics and Chemistry Laboratory	0	0	4	2
9	**21147L18**	Communication Laboratory - I	0	0	2	1
	TOTAL CREDITS					**21**

SEMESTER – II

S.No	Course Code	Course Name	L	T	P	C
1	**21147S21**	Professional English – II	2	0	0	2
2	**21148S22**	Statistics and Numerical Methods	3	1	0	4
3	**21149S23C**	Physics for Electrical Engineering	3	0	0	3
4	**21154S24**	Engineering Graphics	2	0	4	4
5	**21154S25**	Basic Civil and Mechanical Engineering	3	0	0	3
6	**21153S26B**	Electric Circuit Analysis	3	1	0	4
7	**21154L21**	Engineering Practices Laboratory	0	0	4	2
8	**21153L22B**	Electric Circuits Laboratory	0	0	4	2
9	**21147L23**	Communication Laboratory - II	0	0	4	2
	TOTAL CREDITS					**26**

SEMESTER III

S.No	Course Code	Course Name	L	T	P	C
1	**21148S31C**	Probability and Complex Functions	3	1	0	4
2	**21153C32**	Digital Logic Circuits	3	0	0	3
3	**21153C33**	Electromagnetic Fields	3	1	0	4
4	**21153C34**	Electrical Machines – I	3	0	0	3
5	**21153S35**	Electron Devices and Circuits	3	0	0	3
6	**21153S36**	C Programming and Data Structures	3	0	0	3
7	**21153L31**	Electronic Devices and Circuits Laboratory	0	0	4	2
8	**21153L32**	Electrical Machines Laboratory – I	0	0	4	2
9	**21153L33**	C Programming and Data Structures Laboratory	0	0	4	2
10	**21153L34**	Professional Development	0	0	2	1
					TOTAL CREDITS	**27**

SEMESTER IV

S.No	Course Code	Course Name	L	T	P	C
1	**21153C41**	Electrical Machines – II	3	0	0	3
2	**21153C42**	Transmission and Distribution	3	0	0	3
3	**21153C43**	Measurements and Instrumentation	3	0	0	3
4	**21153C44**	Linear Integrated Circuits	3	0	0	3
5	**21153C45**	Microprocessors and Microcontrollers	3	0	0	3
6	**21149S46**	Environmental Sciences and Sustainability	2	0	0	2
7	**21153L47**	Electrical Machines Laboratory - II	0	0	4	2
8	**21153L48**	Linear and Digital Circuits Laboratory	0	0	4	2
9	**21153L49**	Microprocessors and Microcontrollers Laboratory	0	0	4	2
					TOTAL CREDITS	**23**

SEMESTER – V

S.No	Course Code	Course Name	L	T	P	C
1	**21153C51**	Power System Analysis	3	0	0	3
2	**21153C52**	Control Systems	3	0	0	3
3	**21153C53**	Power Electronics	3	0	0	3
4	**21153E54_**	Elective I	3	0	0	3
5	**21153E55_**	Elective II	2	0	2	3
6	**21153E56_**	Elective III	2	0	2	3
7	**21147MC51_**	Mandatory Course I	3	0	0	0
8	**21153L57**	Control and Instrumentation Laboratory	0	0	4	2
9	**21153L58**	Power Electronics Laboratory	0	0	4	2
					TOTAL CREDITS	**22**

SEMESTER – VI

S.No	Course Code	Course Name	L	T	P	C
1	**21150OE61_**	Open Elective I	2	0	2	3
2	**21153C62**	Power System Operation and Control	3	0	0	3
3	**21153C63**	Protection and Switchgear	3	0	0	3
4	**21153E64_**	Elective IV	3	0	0	3
5	**21153E65_**	Elective V	2	0	2	3
6	**21153E66_**	Elective VI	2	0	2	3
7	**21147MC61_**	Mandatory Course II	3	0	0	0
8	**21153L67**	Power System Laboratory	0	0	4	2
					TOTAL CREDITS	**20**

SEMESTER – VII

S.No	Course Code	Course Name	L	T	P	C
1	**21147S71**	Human Values and Ethics	2	0	0	2
2	**211_ _OE72 _**	Open Elective II	2	0	2	3
3	**211_ _OE73 _**	Open Elective III	3	0	0	3
4	**211_ _OE74_**	Open Elective IV	3	0	0	3
5	**21160E75_**	Elective VII	3	0	0	3
6	**21153E76_**	Elective VIII	2	0	2	3
7	**21153C77**	High Voltage Engineering	3	0	0	3
					TOTAL CREDITS	**20**

SEMESTER – VIII

S.No	Course Code	Course Name	L	T	P	C
1.	**21153P81**	Project Work/ Internship	0	0	20	10
		TOTAL CREDITS				**10**

LIST OF ELECTIVES

MANDATORY COURSES I (V SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1.	21147MC51A	Introduction to Women and Gender Studies	3	0	0	0
2.	21147MC51B	Elements of Literature	3	0	0	0
3.	21147MC51C	Film Appreciation	3	0	0	0
4.	21147MC51D	Disaster Management	3	0	0	0

MANDATORY COURSES II (VI SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1.	21147MC61A	Well Being with Traditional Practices (Yoga, Ayurveda and Siddha)	3	3	0	0
2.	21147MC61B	History of Science and Technology in India	3	0	0	0
3.	21147MC61C	Political and Economic Thought for a Humane Society	3	0	0	0
4.	21147MC61D	State, Nation Building and Politics in India	3	0	0	0
5.	21147MC61E	Safety in Engineering Industries	3	0	0	0

ELECTIVE –I (V SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1.	21153E54A	Utilization and Conservation of Electrical Energy	3	0	0	3
2.	21153E54B	Embedded System Design	3	0	0	3
3.	21153E54C	Electric Vehicle Architecture	3	0	0	3
4.	21153E54D	Energy Management and Auditing	3	0	0	3
5.	21153E54E	SMPS and UPS	3	0	0	3
6.	21153E54F	Smart System Automation	3	0	0	3

ELECTIVE – II (VSEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1.	21153E55A	Special Electrical Machines	3	0	0	3
2.	21153E55B	Process Modeling and Simulation	3	0	0	3
3.	21153E55C	Energy Storage Systems	3	0	0	3
4.	21153E55D	Testing of Electric Vehicles	3	0	0	3
5.	21153E55E	Non Linear Control	3	0	0	3

ELECTIVE – III (V SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1	21153E56A	Embedded C- Programming	3	0	0	3
2	21153E56B	Smart Grids	3	0	0	3
3	21153E56C	Control of Power Electronics Circuits	3	0	0	3
4	21153E56D	VLSI Design	3	0	0	3
5	21153E56E	Intelligent control of Electric Vehicles	3	0	0	3
6	21153E56F	Adaptive Control	3	0	0	3
7	21153E56G	PLC Programming	3	0	0	3

ELECTIVE – IV (VI SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1	21153E64A	Power System Transients	3	0	0	3
2	21153E64B	Power Quality	3	0	0	3
3	21153E64C	Power Electronics for Renewable Energy Systems	3	0	0	3
4	21153E64D	Embedded System for Automotive Applications	3	0	0	3
5	21153E64E	Grid Integration of Electric Vehicles	3	0	0	3
6	21153E64F	Optimal Control	3	0	0	3

ELECTIVE – V (VI SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1	21153E65A	HVDC and FACTS	3	0	0	3
2	21153E65B	Electrical Drives	3	0	0	3
3	21153E65C	Embedded Control for Electrical Drives	3	0	0	3
4	21153E65D	Design of Electric Vehicle Charging System	3	0	0	3
5	21153E65E	Model Based Control	3	0	0	3
6	21153E65F	Grid integrating Techniques and Challenges	3	0	0	3

ELECTIVE – VI (VI SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1	21153E66A	Digital Signal Processing System	3	0	0	3
2	21153E66B	Under Ground Cable Engineering	3	0	0	3
3	21153E66C	Analysis of Electrical Machines	3	0	0	3
4	21153E66D	Design of Motor and Power Converters for Electric Vehicles	3	0	0	3
5	21153E66E	Hybrid Energy Technology	3	0	0	3
6	21153E66F	Computer Control of Processes	3	0	0	3

ELECTIVE – VII (VII SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1.	21160S75A	Total Quality Management	3	0	0	3
2.	21160S75B	Engineering Economics and Financial Accounting	3	0	0	3
3.	21160S75C	Human Resource Management	3	0	0	3
4.	21160S75D	Knowledge Management	3	0	0	3
5.	21160S75E	Industrial Management	3	0	0	3
6.	21160S75F	Principles of Management	3	0	0	3

ELECTIVE – VIII (VII SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1	21153E76A	Substation Engineering and Substation and Substation Automation	3	0	0	3
2	21153E76B	Multilevel Power Converters	3	0	0	3
3	21153E76C	Embedded Processors	3	0	0	3
4	21153E76D	Electric Vehicle Design, Mechanics and Control	3	0	0	3
5	21153E76E	System Identification	3	0	0	3
6	21153E76F	Design and Modelling of Renewable Energy Systems	3	0	0	3

OPEN ELECTIVE I (VI SEM)

S.No	Course Code	Course Name	L	T	P	C
1	21150OE61A	IoT Concepts and Applications	2	0	2	3
2	21150OE61B	Augmented and Virtual Reality	2	0	2	3

OPEN ELECTIVE II (VII SEM)

S.No	Course Code	Course Name	L	T	P	C
1	21150OE74A	Artificial Intelligence and Machine Learning Fundamentals	2	0	2	3
2	21150OE74B	Data Science Fundamentals	2	0	2	3

OPEN ELECTIVE III (VII SEM)

S.No	Course Code	Course Name	L	T	P	C
1	21147OE73A	English for Competitive Examinations	3	0	0	3
2	21154OE73A	Industrial Management	3	0	0	3
3	21154OE73B	Introduction to nondestructive testing	3	0	0	3
4	21155OE73A	Remote Sensing Concepts	3	0	0	3
5	21155OE73B	Drinking Water Supply and Treatment	3	0	0	3
6	21152OE73A	Nano Technology	3	0	0	3
7	21152OE73B	Signals and Systems	3	0	0	3

OPEN ELECTIVE IV (VII SEM)

S.No	Course Code	Course Name	L	T	P	C
1	21154OE74A	Additive Manufacturing	3	0	0	3
2	21154OE74B	Industrial safety	3	0	0	3
3	21155OE74A	Geographical Information System	3	0	0	3
4	21155OE74B	Basics of Integrated Water Resources Management	3	0	0	3
5	21152OE74A	Wearable devices	3	0	0	3
6	21152OE74B	Medical Informatics	3	0	0	3

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

CREDITS DISTRIBUTION

CGPA CREDITS

Semester	Core	Elective	Free Elective	Management Elective	RSD Course	Others	Total
I	21	-	-	-	-	-	21
II	26	-	-	-	-	-	26
III	27	-	-	-	-	-	27
IV	23	-	-	-	-	-	23
V	13	09	-	-	-	-	22
VI	08	09	03	-	-	-	20
VII	05	03	09	03	-	-	20
VIII	10	-	-	-	-	-	10
Over ALL Credits							**169**

NON CGPA CREDITS

Semester	Mandatory Course	Total
I	01	**01**
II	-	**-**
III	-	**-**
IV	-	**-**
V	01	**01**
VI	01	**01**
VII	-	**-**
VIII	-	**-**
Co curricular Activities	In-plant Training , Industrial Visit , Seminars & Conferences	-
TOTAL NON-CGPA CREDITS		**03**

TOTAL CREDITS	
CGPA CREDITS	**169**
NON-CGPA CREDITS	**03**
TOTAL	**172**

SYLLABI

21147S11 **COMMUNICATIVE ENGLISH**

L	T	P	C
3	0	0	

OBJECTIVES:

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills

UNIT I SHARING INFORMATION RELATED TO ONESELF/FAMILY& FRIENDS 12

Reading- short comprehension passages, practice in skimming-scanning and predicting- **Writing-** completing sentences- - developing hints. **Listening-** short texts- short formal and informal conversations. **Speaking-** introducing oneself - exchanging personal information- **Language development-** Wh- Questions- asking and answering-yes or no questions- parts of speech. **Vocabulary development--** prefixes- suffixes- articles.- count/ uncount nouns.

UNIT II GENERAL READING AND FREE WRITING 12

Reading - comprehension-pre-reading-post reading- comprehension questions (multiple choice questions and /or short questions/ open-ended questions)-inductive reading- short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts)- register- **Writing** – paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions using some suggested vocabulary and structures –**Listening-** telephonic conversations. **Speaking –** sharing information of a personal kind—greeting – taking leave- **Language development**
– prepositions, conjunctions **Vocabulary development-** guessing meanings of words in context.

UNIT III GRAMMAR AND LANGUAGE DEVELOPMENT 12

Reading- short texts and longer passages (close reading) **Writing-** understanding text structure- use of reference words and discourse markers-coherence-jumbled sentences **Listening** – listening to longer texts and filling up the table- product description- narratives from different sources. **Speaking-** asking about routine actions and expressing opinions. **Language development-** degrees of comparison- pronouns- direct vs indirect questions- **Vocabulary development –** single word substitutes- adverbs.

UNIT IV READING AND LANGUAGE DEVELOPMENT 12

Reading- comprehension-reading longer texts- reading different types of texts- magazines **Writing-** letter writing, informal or personal letters-e-mails-conventions of personal email- **Listening-** listening to dialogues or conversations and completing exercises based on them. **Speaking-** speaking about oneself- speaking about one's friend- **Language development-** Tenses- simple present-simple past- present continuous and past continuous- **Vocabulary development-** synonyms-antonyms- phrasal verbs

UNIT V EXTENDED WRITING 12

Reading- longer texts- close reading –**Writing-** brainstorming -writing short essays – developing an outline- identifying main and subordinate ideas- dialogue writing-**Listening** – listening to talks- conversations- **Speaking –** participating in conversations- short group conversations-**Language development**-modal verbs- present/ past perfect tense - **Vocabulary development**-collocations- fixed and semi-fixed expressions

REFERENCES

1. Bailey, Stephen. **Academic Writing: A practical guide for students**. New York: Rutledge,2011.
2. Comfort, Jeremy, et al. **Speaking Effectively : Developing Speaking Skillsfor BusinessEnglish.** Cambridge University Press, Cambridge: Reprint 2011
3. Dutt P. Kiranmai and RajeevanGeeta. **Basic Communication Skills,** Foundation Books: 2013
4. Means,L. Thomas and Elaine Langlois. **English & Communication For Colleges.** CengageLearning ,USA: 2007
5. Redston, Chris &Gillies Cunningham **Face2Face** (Pre-intermediate Student's Book& Workbook) Cambridge University Press, New Delhi: 2005
.

21148S12	ENGINEERING MATHEMATICS - I	L	T	P	C
		5	1	0	4

OBJECTIVES :

- The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

UNIT I DIFFERENTIAL CALCULUS 12

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

UNIT II FUNCTIONS OF SEVERAL VARIABLES 12

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT III INTEGRAL CALCULUS 12

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT IV MULTIPLE INTEGRALS 12

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

UNIT V DIFFERENTIAL EQUATIONS 12

Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients - Method of undetermined coefficients.

TOTAL : 60 PERIODS

OUTCOMES :

After completing this course, students should demonstrate competency in the following skills:

- Use both the limit definition and rules of differentiation to differentiate functions.
- Apply differentiation to solve maxima and minima problems.
- Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
- Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
- Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
- Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
- Apply various techniques in solving differential equations.

TEXT BOOKS :

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015. [For Units I & III - Sections 1.1, 2.2, 2.3, 2.5, 2.7(Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1(Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCES :

1. Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10th Edition, 2016.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
3. Narayanan, S. and Manicavachagom Pillai, T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.
4. Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.
5. Weir, M.D and Joel Hass, "Thomas Calculus", 12tn Edition, Pearson India, 2016.

21149S13 **ENGINEERING PHYSICS**

L	T	P	C
5	1	0	4

OBJECTIVES :

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I PROPERTIES OF MATTER 9

Elasticity – Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment - I-shaped girders - stress due to bending in beams.

UNIT II WAVES AND FIBER OPTICS 9

Oscillatory motion – forced and damped oscillations: differential equation and its solution – plane progressive waves – wave equation. Lasers : population of energy levels, Einstein’s A and B coefficients derivation – resonant cavity, optical amplification (qualitative) – Semiconductor lasers: homojunction and heterojunction – Fiber optics: principle, numerical aperture and acceptance angle -types of optical fibres (material, refractive index, mode) – losses associated with optical fibers - fibre optic sensors: pressure and displacement.

UNIT III THERMAL PHYSICS 9

Transfer of heat energy – thermal expansion of solids and liquids – expansion joints - bimetallic strips - thermal conduction, convection and radiation – heat conductions in solids – thermal conductivity - Forbe’s and Lee’s disc method: theory and experiment - conduction through compound media (series and parallel) – thermal insulation – applications: heat exchangers, refrigerators, ovens and solar water heaters.

UNIT IV QUANTUM PHYSICS 9

Black body radiation – Planck’s theory (derivation) – Compton effect: theory and experimental verification – wave particle duality – electron diffraction – concept of wave function and its physical significance – Schrödinger’s wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box – tunnelling (qualitative) - scanning tunnelling microscope.

UNIT V CRYSTAL PHYSICS 9

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - crystal imperfections: point defects, line defects – Burger vectors, stacking faults – role of imperfections in plastic deformation - growth of single crystals: solution and melt growth techniques.

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course,

- the students will gain knowledge on the basics of properties of matter and its applications,
- the students will acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics,
- the students will have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers,
- the students will get knowledge on advanced physics concepts of quantum theory and its applications in tunneling microscopes, and
- the students will understand the basics of crystals, their structures and different crystal growth techniques.

TEXT BOOKS:

1. Bhattacharya, D.K. & Poonam, T. “Engineering Physics”. Oxford University Press, 2015.
2. Gaur, R.K. & Gupta, S.L. “Engineering Physics”. Dhanpat Rai Publishers, 2012.
3. Pandey, B.K. & Chaturvedi, S. “Engineering Physics”. Cengage Learning India, 2012.

REFERENCES:

1. Halliday, D., Resnick, R. & Walker, J. “Principles of Physics”. Wiley, 2015.
2. Serway, R.A. & Jewett, J.W. “Physics for Scientists and Engineers”. Cengage Learning, 2010.
3. Tipler, P.A. & Mosca, G. “Physics for Scientists and Engineers with Modern Physics’. W.H.Freeman, 2007.

21149S14 **ENGINEERING CHEMISTRY** **L T P C**
5 1 0 4

OBJECTIVES:

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.

UNIT I WATER AND ITS TREATMENT 9

Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA – numerical problems – boiler troubles (scale and sludge) – treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) external treatment
– Ion exchange process, zeolite process – desalination of brackish water - Reverse Osmosis.

UNIT II SURFACE CHEMISTRY AND CATALYSIS 9

Adsorption: Types of adsorption – adsorption of gases on solids – adsorption of solute from solutions
– adsorption isotherms – Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – contact theory – kinetics of surface reactions, unimolecular reactions, Langmuir - applications of adsorption on pollution abatement.

Catalysis: Catalyst – types of catalysis – criteria – autocatalysis – catalytic poisoning and catalytic promoters - acid base catalysis – applications (catalytic convertor) – enzyme catalysis– Michaelis –
Menten equation.

UNIT III ALLOYS AND PHASE RULE 9

Alloys: Introduction- Definition- properties of alloys- significance of alloying, functions and effect of alloying elements- Nichrome and stainless steel (18/8) – heat treatment of steel. Phase rule: Introduction, definition of terms with examples, one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system - Pattinson process.

UNIT IV FUELS AND COMBUSTION 9

Fuels: Introduction - classification of fuels - coal - analysis of coal (proximate and ultimate) - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum - manufacture of synthetic petrol (Bergius process) - knocking - octane number - diesel oil - cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) - power alcohol and biodiesel. Combustion of fuels: Introduction - calorific value - higher and lower calorific values- theoretical calculation of calorific value - ignition temperature - spontaneous ignition temperature - explosive range - flue gas analysis (ORSAT Method).

UNIT V ENERGY SOURCES AND STORAGE DEVICES 9

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells
– H_2-O_2 fuel cell.

TOTAL: 45 PERIODS

OUTCOMES:

- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

TEXT BOOKS:

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015
2. P. C. Jain and Monika Jain, "Engineering Chemistry" Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.

REFERENCES:

1. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
2. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
3. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.

21154S15	ENGINEERING GRAPHICS	L T P C
		5 1 0 4

OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (Not for Examination) 1

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREEHAND SKETCHING 7+12

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and t r ue inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 5+12

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES **5+12**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS **6+12**

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

TOTAL: 90 PERIODS

OUTCOMES:

On successful completion of this course, the student will be able to

- familiarize with the fundamentals and standards of Engineering graphics
- perform freehand sketching of basic geometrical constructions and multiple views of objects.
- project orthographic projections of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- visualize and to project isometric and perspective sections of simple solids.

TEXT BOOK:

1. Natrajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.
2. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.

REFERENCES:

1. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
2. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50th Edition, 2010.
3. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
4. Luzzader, Warren.J. and Duff,John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
5. N S Parthasarathy And Vela Murali, “Engineering Graphics”, Oxford University, Press, New Delhi, 2015.
6. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2nd Edition, 2009.

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

21150S16 **PROBLEM SOLVING AND PYTHON PROGRAMMING** **L T P C**
5 1 0 4

COURSE OBJECTIVES:

- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures –- lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT I ALGORITHMIC PROBLEM SOLVING 9

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS 9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

UNIT V FILES, MODULES, PACKAGES 9

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

- Develop algorithmic solutions to simple computational problems
- Read, write, execute by hand simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python Programs.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)

2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

REFERENCES:

1. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
2. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press , 2013
3. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
4. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013.
5. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
6. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd.,, 2015.

19150L17	**PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY**	**LT P C**
		0 0 3 2

COURSE OBJECTIVES:

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

LIST OF PROGRAMS

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

PLATFORM NEEDED
Python 3 interpreter for Windows/Linux

COURSE OUTCOMES:
Upon completion of the course, students will be able to

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

TOTAL :60 PERIODS

21149L18	**PHYSICS AND CHEMISTRY LABORATORY** **(Common to all branches of B.E. / B.Tech Programmes)**	**L T P C** **0 0 3 2**

OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young's modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser
   (b) Determination of acceptance angle in an optical fiber.
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method

OUTCOMES:

Upon completion of the course, the students will be able to **TOTAL: 30 PERIODS**

- apply principles of elasticity, optics and thermal properties for engineering applications.

CHEMISTRY LABORATORY: (Any seven experiments to be conducted) OBJECTIVES:

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by viscometery.

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10- Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
11. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
12. Pseudo first order kinetics-ester hydrolysis.
13. Corrosion experiment-weight loss method.
14. Determination of CMC.
15. Phase change in a solid.
16. Conductometric titration of strong acid vs strong base.

OUTCOMES:

- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

TOTAL: 30

PERIODS TEXTBOOKS:

1. Vogel's Textbook of Quantitative Chemical Analysis (8^{TH} edition, 2014)

21147S21

TECHNICAL ENGLISH

L	T	P	C
3	1	0	4

OBJECTIVES: The Course prepares second semester engineering and Technology students to:

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations , participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialisation.

UNIT I INTRODUCTION TECHNICAL ENGLISH 12

Listening- Listening to talks mostly of a scientific/technical nature and completing information-gap exercises- **Speaking** –Asking for and giving directions- **Reading** – reading short technical texts from journals-newsapapers- **Writing-** purpose statements – extended definitions – issue- writing instructions – checklists-recommendations-**Vocabulary Development-** technical vocabulary **Language Development** –subject verb agreement **-** compound words.

UNIT II READING AND STUDY SKILLS 12

Listening- Listening to longer technical talks and completing exercises based on them-**Speaking** – describing a process-**Reading** – reading longer technical texts- identifying the various transitions in a text- paragraphing-**Writing**- interpreting cgarts, graphs- **Vocabulary Development-**vocabularyused in formal letters/emails and reports **Language Development-** impersonal passive voice, numerical adjectives.

UNIT III TECHNICAL WRITING AND GRAMMAR 12

Listening- Listening to classroom lectures/ talkls on engineering/technology **-Speaking** – introduction to technical presentations- **Reading** – longer texts both general and technical, practice in speed reading; **Writing**-Describing a process, use of sequence words- **Vocabulary Development-** sequence words-Misspelled words. **Language Development-** embedded sentences

UNIT IV REPORT WRITING 12

Listening- Listening to documentaries and making notes. **Speaking** – mechanics of presentations- **Reading** – reading for detailed comprehension- **Writing-** email etiquette- job application – cover letter – Résumé preparation(via email and hard copy)- analytical essays and issue based essays-- **Vocabulary Development-** finding suitable synonyms-paraphrasing-. **Language Development-** clauses- if conditionals.

UNIT V GROUP DISCUSSION AND JOB APPLICATIONS 12

Listening- TED/Ink talks; **Speaking** –participating in a group discussion **-Reading**– reading and understanding technical articles **Writing**– Writing reports- minutes of a meeting- accident and survey-**Vocabulary Development- verbal analogies Language Development-** reported speech

TOTAL : 60 PERIODS

OUTCOMES: At the end of the course learners will be able to:

- Read technical texts and write area- specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialisation successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write reports and winning job applications.

TEXT BOOKS:

1. Board of editors. **Fluency in English A Course book for Engineering and Technology.** Orient Blackswan, Hyderabad: 2016
2. Sudharshana.N.P and Saveetha. C. **English for Technical Communication**. Cambridge University Press: New Delhi, 2016.

REFERENCES

1. Booth-L. Diana**, Project Work,** Oxford University Press**,** Oxford: 2014.
2. Grussendorf, Marion, **English for Presentations,** Oxford University Press, Oxford: 2007
3. Kumar, Suresh. E. **Engineering English**. Orient Blackswan: Hyderabad,2015
4. Means, L. Thomas and Elaine Langlois, **English & Communication For Colleges.** Cengage Learning, USA: 2007
5. Raman, Meenakshi and Sharma, Sangeetha- **Technical Communication Principles and Practice.**Oxford University Press: New Delhi,2014.

Students can be asked to read Tagore, Chetan Bhagat and for suplementary reading.

21148S22A	ENGINEERING MATHEMATICS – II	L	T	P	C
		5	1	0	4

OBJECTIVES :

- This course is designed to cover topics such as Matrix Algebra, Vector Calculus, Complex Analysis and Laplace Transform. Matrix Algebra is one of the powerful tools to handle practical problems arising in the field of engineering. Vector calculus can be widely used for modelling the various laws of physics. The various methods of complex analysis and Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

UNIT I MATRICES **12**

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II VECTOR CALCULUS **12**

Gradient and directional derivative – Divergence and curl - Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III ANALYTIC FUNCTIONS **12**

Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions w z 1 2 - Bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour.

UNIT V LAPLACE TRANSFORMS 12

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear second order ordinary differential equations with constant coefficients.

OUTCOMES : **TOTAL: 60 PERIODS**

After successfully completing the course, the student will have a good understanding of the following topics and their applications:

- Eigenvalues and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.
- Gradient, divergence and curl of a vector point function and related identities.
- Evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems and their verification.
- Analytic functions, conformal mapping and complex integration.
- Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.

TEXT BOOKS :

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.

REFERENCES :

1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
2. Jain R.K. and Iyengar S.R.K., " Advanced Engineering Mathematics ", Narosa Publications, New Delhi , 3rd Edition, 2007.
3. O'Neil, P.V. "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.
4. Sastry, S.S, "Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi, 2014.
5. Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

21149S23B **PHYSICS FOR ELECTRONICS ENGINEERING**

L	T	P	C
5	1	0	3

(Common to BME, ME, CC, ECE, EEE, E&I, ICE)

OBJECTIVES:

- To understand the essential principles of Physics of semiconductor device and Electron transport properties. Become proficient in magnetic, dielectric and optical properties of materials and nano devices.

UNIT I ELECTRICAL PROPERTIES OF MATERIALS 9

Classical free electron theory - Expression for electrical conductivity – Thermal conductivity, expression - Wiedemann-Franz law – Success and failures - electrons in metals – Particle in a three dimensional box – degenerate states – Fermi- Dirac statistics – Density of energy states – Electron in periodic potential: Bloch thorem – metals and insulators - Energy bands in solids– tight binding approximation - Electron effective mass – concept of hole.

UNIT II SEMICONDUCTOR PHYSICS 9

Intrinsic Semiconductors – Energy band diagram – direct and indirect semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Carrier transport: Velocity-electric field relations – drift and diffusion transport - Einstein's relation – Hall effect and devices – Zener and avalanche breakdown in p-n junctions - Ohmic contacts – tunnel diode - Schottky diode – MOS capacitor - power transistor.

UNIT III MAGNETIC AND DIELECTRIC PROPERTIES OF MATERIALS 9

Magnetism in materials – magnetic field and induction – magnetization - magnetic permeability and susceptibility–types of magnetic materials – microscopic classification of magnetic materials - Ferromagnetism: origin and exchange interaction- saturation magnetization and Curie temperature – Domain Theory. Dielectric materials: Polarization processes – dielectric loss – internal field – Clausius-Mosotti relation- dielectric breakdown – high-k dielectrics.

UNIT IV OPTICAL PROPERTIES OF MATERIALS 9

Classification of optical materials – carrier generation and recombination processes - Absorption emission and scattering of light in metals, insulators and Semiconductors (concepts only) - photo current in a P- N diode – solar cell –photo detectors - LED – Organic LED – Laser diodes – excitons - quantum confined Stark effect – quantum dot laser.

UNIT V NANOELECTRONIC DEVICES 9

Introduction - electron density in bulk material – Size dependence of Fermi energy– quantum confinement – quantum structures - Density of states in quantum well, quantum wire and quantum dot structures –Zener-Bloch oscillations – resonant tunneling – quantum interference effects – mesoscopic structures: conductance fluctuations and coherent transport – Coulomb blockade effects - Single electron phenomena and Single electron Transistor – magnetic semiconductors– spintronics - Carbon nanotubes: Properties and applications.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the students will able to

- gain knowledge on classical and quantum electron theories, and energy band structuues,
- acquire knowledge on basics of semiconductor physics and its applications in various devices,
- get knowledge on magnetic and dielectric properties of materials,
- have the necessary understanding on the functioning of optical materials for optoelectronics,
- understand the basics of quantum structures and their applications in spintronics and carbon electronics.

TEXT BOOKS:

1. Kasap, S.O. "Principles of Electronic Materials and Devices", McGraw-Hill Education, 2007.
2. Umesh K Mishra & Jasprit Singh, "Semiconductor Device Physics and Design", Springer, 2008.
3. Wahab, M.A. "Solid State Physics: Structure and Properties of Materials". Narosa Publishing House, 2009.

REFERENCES

1. Garcia, N. & Damask, A. "Physics for Computer Science Students". Springer-Verlag, 2012.
2. Hanson, G.W. "Fundamentals of Nanoelectronics". Pearson Education, 2009
3. Rogers, B., Adams, J. & Pennathur, S. "Nanotechnology: Understanding Small Systems". CRC Press, 2014

21149S24A **ENVIRONMENTAL SCIENCE AND ENGINEERING** **L T P C**
5 1 0 4

OBJECTIVES:

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth‟s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY **14**

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In- situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION **8**

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL: 45 PERIODS

OUTCOMES:

- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXTBOOKS:

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.

REFERENCES :

1. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD,New Delhi, 2007.
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) PVT, LTD, Hydrabad, 2015.
3. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.

21153S25C	CIRCUIT THEORY	L	T	P	C
		5	1	0	4

OBJECTIVES:

- To introduce electric circuits and its analysis
- To impart knowledge on solving circuit equations using network theorems
- To introduce the phenomenon of resonance in coupled circuits.
- To educate on obtaining the transient response of circuits.
- To introduce Phasor diagrams and analysis of three phase circuits

UNIT I BASIC CIRCUITS ANALYSIS 6+6

Resistive elements - Ohm's Law Resistors in series and parallel circuits – Kirchoffs laws – Mesh current and node voltage - methods of analysis.

UNIT II NETWORK REDUCTION AND THEOREMS FOR DC AND AC IRCUITS 6+6

Network reduction: voltage and current division, source transformation – star delta conversion. Thevenins and Norton Theorems – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem – Millman's theorem.

UNIT III TRANSIENT RESPONSE ANALYSIS 6+6

L and C elements -Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. sinusoidal input.

UNIT IV THREE PHASE CIRCUITS 6+6

A.C. circuits – Average and RMS value - Phasor Diagram – Power, Power Factor and Energy.- Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents – power measurement in three phase circuits.

UNIT V RESONANCE AND COUPLED CIRCUITS 6+6

Series and parallel resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

OUTCOMES: **TOTAL : 60 PERIODS**

- Ability to analyse electrical circuits
- Ability to apply circuit theorems
- Ability to analyse transients

TEXT BOOKS:

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", McGraw Hill publishers, edition, New Delhi, 2013.
2. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, 2013.
3. Allan H. Robbins, Wilhelm C. Miller, "Circuit Analysis Theory and Practice", Cengage Learning India, 2013.

REFERENCES

1. Chakrabarti A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, 1999.
2. Jegatheesan, R., "Analysis of Electric Circuits," McGraw Hill, 2015.
3. Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, McGraw- Hill, New Delhi, 2010.
4. M E Van Valkenburg, "Network Analysis",Prentice-Hall of India Pvt Ltd, New Delhi,

2015.
5. Mahadevan, K., Chitra, C., "Electric Circuits Analysis," Prentice-Hall of India Pvt Ltd., New Delhi, 2015.
6. Richard C. Dorf and James A. Svoboda, "Introduction to Electric Circuits", 7th Edition, John Wiley & Sons, Inc. 2015.
7. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", McGraw Hill, 2015.

21154S26C **BASIC CIVIL AND MECHANICAL ENGINEERING** **L T P C**
5 1 0 4

OBJECTIVES:

- To impart basic knowledge on Civil and Mechanical Engineering.
- To familiarize the materials and measurements used in Civil Engineering.
- To provide the exposure on the fundamental elements of civil engineering structures.
- To enable the students to distinguish the components and working principle of power plant units, IC engines, and R & AC system.

A – OVER VIEW

UNIT I SCOPE OF CIVIL AND MECHANICAL ENGINEERING 10

Overview of Civil Engineering - Civil Engineering contributions to the welfare of Society – Specialized sub disciplines in Civil Engineering – Structural, Construction, Geotechnical, Environmental, Transportation and Water Resources Engineering

Overview of Mechanical Engineering - Mechanical Engineering contributions to the welfare of Society –Specialized sub disciplines in Mechanical Engineering - Production, Automobile, Energy Engineering - Interdisciplinary concepts in Civil and Mechanical Engineering.

B – CIVIL ENGINEERING

UNIT II SURVEYING AND CIVIL ENGINEERING MATERIALS 10

Surveying: Objects – classification – principles – measurements of distances – angles – leveling – determination of areas– contours - examples.

Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel - timber - modern materials

UNIT III BUILDING COMPONENTS AND STRUCTURES 15

Foundations: Types of foundations - Bearing capacity and settlement – Requirement of good foundations.

Civil Engineering Structures: Brickmasonry – stonemasonry – beams – columns – lintels – roofing – flooring – plastering – floor area, carpet area and floor space index - Types of Bridges and Dams – water supply - sources and quality of water - Rain water harvesting - introduction to high way and rail way.

C – MECHANICAL ENGINEERING

UNIT IV INTERNAL COMBUSTION ENGINES AND POWER PLANTS 15

Classification of Power Plants - Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Working principle of steam, Gas, Diesel, Hydro - electric and Nuclear Power plants –- working principle of Boilers, Turbines, Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps

UNIT V REFRIGERATION AND AIR CONDITIONING SYSTEM 10

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system– Layout of typical domestic refrigerator–Window and Split type room Air conditioner.

OUTCOMES: **TOTAL: 60 PERIODS**

On successful completion of this course, the student will be able to

- appreciate the Civil and Mechanical Engineering components of Projects.
- explain the usage of construction material and proper selection of construction materials.
- measure distances and area by surveying
- identify the components used in power plant cycle.
- demonstrate working principles of petrol and diesel engine.
- elaborate the components of refrigeration and Air conditioning cycle.

TEXTBOOKS:

1. Shanmugam Gand Palanichamy MS,"Basic Civil and Mechanical Engineering",Tata McGraw Hill PublishingCo.,NewDelhi,1996.

REFERENCES:

1. Palanikumar, K. Basic Mechanical Engineering, ARS Publications, 2010.
2. Ramamrutham S.,"Basic Civil Engineering", Dhanpat Rai Publishing Co.(P) Ltd.1999.
3. Seetharaman S.,"BasicCivil Engineering",AnuradhaAgencies,2005.
4. ShanthaKumar SRJ.,"Basic Mechanical Engineering", Hi-tech Publications, Mayiladuthurai, 2000.
5. Venugopal K. and Prahu Raja V., "Basic Mechanical Engineering", Anuradha Publishers, Kumbakonam,2000.

21154L27 ENGINEERING PRACTICES LABORATORY L T P C
0 0 3 2

OBJECTIVES:

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE 13

Buildings:

(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works. (d) Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

(a) Study of the joints in roofs, doors, windows and furniture. (b) Hands-on-exercise:
Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE 18

Welding:

(a) Preparation of butt joints, lap joints and T-joints by Shielded metal arc welding. (b) Gas welding practice

Basic Machining:

(a) Simple Turning and Taper turning
(b) Drilling Practice

Sheet Metal Work:

(a) Forming & Bending:
(b) Model making – Trays and funnels. (c) Different type of joints.

Machine assembly practice:

(a) Study of centrifugal pump
(b) Study of air conditioner

Demonstration on:

(a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.
(c) Fitting – Exercises – Preparation of square fitting and V – fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE 13

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of an electrical equipment.

IV ELECTRONICS ENGINEERING PRACTICE 16

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

OUTCOMES:

On successful completion of this course, the student will be able to

TOTAL: 60 PERIODS

- fabricate carpentry components and pipe connections including plumbing works.
- use welding equipments to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metal works
- Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundary and fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, soldering practices.

CIVIL

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.	15 Sets.
2. Carpentry vice (fitted to work bench)	15 Nos.
3. Standard woodworking tools	15 Sets.
4. Models of industrial trusses, door joints, furniture joints	5 each
5. Power Tools: (a) Rotary Hammer	2 Nos
(b) Demolition Hammer	2 Nos (c)
Circular Saw	2 Nos (d)
Planer	2 Nos (e)
Hand Drilling Machine	2 Nos (f)
Jigsaw	2 Nos

MECHANICAL

1. Arc welding transformer with cables and holders	5 Nos.
2. Welding booth with exhaust facility	5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 Nos.
5. Centre lathe	2 Nos.
6. Hearth furnace, anvil and smithy tools	2 Sets.
7. Moulding table, foundry tools	2 Sets.
8. Power Tool: Angle Grinder	2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner	One each.

ELECTRICAL

1. Assorted electrical components for house wiring	15 Sets
2. Electrical measuring instruments	10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp	1 each
4. Megger (250V/500V)	1 No.
5. Power Tools: (a) Range Finder	2 Nos
(b) Digital Live-wire detector	2 Nos

ELECTRONICS

1. Soldering guns	10 Nos.
2. Assorted electronic components for making circuits	50 Nos.
3. Small PCBs	10 Nos.
4. Multimeters	10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply	

21153L28C	ELECTRIC CIRCUITS LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES:

- To simulate various electric circuits using Pspice/ Matlab/e-Sim / Scilab
- To gain practical experience on electric circuits and verification of theorems.

LIST OF EXPERIMENTS

1. Simulation and experimental verification of electrical circuit problems using Kirchhoff's voltage and current laws.
2. Simulation and experimental verification of electrical circuit problems using Thevenin's theorem.
3. Simulation and experimental verification of electrical circuit problems using Norton's theorem.
4. Simulation and experimental verification of electrical circuit problems using Superposition theorem.
5. Simulation and experimental verification of Maximum Power transfer Theorem.
6. Study of Analog and digital oscilloscopes and measurement of sinusoidal voltage, frequency and power factor.
7. Simulation and Experimental validation of R-C electric circuit transients.
8. Simulation and Experimental validation of frequency response of RLC electric circuit.
9. Design and Simulation of series resonance circuit.
10. Design and Simulation of parallel resonant circuits.
11. Simulation of three phase balanced and unbalanced star, delta networks circuits.

OUTCOMES: **TOTAL: 60 PERIODS**

- Understand and apply circuit theorems and concepts in engineering applications.
- Simulate electric circuits.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1 Regulated Power Supply: 0 – 15 V D.C - 10 Nos / Distributed Power Source.
2 Function Generator (1 MHz) - 10 Nos.
3 Single Phase Energy Meter - 1 No.
4 Oscilloscope (20 MHz) - 10 Nos.
5 Digital Storage Oscilloscope (20 MHz) – 1 No.
6 10 Nos. of PC with Circuit Simulation Software (min 10 Users) (e-Sim / Scilab/ Pspice / MATLAB /other Equivalent software Package) and Printer (1 No.)
7 AC/DC - Voltmeters (10 Nos.), Ammeters (10 Nos.) and Multi-meters (10 Nos.)
8 Single Phase Wattmeter – 3 Nos.
9 Decade Resistance Box, Decade Inductance Box, Decade Capacitance Box - 6 Nos each.
10 Circuit Connection Boards - 10 Nos.Necessary Quantities of Resistors,Inductors, Capacitors of various capacities (Quarter Watt to 10Watt

21149S31C TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

L	T	P	C
3	1	0	4

OBJECTIVES :

- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations – Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II FOURIER SERIES 12

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12

Classification of PDE – Method of separation of variables - Fourier Series Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

UNIT IV FOURIER TRANSFORMS 12

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS 12

Z-transforms - Elementary properties – Inverse Z-transform (using partial fraction and residues) – Initial and final value theorems - Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

TOTAL : 60 PERIODS

OUTCOMES :

Upon successful completion of the course, students should be able to:

- Understand how to solve the given standard partial differential equations.
- Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
- Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
- Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

TEXT BOOKS :

1. Grewal B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, New Delhi, 2014.
2. Narayanan S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.

REFERENCES :

1. Andrews, L.C and Shivamoggi, B, "Integral Transforms for Engineers" SPIE Press, 1999.
2. Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 9th Edition, Laxmi Publications Pvt. Ltd, 2014.
3. Erwin Kreyszig, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, India, 2016.
4. James, G., "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.
5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
6. Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

21153C32	DIGITAL LOGIC CIRCUITS	L	T	P	C
		3	1	0	3

OBJECTIVES:

- To study various number systems and simplify the logical expressions using Boolean functions
- To study combinational circuits
- To design various synchronous and asynchronous circuits.
- To introduce asynchronous sequential circuits and PLDs
- To introduce digital simulation for development of application oriented logic circuits.

UNIT I NUMBER SYSTEMS AND DIGITAL LOGIC FAMILIES 6+6

Review of number systems, binary codes, error detection and correction codes (Parity and Hamming code) - Digital Logic Families -comparison of RTL, DTL, TTL, ECL and MOS families -operation, characteristics of digital logic family.

UNIT II COMBINATIONAL CIRCUITS 6+6

Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps - simplification and implementation of combinational logic – multiplexers and de multiplexers - code converters, adders, subtractors, Encoders and Decoders.

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS 6+6

Sequential logic- SR, JK, D and T flip flops - level triggering and edge triggering - counters - asynchronous and synchronous type - Modulo counters - Shift registers - design of synchronous sequential circuits – Moore and Melay models- Counters, state diagram; state reduction; state assignment.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS AND PROGRAMMABILITY LOGIC DEVICES 6+6

Asynchronous sequential logic circuits-Transition tability, flow tability-race conditions, hazards &errors in digital circuits; analysis of asynchronous sequential logic circuits- introduction to Programmability Logic Devices: PROM – PLA –PAL, CPLD-FPGA.

UNIT V VHDL 6+6

RTL Design – combinational logic – Sequential circuit – Operators – Introduction to Packages – Subprograms – Test bench. (Simulation /Tutorial Examples: adders, counters, flip flops, Multiplexers & De multiplexers).

OUTCOMES: **TOTAL : 60PERIODS**

- Ability to design combinational and sequential Circuits.
- Ability to simulate using software package.
- Ability to study various number systems and simplify the logical expressions using Boolean functions
- Ability to design various synchronous and asynchronous circuits.
- Ability to introduce asynchronous sequential circuits and PLDs
- Ability to introduce digital simulation for development of application oriented logic circuits.

TEXT BOOKS:

1. James W. Bignel, Digital Electronics, Cengage learning, 5th Edition, 2007.
2. M. Morris Mano, 'Digital Design with an introduction to the VHDL', Pearson Education, 2013.
3. Comer "Digital Logic & State Machine Design, Oxford, 2012.

REFERENCES

1. Mandal, "Digital Electronics Principles & Application, McGraw Hill Edu, 2013.
2. William Keitz, Digital Electronics-A Practical Approach with VHDL, Pearson, 2013.
3. Thomas L.Floyd, 'Digital Fundamentals', 11th edition, Pearson Education,2015.
4. Charles H.Roth, Jr, Lizy Lizy Kurian John, 'Digital System Design using VHDL, Cengage, 2013.
5. D.P.Kothari,J.S.Dhillon, 'Digital circuits and Design',Pearson Education,2016.

21153C33	ELECTROMAGNETIC THEORY	L	T	P	C
		2	2	0	3

OBJECTIVES:

- To introduce the basic mathematical concepts related to electromagnetic vector fields
- To impart knowledge on the concepts of
  - Electrostatic fields, electrical potential, energy density and their applications.
  - Magneto static fields, magnetic flux density, vector potential and its applications. Different methods of emf generation and Maxwell's equations
  - Electromagnetic waves and characterizing parameters

UNIT I ELECTROSTATICS – I 6+6

Sources and effects of electromagnetic fields – Coordinate Systems – Vector fields –Gradient, Divergence, Curl – theorems and applications - Coulomb's Law – Electric field intensity – Field due to discrete and continuous charges – Gauss's law and applications.

UNIT II ELECTROSTATICS – II 6+6

Electric potential – Electric field and equipotential plots, Uniform and Non-Uniform field, Utilization factor – Electric field in free space, conductors, dielectrics - Dielectric polarization – Dielectric strength - Electric field in multiple dielectrics – Boundary conditions, Poisson's and Laplace's equations, Capacitance, Energy density, Applications.

UNIT III MAGNETOSTATICS 6+6

Lorentz force, magnetic field intensity (H) – Biot–Savart's Law - Ampere's Circuit Law – H due to straight conductors, circular loop, infinite sheet of current, Magnetic flux density (B) – B in free space, conductor, magnetic materials – Magnetization, Magnetic field in multiple media – Boundary conditions, scalar and vector potential, Poisson's Equation, Magnetic force, Torque, Inductance, Energy density, Applications.

UNIT IV ELECTRODYNAMIC FIELDS 6+6

Magnetic Circuits - Faraday's law – Transformer and motional EMF – Displacement current - Maxwell's equations (differential and integral form) – Relation between field theory and circuit theory – Applications.

UNIT V ELECTROMAGNETIC WAVES 6+6

Electromagnetic wave generation and equations – Wave parameters; velocity, intrinsic impedance, propagation constant – Waves in free space, lossy and lossless dielectrics, conductors- skin depth - Poynting vector – Plane wave reflection and refraction.

TOTAL : 60 PERIODS

OUTCOMES:

- Ability to understand the basic mathematical concepts related to electromagnetic vector fields.
- Ability to understand the basic concepts about electrostatic fields, electrical potential, energy density and their applications.
- Ability to acquire the knowledge in magneto static fields, magnetic flux density, vector potential and its applications.
- Ability to understand the different methods of emf generation and Maxwell's equations
- Ability to understand the basic concepts electromagnetic waves and characterizing parameters
- Ability to understand and compute Electromagnetic fields and apply them for design and analysis of electrical equipment and systems

TEXT BOOKS:

1. Mathew N. O. Sadiku, 'Principles of Electromagnetics', 6th Edition, Oxford University Press Inc. Asian edition, 2015.
2. William H. Hayt and John A. Buck, 'Engineering Electromagnetics', McGraw Hill Special Indian edition, 2014.
3. Kraus and Fleish, 'Electromagnetics with Applications', McGraw Hill International Editions, Fifth Edition, 2010

REFERENCES

1. V.V.Sarwate, 'Electromagnetic fields and waves', First Edition, Newage Publishers, 1993.
2. J.P.Tewari, 'Engineering Electromagnetics - Theory, Problems and Applications', Second Edition, Khanna Publishers.
3. Joseph. A.Edminister, 'Schaum's Outline of Electromagnetics, Third Edition (Schaum's Outline Series), McGraw Hill, 2010.
4. S.P.Ghosh, Lipika Datta, 'Electromagnetic Field Theory', First Edition, McGraw Hill Education(India) Private Limited, 2012.
5. K A Gangadhar, 'Electromagnetic Field Theory', Khanna Publishers; Eighth Reprint : 2015
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21153C34	ELECTRICAL MACHINES – I	L	T	P	C
		2	2	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Magnetic-circuit analysis and introduce magnetic materials
- Constructional details, the principle of operation, prediction of performance, the methods of testing the transformers and three phase transformer connections.
- Working principles of electrical machines using the concepts of electromechanical energy conversion principles and derive expressions for generated voltage and torque developed in all Electrical Machines.
- Working principles of DC machines as Generator types, determination of their no-load/load characteristics, starting and methods of speed control of motors.
- Various losses taking place in D.C. Motor and to study the different testing methods to arrive at their performance.

UNIT I MAGNETIC CIRCUITS AND MAGNETIC MATERIALS 6+6

Magnetic circuits –Laws governing magnetic circuits - Flux linkage, Inductance and energy – Statically and Dynamically induced EMF - Torque – Properties of magnetic materials, Hysteresis and Eddy Current losses - AC excitation, introduction to permanent magnets-Transformer as a magnetically coupled circuit.

UNIT II TRANSFORMERS 6+6

Construction – principle of operation – equivalent circuit parameters – phasor diagrams, losses – testing – efficiency and voltage regulation-all day efficiency-Sumpner's test, per unit representation – inrush current - three phase transformers-connections – Scott Connection – Phasing of transformer– parallel operation of three phase transformers-auto transformer – tap changing transformers- tertiary winding.

UNIT III ELECTROMECHANICAL ENERGY CONVERSION AND CONCEPTS IN ROTATING MACHINES 6+6

Energy in magnetic system – Field energy and co energy-force and torque equations – singly and multiply excited magnetic field systems-mmf of distributed windings – Winding Inductances-, magnetic fields in rotating machines – rotating mmf waves – magnetic saturation and leakage fluxes.

UNIT IV DC GENERATORS 6+6

Construction and components of DC Machine – Principle of operation - Lap and wave windings-EMF equations– circuit model – armature reaction –methods of excitation- commutation - interpoles compensating winding –characteristics of DC generators.

UNIT V DC MOTORS 6+6

Principle and operations - types of DC Motors – Speed Torque Characteristics of DC Motors- starting and speed control of DC motors –Plugging, dynamic and regenerative braking- testing and efficiency – Retardation test- Swinburne's test and Hopkinson's test - Permanent Magnet DC (PMDC)motors-applications of DC Motor

OUTCOMES: **TOTAL : 60 PERIODS**

- Ability to analyze the magnetic-circuits.
- Ability to acquire the knowledge in constructional details of transformers.
- Ability to understand the concepts of electromechanical energy conversion.
- Ability to acquire the knowledge in working principles of DC Generator.
- Ability to acquire the knowledge in working principles of DC Motor
- Ability to acquire the knowledge in various losses taking place in D.C. Machines

TEXT BOOKS:

1. Stephen J. Chapman, 'Electric Machinery Fundamentals'4th edition, McGraw Hill Education Pvt. Ltd, 2010.
2. P.C. Sen'Principles of Electric Machines and Power Electronics' John Wiley & Sons; 3rd Edition 2013.
3. Nagrath, I.J. and Kothari.D.P., Electric Machines', McGraw-Hill Education, 2004

REFERENCES

1. Theodore Wildi, "Electrical Machines, Drives, and Power Systems", Pearson Education., (5th Edition)**,** 2002**.**
2. B.R. Gupta ,'Fundamental of Electric Machines' New age International Publishers,3rd Edition ,Reprint 2015.
3. S.K. Bhattacharya, 'Electrical Machines' McGraw - Hill Education, New Delhi, 3rd Edition,2009.
4. Vincent Del Toro, 'Basic Electric Machines' Pearson India Education, 2016.
5. Surinder Pal Bali, 'Electrical Technology Machines & Measurements, Vol.II, Pearson, 2013.
6. Fitzgerald. A.E., Charles Kingsely Jr, Stephen D.Umans, 'Electric Machinery', Sixth edition, McGraw Hill Books Company, 2003.

21153C35	**ELECTRON DEVICES AND CIRCUITS**	**L T P C**
		3 0 0 3

OBJECTIVES:

The student should be made to:

- Understand the structure of basic electronic devices.
- Be exposed to active and passive circuit elements.
- Familiarize the operation and applications of transistor like BJT and FET.
- Explore the characteristics of amplifier gain and frequency response.
- Learn the required functionality of positive and negative feedback systems.

UNIT I PN JUNCTION DEVICES 9

PN junction diode –structure, operation and V-I characteristics, diffusion and transition capacitance - Rectifiers – Half Wave and Full Wave Rectifier,– Display devices- LED, Laser diodes, Zener diodecharacteristics- Zener Reverse characteristics – Zener as regulator

UNIT II TRANSISTORS AND THYRISTORS 9

BJT, JFET, MOSFET- structure, operation, characteristics and Biasing UJT, Thyristors and IGBT - Structure and characteristics.

UNIT III AMPLIFIERS 9

BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response –MOSFET small signal model– Analysis of CS and Source follower – Gain and frequency response- High frequency analysis.

UNIT IV MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER 9

BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis – FET input stages – Single tuned amplifiers – Gain and frequency response – Neutralization methods, power amplifiers –Types (Qualitative analysis).

UNIT V FEEDBACK AMPLIFIERS AND OSCILLATORS 9

Advantages of negative feedback – voltage / current, series , Shunt feedback –positive feedback – Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.

OUTCOMES: **TOTAL : 45 PERIODS**

Upon Completion of the course, the students will be ability to:

- Explain the structure and working operation of basic electronic devices.
- Able to identify and differentiate both active and passive elements
- Analyze the characteristics of different electronic devices such as diodes and transistors
- Choose and adapt the required components to construct an amplifier circuit.
- Employ the acquired knowledge in design and analysis of oscillators

TEXT BOOKS:

1. . David A. Bell ,"Electronic devices and circuits", Oxford University higher education, 5^{th} edition 2008.
2. Sedra and smith, "Microelectronic circuits",7^{th} Ed., Oxford University Press

REFERENCES:

1. Balbir Kumar, Shail.B.Jain, "Electronic devices and circuits" PHI learning private limited, 2^{nd} edition 2014.
2. Thomas L.Floyd, "Electronic devices" Conventional current version, Pearson prentice hall, 10^{th} Edition, 2017.
3. Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGraw Hill, 3rd Edition, 2003.
4. Robert L.Boylestad, "Electronic devices and circuit theory", 2002.
5. Robert B. Northrop, "Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation", CRC Press, 2004.

21153C36	POWER PLANT ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVE:

- Providing an overview of Power Plants and detailing the role of Mechanical Engineers in their operation and maintenance.

UNIT I COAL BASED THERMAL POWER PLANTS 9

Rankine cycle - improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.

UNIT II DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS 9

Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimisation. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.

UNIT III NUCLEAR POWER PLANTS 9

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : Boili*ng Water Reactor* (BWR), P*ressurized Water Reactor* (PW R), CANada Deuterium-Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

UNIT IV POWER FROM RENEWABLE ENERGY 9

Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, *Solar* Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.

UNIT V ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS 9

Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

OUTCOMES: **TOTAL : 45 PERIODS**

Upon the completion of this course the students will be able to

CO1 Explain the layout, construction and working of the components inside a thermal power plant.

CO2 Explain the layout, construction and working of the components inside a Diesel, Gas and Combined cycle power plants.

CO3 Explain the layout, construction and working of the components inside nuclear power plants.

CO4 Explain the layout, construction and working of the components inside Renewable energy power plants.

CO5 Explain the applications of power plants while extend their knowledge to power plant economics and environmental hazards and estimate the costs of electrical energy production.

TEXT BOOK:

1. Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008.

REFERENCES:

1. El-Wakil. M.M., "Power Plant Technology", Tata McGraw – Hill Publishing Company Ltd., 2010.

2. Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.
3. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, "Power Plant Engineering", Second Edition, Standard Handbook of McGraw – Hill, 1998.

21153L37	ELECTRONICS LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES:

- To enability the students to understand the behavior of semiconductor device based on experimentation.

LIST OF EXPERIMENTS

1. Characteristics of Semiconductor diode and Zener diode
2. Characteristics of a NPN Transistor under common emitter , common collector and common base configurations
3. Characteristics of JFET and draw the equivalent circuit
4. Characteristics of UJT and generation of saw tooth waveforms
5. Design and Frequency response characteristics of a Common Emitter amplifier
6. Characteristics of photo diode & photo transistor, Study of light activated relay circuit
7. Design and testing of RC phase shift and LC oscillators
8. Single Phase half-wave and full wave rectifiers with inductive and capacitive filters
9. Differential amplifiers using FET
10. Study of CRO for frequency and phase measurements
11. Realization of passive filters

OUTCOMES:

- Ability to understand and analyse electronic circuits.

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Semiconductor devices like Diode, Zener Diode, NPN Transistors, JFET, UJT, Photo diode, Photo Transistor
2. Resistors, Capacitors and inductors
3. Necessary digital IC 8
4. Function Generators 10
5. Regulated 3 output Power Supply 5, ± 15V 10
6. CRO 10
7. Storage Oscilloscope 1
8. Bread boards
9. Atleast one demo module each for the listed equipments.
10. Component data sheets to be provided

21153L38 **ELECTRICAL MACHINES LABORATORY-I**

L	T	P	C
0	**0**	**3**	**2**

OBJECTIVES:

- To expose the students to the operation of D.C. machines and transformers and give them experimental skill.

LIST OF EXPERIMENTS

1. Open circuit and load characteristics of DC shunt generator- critical resistance and critical speed.
2. Load characteristics of DC compound generator with differential and cumulative connections.
3. Load test on DC shunt motor.
4. Load test on DC compound motor.
5. Load test on DC series motor.
6. Swinburne's test and speed control of DC shunt motor.
7. Hopkinson's test on DC motor – generator set.
8. Load test on single-phase transformer and three phase transformers.
9. Open circuit and short circuit tests on single phase transformer.
10. Sumpner's test on single phase transformers.
11. Separation of no-load losses in single phase transformer.
12. Study of starters and 3-phase transformers connections.

OUTCOMES: **TOTAL: 60 PERIODS**

- Ability to understand and analyze DC Generator
- Ability to understand and analyze DC Motor
- Ability to understand and analyse Transformers.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. DC Shunt Motor with Loading Arrangement – 3 nos
2. DC Shunt Motor Coupled with Three phase Alternator – 1 No.
3. Single Phase Transformer – 4 nos
4. DC Series Motor with Loading Arrangement – 1 No.
5. DC compound Motor with Loading Arrangement – 1 No.
6. Three Phase Induction Motor with Loading Arrangement – 2 nos
7. Single Phase Induction Motor with Loading Arrangement – 1 No.
8. DC Shunt Motor Coupled With DC Compound Generator – 2 nos
9. DC Shunt Motor Coupled With DC Shunt Motor – 1 No.
10. Tachometer -Digital/Analog – 8 nos
11. Single Phase Auto Transformer – 2 nos
12. Three Phase Auto Transformer – 1 No.
13. Single Phase Resistive Loading Bank – 2 nos
14. Three Phase Resistive Loading Bank. – 2 nos

21149S41C **NUMERICAL METHODS**

L	T	P	C
4	0	0	4

OBJECTIVES :

- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals in real life situations.
- To acquaint the student with understanding of numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.
- To understand the knowledge of various techniques and methods of solving various types of partial differential equations.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 12

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

UNIT II INTERPOLATION AND APPROXIMATION 12

Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Difference operators and relations - Interpolation with equal intervals - Newton's forward and backward difference formulae.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 12

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's Method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 12

Single step methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge - Kutta method for solving first order equations - Multi step methods - Milne's and Adams - Bash forth predictor corrector methods for solving first order equations.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 12

Finite difference methods for solving second order two - point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

TOTAL : 60 PERIODS

OUTCOMES :

Upon successful completion of the course, students should be able to:

- Understand the basic concepts and techniques of solving algebraic and transcendental equations.
- Appreciate the numerical techniques of interpolation and error approximations in various intervals in real life situations.
- Apply the numerical techniques of differentiation and integration for engineering problems.
- Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
- Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

TEXTBOOKS :

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.

REFERENCES :

1. Brian Bradie, "A Friendly Introduction to Numerical Analysis", Pearson Education, Asia, New Delhi, 2007.
2. Gerald. C. F. and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6th Edition, New Delhi, 2006.
3. Mathews, J.H. "Numerical Methods for Mathematics, Science and Engineering", 2nd Edition, Prentice Hall, 1992.
4. Sankara Rao. K., "Numerical Methods for Scientists and Engineers", Prentice Hall of India Pvt. Ltd, 3rd Edition, New Delhi, 2007.
5. Sastry, S.S, "Introductory Methods of Numerical Analysis", PHI Learning Pvt. Ltd, 5th Edition, 2015.

21153C42 ELECTRICAL MACHINES – II

L	T	P	C
2	2	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Construction and performance of salient and non – salient type synchronous generators.
- Principle of operation and performance of synchronous motor.
- Construction, principle of operation and performance of induction machines.
- Starting and speed control of three-phase induction motors.
- Construction, principle of operation and performance of single phase induction motors and special machines.

UNIT I SYNCHRONOUS GENERATOR 6+6

Constructional details – Types of rotors –winding factors- emf equation – Synchronous reactance – Armature reaction – Phasor diagrams of non salient pole synchronous generator connected to infinite bus--Synchronizing and parallel operation – Synchronizing torque -Change of excitation and mechanical input- Voltage regulation – EMF, MMF, ZPF and A.S.A methods – steady state power- angle characteristics– Two reaction theory –slip test -short circuit transients - Capability Curves

UNIT II SYNCHRONOUS MOTOR 6+6

Principle of operation – Torque equation – Operation on infinite bus bars - V and Inverted V curves – Power input and power developed equations – Starting methods – Current loci for constant power input, constant excitation and constant power developed-Hunting – natural frequency of oscillations – damper windings- synchronous condenser.

UNIT III THREE PHASE INDUCTION MOTOR 6+6

Constructional details – Types of rotors –- Principle of operation – Slip –cogging and crawling- Equivalent circuit – Torque-Slip characteristics - Condition for maximum torque – Losses and efficiency – Load test - No load and blocked rotor tests - Circle diagram – Separation of losses – Double cage induction motors –Induction generators – Synchronous induction motor.

UNIT IV STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR 6+6

Need for starting – Types of starters – DOL, Rotor resistance, Autotransformer and Star- delta starters – Speed control – Voltage control, Frequency control and pole changing – Cascaded connection-V/f control – Slip power recovery scheme-Braking of three phase induction motor: Plugging, dynamic braking and regenerative braking.

UNIT V SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES 6+6

Constructional details of single phase induction motor – Double field revolving theory and operation – Equivalent circuit – No load and blocked rotor test – Performance analysis – Starting methods of single-phase induction motors – Capacitor-start capacitor run Induction motor- Shaded pole induction motor - Linear induction motor – Repulsion motor - Hysteresis motor - AC series motor- Servo motors- Stepper motors - introduction to magnetic levitation systems.

TOTAL : 60 PERIODS

OUTCOMES:

- Ability to understand the construction and working principle of Synchronous Generator
- Ability to understand MMF curves and armature windings.
- Ability to acquire knowledge on Synchronous motor.
- Ability to understand the construction and working principle of Three phase Induction Motor
- Ability to understand the construction and working principle of Special Machines
- Ability to predetermine the performance characteristics of Synchronous Machines.

TEXT BOOKS:

1. A.E. Fitzgerald, Charles Kingsley, Stephen. D. Umans, 'Electric Machinery', Mc Graw Hill publishing Company Ltd, 2003.
2. Vincent Del Toro, 'Basic Electric Machines' Pearson India Education, 2016.
3. Stephen J. Chapman, 'Electric Machinery Fundamentals' 4^{th} edition, McGraw Hill Education Pvt. Ltd, 2010.

REFERENCES

1. D.P. Kothari and I.J. Nagrath, 'Electric Machines', McGraw Hill Publishing Company Ltd, 2002.
2. P.S. Bhimbhra, 'Electrical Machinery', Khanna Publishers, 2003.
3. M.N. Bandyopadhyay, Electrical Machines Theory and Practice, PHI Learning PVT LTD., New Delhi, 2009.
4. B.R.Gupta, 'Fundamental of Electric Machines' New age International Publishers, 3^{rd} Edition ,Reprint 2015.
5. Murugesh Kumar, 'Electric Machines', Vikas Publishing House Pvt. Ltd, 2002.
6. Alexander S. Langsdorf, 'Theory of Alternating-Current Machinery', McGraw Hill Publications, 2001.

21153C43	TRANSMISSION AND DISTRIBUTION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the structure of electric power system and to develop expressions for the computation of transmission line parameters.
- To obtain the equivalent circuits for the transmission lines based on distance and to determine voltage regulation and efficiency.
- To understand the mechanical design of transmission lines and to analyze the voltage distribution in insulator strings to improve the efficiency.
- To study the types, construction of cabilitys and methods to improve the efficiency.
- To study about distribution systems, types of substations, methods of grounding, EHVAC, HVDC and FACTS.

UNIT I TRANSMISSION LINE PARAMETERS 9

Structure of Power System - Parameters of single and three phase transmission lines with single and double circuits -Resistance, inductance and capacitance of solid, stranded and bundled conductors, Symmetrical and unsymmetrical spacing and transposition - application of self and mutual GMD; skin and proximity effects -Typical configurations, conductor types and electrical parameters of EHV lines.

UNIT II MODELLING AND PERFORMANCE OF TRANSMISSION LINES 9

Performance of Transmission lines - short line, medium line and long line - equivalent circuits, phasor diagram, attenuation constant, phase constant, surge impedance - transmission efficiency and voltage regulation, real and reactive power flow in lines - Power Circle diagrams - Formation of Corona – Critical Voltages – Effect on Line Performance.

UNIT III MECHANICAL DESIGN OF LINES 9

Mechanical design of OH lines – Line Supports –Types of towers – Stress and Sag Calculation – Effects of Wind and Ice loading. Insulators: Types, voltage distribution in insulator string, improvement of string efficiency, testing of insulators.

UNIT IV UNDER GROUND CABILITYS 9

Underground cabilitys - Types of cabilitys – Construction of single core and 3 core Cabilitys - Insulation Resistance – Potential Gradient - Capacitance of Single-core and 3 core cabilitys - Grading of cabilitys - Power factor and heating of cabilitys– DC cabilitys.

UNIT V DISTRIBUTION SYSTEMS 9

Distribution Systems – General Aspects – Kelvin's Law – AC and DC distributions - Techniques of Voltage Control and Power factor improvement – Distribution Loss –Types of Substations -Methods of Grounding – Trends in Transmission and Distribution: EHVAC, HVDC and FACTS (Qualitative treatment only).

TOTAL : 45 PERIODS

OUTCOMES:

- To understand the importance and the functioning of transmission line parameters.
- To understand the concepts of Lines and Insulators.
- To acquire knowledge on the performance of Transmission lines.
- To acquire knowledge on Underground Cabilitys
- To become familiar with the function of different components used in Transmission and Distribution levels of power system and modelling of these components.

TEXT BOOKS:

1. D.P.Kothari, I.J. Nagarath, 'Power System Engineering', Mc Graw-Hill Publishing Company limited, New Delhi, Second Edition, 2008.
2. C.L.Wadhwa, 'Electrical Power Systems', New Academic Science Ltd, 2009.
3. S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall of India Pvt. Ltd, New Delhi, Second Edition, 2011.

REFERENCES

1. B.R.Gupta, 'Power System Analysis and Design' S. Chand, New Delhi, Fifth Edition, 2008.
2. Luces M.Fualken berry, Walter Coffer, 'Electrical Power Distribution and Transmission', Pearson Education, 2007.
3. Arun Ingole, "power transmission and distribution" Pearson Education, 2019
4. J.Brian, Hardy and Colin R.Bayliss 'Transmission and Distribution in Electrical Engineering', Newnes; Fourth Edition, 2012.
5. G.Ramamurthy, "Handbook of Electrical power Distribution," Universities Press, 2013.
6. V.K.Mehta, Rohit Mehta, 'Principles of power system', S. Chand & Company Ltd, New Delhi, 2013

21153C44	MEASUREMENTS AND INSTRUMENTATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Basic functional elements of instrumentation.
- Fundamentals of electrical and electronic instruments.
- Comparison between various measurement techniques.
- Various storage and display devices.
- Various transducers and the data acquisition systems.

UNIT I INTRODUCTION 9

Functional elements of an instrument – Static and dynamic characteristics – Errors in measurement – Statistical evaluation of measurement data – Standards and calibration- Principle and types of analog and digital voltmeters, ammeters.

UNIT II ELECTRICAL AND ELECTRONIC INSTRUMENTS 9

Principle and types of multi meters – Single and three phase watt meters and energy meters – Magnetic measurements – Determination of B-H curve and measurements of iron loss – Instrument transformers – Instruments for measurement of frequency and phase.

UNIT III COMPARATIVE METHODS OF MEASUREMENTS 9

D.C potentiometers, D.C (Wheat stone, Kelvin and Kelvin Double bridge) & A.C bridges (Maxwell, Anderson and Schering bridges), transformer ratio bridges, self-balancing bridges. Interference & screening – Multiple earth and earth loops - Electrostatic and electromagnetic Interference – Grounding techniques.

UNIT IV STORAGE AND DISPLAY DEVICES 9

Magnetic disk and tape – Recorders, digital plotters and printers, CRT display, digital CRO, LED, LCD & Dot matrix display – Data Loggers.

UNIT V TRANSDUCERS AND DATA ACQUISITION SYSTEMS 9

Classification of transducers – Selection of transducers – Resistive, capacitive & inductive Transducers – Piezoelectric, Hall effect, optical and digital transducers – Elements of data acquisition system – Smart sensors-Thermal Imagers.

TOTAL : 45 PERIODS

OUTCOMES:

- To acquire knowledge on Basic functional elements of instrumentation
- To understand the concepts of Fundamentals of electrical and electronic instruments
- Ability to compare between various measurement techniques
- To acquire knowledge on Various storage and display devices
- To understand the concepts Various transducers and the data acquisition systems
- Ability to model and analyze electrical and electronic Instruments and understand the operational features of display Devices and Data Acquisition System.

TEXT BOOKS:

1. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2010.
2. J. B. Gupta, 'A Course in Electronic and Electrical Measurements', S. K. Kataria & Sons, Delhi, 2013.
3. Doebelin E.O. and Manik D.N., Measurement Systems – Applications and Design, Special Indian Edition, McGraw Hill Education Pvt. Ltd., 2007.

REFERENCES

1. H.S. Kalsi, 'Electronic Instrumentation', McGraw Hill, III Edition 2010.
2. D.V.S. Murthy, 'Transducers and Instrumentation', Prentice Hall of India Pvt Ltd, 2015.
3. David Bell, ' Electronic Instrumentation & Measurements', Oxford University Press, 2013.
4. Martin Reissland, 'Electrical Measurements', New Age International (P) Ltd., Delhi, 2001.
5. Alan. S. Morris, Principles of Measurements and Instrumentation, 2nd Edition, Prentice Hall of India, 2003.

21153C45	LINEAR INTEGRATED CIRCUITS AND APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart knowledge on the following topics

- Signal analysis using Op-amp based circuits.
- Applications of Op-amp.
- Functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits.
- IC fabrication procedure.

UNIT I IC FABRICATION 9

IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realisation of monolithic ICs and packaging. Fabrication of diodes, capacitance, resistance, FETs and PV Cell.

UNIT II CHARACTERISTICS OF OPAMP 9

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – Inverting and Non-inverting Amplifiers, summer, differentiator and integrator-V/I & I/V converters.

UNIT III APPLICATIONS OF OPAMP 9

Instrumentation amplifier and its applications for transducer Bridge, Log and Antilog Amplifiers- Analog multiplier & Divider, first and second order active filters, comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R- 2R ladder and weighted resistor types), A/D converters using opamps.

UNIT IV SPECIAL ICs 9

Functional block, characteristics of 555 Timer and its PWM application - IC-566 voltage controlled oscillator IC; 565-phase locked loop IC, AD633 Analog multiplier ICs.

UNIT V APPLICATION ICs 9

AD623 Instrumentation Amplifier and its application as load cell weight measurement - IC voltage regulators –LM78XX, LM79XX; Fixed voltage regulators its application as Linear power supply - LM317, 723 Variability voltage regulators, switching regulator- SMPS - ICL 8038 function generator IC.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to acquire knowledge in IC fabrication procedure
- Ability to analyze the characteristics of Op-Amp
- To understand the importance of Signal analysis using Op-amp based circuits.
- Functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits.
- To understand and acquire knowledge on the Applications of Op-amp
- Ability to understand and analyse, linear integrated circuits their Fabrication and Application.

TEXT BOOKS:

1. David A. Bell, 'Op-amp & Linear ICs', Oxford, 2013.
2. D. Roy Choudhary, Sheil B. Jani, 'Linear Integrated Circuits', II edition, New Age, 2003.
3. Ramakant A.Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, 2003 / PHI. 2000.

REFERENCES

1. Fiore,"Opamps & Linear Integrated Circuits Concepts & applications", Cengage, 2010.
2. Floyd ,Buchla,"Fundamentals of Analog Circuits, Pearson, 2013.
3. Jacob Millman, Christos C.Halkias, 'Integrated Electronics - Analog and Digital circuits system', McGraw Hill, 2003.
4. Robert F.Coughlin, Fredrick F. Driscoll, 'Op-amp and Linear ICs', Pearson, 6th edition,2012.
5. Sergio Franco, 'Design with Operational Amplifiers and Analog Integrated Circuits', Mc Graw Hill, 2016.
6. Muhammad H. Rashid,' Microelectronic Circuits Analysis and Design' Cengage Learning, 2011.

21153C46 CONTROL SYSTEMS **L T P C**
3 2 0 4

COURSE OBJECTIVES

- To understand the use of transfer function models for analysis physical systems and introduce the control system components.
- To provide adequate knowledge in the time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of systems.
- To introduce stability analysis and design of compensators

UNIT I SYSTEMS AND REPRESENTATION 9

Basic elements in control systems: – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs.

UNIT II TIME RESPONSE 9

Time response: – Time domain specifications – Types of test input – I and II order system response – Error coefficients – Generalized error series – Steady state error – Root locus construction- Effects of P, PI, PID modes of feedback control –Time response analysis.

UNIT III FREQUENCY RESPONSE 9

Frequency response: – Bode plot – Polar plot – Determination of closed loop response from open loop response - Correlation between frequency domain and time domain specifications

UNIT IV STABILITY AND COMPENSATOR DESIGN 9

Characteristics equation – Routh Hurwitz criterion – Nyquist stability criterion- Performance criteria – Effect of Lag, lead and lag-lead compensation on frequency response-Design of Lag, lead and lag- lead compensator using bode plots.

UNIT V STATE VARIABLE ANALYSIS 9

Concept of state variables – State models for linear and time invariant Systems – Solution of state and output equation in controllable canonical form – Concepts of controllability and observability.

TOTAL (L: 45+T:30): 75 PERIODS

COURSE OUTCOMES

At the end of the course, the student should have the :

- Ability to develop various representations of system based on the knowledge of
- Mathematics, Science and Engineering fundamentals.
- Ability to do time domain and frequency domain analysis of various models of linear system.
- Ability to interpret characteristics of the system to develop mathematical model.
- Ability to design appropriate compensator for the given specifications.
- Ability to come out with solution for complex control problem.
- Ability to understand use of PID controller in closed loop system.

TEXT BOOKS

1. Nagarath, I.J. and Gopal, M., "Control Systems Engineering", New Age International Publishers, 2017.
2. Benjamin C. Kuo, "Automatic Control Systems", Wiley, 2014.

REFERENCES

1. Katsuhiko Ogata, "Modern Control Engineering", Pearson, 2015.
2. Richard C.Dorf and Bishop, R.H., "Modern Control Systems", Pearson Education,2009.
3. John J.D., Azzo Constantine, H. and Houpis Sttuart, N Sheldon, "Linear Control System Analysis and Design with MATLAB", CRC Taylor& Francis Reprint 2009.
4. Rames C.Panda and T. Thyagarajan, "An Introduction to Process Modelling Identification and Control of Engineers", Narosa Publishing House, 2017.
5. M.Gopal, "Control System: Principle and design", McGraw Hill Education, 2012.
6. NPTEL Video Lecture Notes on "Control Engineering "by Prof. S. D. Agashe, IIT Bombay.

21153L47 **ELECTRICAL MACHINES LABORATORY - II**

L	T	P	C
0	0	3	2

OBJECTIVES:

- To expose the students to the operation of synchronous machines and induction motors and give them experimental skill.

LIST OF EXPERIMENTS

1. Regulation of three phase alternator by EMF and MMF methods.
2. Regulation of three phase alternator by ZPF and ASA methods.
3. Regulation of three phase salient pole alternator by slip test.
4. Measurements of negative sequence and zero sequence impedance of alternators.
5. V and Inverted V curves of Three Phase Synchronous Motor.
6. Load test on three-phase induction motor.
7. No load and blocked rotor tests on three-phase induction motor (Determination of equivalent circuit parameters).
8. Separation of No-load losses of three-phase induction motor.
9. Load test on single-phase induction motor.
10. No load and blocked rotor test on single-phase induction motor.
11. Study of Induction motor Starters

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course, the student should have the :

- Ability to understand and analyze EMF and MMF methods
- Ability to analyze the characteristics of V and Inverted V curves
- Ability to understand the importance of Synchronous machines
- Ability to understand the importance of Induction Machines
- Ability to acquire knowledge on separation of losses

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Synchronous Induction motor 3HP – 1 No.
2. DC Shunt Motor Coupled With Three phase Alternator – 4 nos
3. DC Shunt Motor Coupled With Three phase Slip ring Induction motor – 1 No.
4. Three Phase Induction Motor with Loading Arrangement – 2 nos
5. Single Phase Induction Motor with Loading Arrangement – 2 nos
6. Tachometer -Digital/Analog – 8 nos
7. Single Phase Auto Transformer – 2 nos
8. Three Phase Auto Transformer – 3 nos
9. Single Phase Resistive Loading Bank – 2 nos
10. Three Phase Resistive Loading Bank – 2 nos
11. Capacitor Bank – 1 No.

21153L48 LINEAR AND DIGITAL INTEGRATED CIRCUITS LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:

- To learn design, testing and characterizing of circuit behavior with digital and analog ICs.

LIST OF EXPERIMENTS

1. Implementation of Boolean Functions, Adder and Subtractor circuits.
2. Code converters: Excess-3 to BCD and Binary to Gray code converter and vice-versa
3. Parity generator and parity checking
4. Encoders and Decoders
5. Counters: Design and implementation of 3-bit modulo counters as synchronous and Asynchronous types using FF IC's and specific counter IC.
6. Shift Registers: Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitability IC's.
7. Study of multiplexer and de multiplexer
8. Timer IC application: Study of NE/SE 555 timer in Astability, Monostability operation.
9. Application of Op-Amp: inverting and non-inverting amplifier, Adder, comparator, Integrator and Differentiator.
10. Voltage to frequency characteristics of NE/ SE 566 IC.
11. Variability Voltage Regulator using IC LM317.

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course, the student should have the :

- Ability to understand and implement Boolean Functions.
- Ability to understand the importance of code conversion
- Ability to Design and implement 4-bit shift registers
- Ability to acquire knowledge on Application of Op-Amp
- Ability to Design and implement counters using specific counter IC.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS: (3 per Batch)

S.No	Name of the equipments / Components	Quantity Required	Remarks
1	Dual ,(0-30V) variability Power Supply	10	-
2	CRO	9	30MHz
3	Digital Multimeter	10	Digital
4	Function Generator	8	1 MHz
5	IC Tester (Analog)	2	
6	Bread board	10	

7	Computer (PSPICE installed)	1	
Consumabilitys (sufficient quantity)			
1	IC 741/ IC NE555/566/565		
2	Digital IC types		
3	LED		
4	LM317		
5	LM723		
6	ICSG3524 / SG3525		
7	Transistor – 2N3391		
8	Diodes, IN4001,BY126		
9	Zener diodes		
10	Potentiometer		
11	Step-down transformer 230V/12-0-12V		
12	Capacitor		
13	Resistors 1/4 Watt Assorted		
14	Single Strand Wire		

21153C51	**POWER SYSTEM ANALYSIS**	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To model the power system under steady state operating condition
- To understand and apply iterative techniques for power flow analysis
- To model and carry out short circuit studies on power system
- To model and analyze stability problems in power system

UNIT I POWER SYSTEM 9

Need for system planning and operational studies - Power scenario in India - Power system components – Representation - Single line diagram - per unit quantities - p.u. impedance diagram - p.u. reactance diagram - Network graph, Bus incidence matrix, Primitive parameters, Bus admittance matrix from primitive parameters - Representation of off- nominal transformer - Formation of bus admittance matrix of large power network.

UNIT II POWER FLOW ANALYSIS 9

Bus classification - Formulation of Power Flow problem in polar coordinates - Power flow solution using Gauss Seidel method - Handling of Voltage controlled buses - Power Flow Solution by Newton Raphson method.

UNIT III SYMMETRICAL FAULT ANALYSIS 9

Assumptions in short circuit analysis - Symmetrical short circuit analysis using Thevenin's theorem - Bus Impedance matrix building algorithm (without mutual coupling) - Symmetrical fault analysis through bus impedance matrix - Post fault bus voltages - Fault level - Current limiting reactors.

UNIT IV UNSYMMETRICAL FAULT ANALYSIS 9

Symmetrical components - Sequence impedances - Sequence networks - Analysis of unsymmetrical faults at generator terminals: LG, LL and LLG - unsymmetrical fault occurring at any point in a power system - computation of post fault currents in symmetrical component and phasor domains.

UNIT V STABILITY ANALYSIS 9

Classification of power system stability – Rotor angle stability - Swing equation - Swing curve - Power-Angle equation - Equal area criterion - Critical clearing angle and time - Classical step- by-step solution of the swing equation – modified Euler method.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to model the power system under steady state operating condition
- Ability to understand and apply iterative techniques for power flow analysis
- Ability to model and carry out short circuit studies on power system
- Ability to model and analyze stability problems in power system
- Ability to acquire knowledge on Fault analysis.
- Ability to model and understand various power system components and carry out power flow, short circuit and stability studies.

TEXT BOOKS:

1. John J. Grainger, William D. Stevenson, Jr, 'Power System Analysis', Mc Graw Hill Education (India) Private Limited, New Delhi, 2015.
2. Kothari D.P. and Nagrath I.J., 'Power System Engineering', Tata McGraw-Hill Education, Second Edition, 2008.
3. Hadi Saadat, 'Power System Analysis', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.

REFERENCES

1. Pai M A, 'Computer Techniques in Power System Analysis', Tata Mc Graw-Hill Publishing Company Ltd., New Delhi, Second Edition, 2007.
2. J. Duncan Glover, Mulukutla S.Sarma, Thomas J. Overbye, 'Power System Analysis & Design', Cengage Learning, Fifth Edition, 2012.
3. Gupta B.R., 'Power System - Analysis and Design', S. Chand Publishing, 2001.
4. Kundur P., 'Power System Stability and Control', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.

21153C52	**MICROPROCESSORS AND MICROCONTROLLERS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

To impart knowledge on the following Topics

- Architecture of µP8085 & µC 8051
- Addressing modes & instruction set of 8085 & 8051.
- Need & use of Interrupt structure 8085 & 8051.
- Simple applications development with programming 8085 & 8051

UNIT I 8085 PROCESSOR 9

Hardware Architecture, pinouts – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts.

UNIT II PROGRAMMING OF 8085 PROCESSOR 9

Instruction -format and addressing modes – Assembly language format – Data transfer, data manipulation& control instructions – Programming: Loop structure with counting & Indexing – Look up tability - Subroutine instructions - stack.

UNIT III 8051 MICRO CONTROLLER 9

Hardware Architecture, pinouts – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts- Data Transfer, Manipulation, Control Algorithms& I/O instructions, Comparison to Programming concepts with 8085.

UNIT IV PERIPHERAL INTERFACING 9

Study on need, Architecture, configuration and interfacing, with ICs: 8255, 8259, 8254, 8279, - A/D and D/A converters &Interfacing with 8085& 8051.

UNIT V MICRO CONTROLLER PROGRAMMING & APPLICATIONS 9

Simple programming exercises- key board and display interface –Control of servo motor- stepper motor control- Application to automation systems.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to acquire knowledge in Addressing modes & instruction set of 8085 & 8051.
- Ability to need & use of Interrupt structure 8085 & 8051.
- Ability to understand the importance of Interfacing
- Ability to explain the architecture of Microprocessor and Microcontroller.
- Ability to write the assembly language programme.
- Ability to develop the Microprocessor and Microcontroller based applications.

TEXT BOOKS:

1. Sunil Mathur &Jeebananda Panda, "Microprocessor and Microcontrollers", PHI Learning Pvt. Ltd, 2016.
2. R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', with 8085, Wiley Eastern Ltd., New Delhi, 2013.
3. Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely 'The 8051 Micro Controller and Embedded Systems', PHI Pearson Education, 5th Indian reprint, 2003.

REFERENCES

1. Krishna Kant, "Microprocessor and Microcontrollers", Eastern Company Edition, Prentice Hall of India, New Delhi, 2007.
2. B.RAM," Computer Fundamentals Architecture and Organization" New age International Private Limited, Fifth edition, 2017.
3. Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051,McGraw Hill Edu,2013.
4. Ajay V.Deshmukh, 'Microcontroller Theory &Applications', McGraw Hill Edu,2016
5. Douglas V.Hall, 'Microprocessor and Interfacing', McGraw Hill Edu,2016.

21153C53	POWER ELECTRONICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Different types of power semiconductor devices and their switching
- Operation, characteristics and performance parameters of controlled rectifiers
- Operation, switching techniques and basics topologies of DC-DC switching regulators.
- Different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
- Operation of AC voltage controller and various configurations.

UNIT I POWER SEMI-CONDUCTOR DEVICES 9

Study of switching devices, SCR, TRIAC, GTO, BJT, MOSFET, IGBT and IGCT- Static characteristics: SCR, MOSFET and IGBT - Triggering and commutation circuit for SCR- Introduction to Driver and snubber circuits.

UNIT II PHASE-CONTROLLED CONVERTERS 9

2-pulse, 3-pulse and 6-pulseconverters– performance parameters –Effect of source inductance–– Firing Schemes for converter–Dual converters, Applications-light dimmer, Excitation system, Solar PV systems.

UNIT III DC TO DC CONVERTERS 9

Step-down and step-up chopper-control strategy– Introduction to types of choppers-A, B, C, D and E -Switched mode regulators- Buck, Boost, Buck- Boost regulator, Introduction to Resonant Converters, Applications-Battery operated vehicles.

UNIT IV INVERTERS 9

Single phase and three phase voltage source inverters (both120^0 mode and 180^0 mode)–Voltage& harmonic control--PWM techniques: Multiple PWM, Sinusoidal PWM, modified sinusoidal PWM – Introduction to space vector modulation –Current source inverter, Applications-Induction heating, UPS.

UNIT V AC TO AC CONVERTERS 9

Single phase and Three phase AC voltage controllers–Control strategy- Power Factor Control – Multistage sequence control -single phase and three phase cyclo converters – Introduction to Matrix converters, Applications –welding .

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to analyse AC-AC and DC-DC and DC-AC converters.
- Ability to choose the converters for real time applications.

TEXT BOOKS:

1. M.H. Rashid, 'Power Electronics: Circuits, Devices and Applications', Pearson Education, Third Edition, New Delhi, 2004.
2. P.S.Bimbra "Power Electronics" Khanna Publishers, third Edition, 2003.
3. Ashfaq Ahmed 'Power Electronics for Technology', Pearson Education, Indian reprint, 2003.

REFERENCES

1. Joseph Vithayathil,' Power Electronics, Principles and Applications', McGraw Hill Series, 6th Reprint, 2013.
2. Philip T. Krein, "Elements of Power Electronics" Oxford University Press, 2004 Edition.
3. L. Umanand, "Power Electronics Essentials and Applications", Wiley, 2010.
4. Ned Mohan Tore. M. Undel and, William. P. Robbins, 'Power Electronics: Converters, Applications and Design', John Wiley and sons, third edition, 2003.
5. S.Rama Reddy, 'Fundamentals of Power Electronics', Narosa Publications, 2014.
6. M.D. Singh and K.B. Khanchandani, "Power Electronics," Mc Graw Hill India, 2013.
7. JP Agarwal," Power Electronic Systems: Theory and Design" 1e, Pearson Education, 2002.

21153C55	**DIGITAL SIGNAL PROCESSING**	**L**	**T**	**P**	**C**
		2	**2**	**0**	**3**

OBJECTIVES: To impart knowledge about the following topics:

- Signals and systems & their mathematical representation.
- Discrete time systems.
- Transformation techniques & their computation.
- Filters and their design for digital implementation.
- Programmability digital signal processor & quantization effects.

UNIT I INTRODUCTION 6+6

Classification of systems: Continuous, discrete, linear, causal, stability, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect.

UNIT II DISCRETE TIME SYSTEM ANALYSIS 6+6

Z-transform and its properties, inverse z-transforms; difference equation – Solution by z-transform, application to discrete systems - Stability analysis, frequency response – Convolution – Discrete Time Fourier transform , magnitude and phase representation.

UNIT III DISCRETE FOURIER TRANSFORM & COMPUTATION 6+6

Discrete Fourier Transform- properties, magnitude and phase representation - Computation of DFT using FFT algorithm – DIT &DIF using radix 2 FFT – Butterfly structure.

UNIT IV DESIGN OF DIGITAL FILTERS 6+6

FIR & IIR filter realization – Parallel & cascade forms. FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics. Analog filter design – Butterworth and Chebyshev approximations; IIR Filters, digital design using impulse invariant and bilinear transformation Warping, pre warping.

UNIT V DIGITAL SIGNAL PROCESSORS 6+6

Introduction – Architecture – Features – Addressing Formats – Functional modes - Introduction to Commercial DS Processors.

TOTAL : 60 PERIODS

OUTCOMES:

1. Ability to understand the importance of Fourier transform, digital filters and DS Processors.
2. Ability to acquire knowledge on Signals and systems & their mathematical representation.
3. Ability to understand and analyze the discrete time systems.
4. Ability to analyze the transformation techniques & their computation.
5. Ability to understand the types of filters and their design for digital implementation.
6. Ability to acquire knowledge on programmability digital signal processor & quantization effects.

TEXT BOOKS:

1. J.G. Proakis and D.G. Manolakis, 'Digital Signal Processing Principles, Algorithms and Applications', Pearson Education, New Delhi, PHI. 2003.

2. S.K. Mitra, 'Digital Signal Processing – A Computer Based Approach', McGraw Hill Edu, 2013.

3. Lonnie C.Ludeman ,"Fundamentals of Digital Signal Processing",Wiley,2013

REFERENCES

1. Poorna Chandra S, Sasikala. B ,Digital Signal Processing, Vijay Nicole/TMH,2013.

2. Robert Schilling & Sandra L.Harris, Introduction to Digital Signal Processing using Matlab", Cengage Learning,2014.

3. B.P.Lathi, 'Principles of Signal Processing and Linear Systems', Oxford University Press, 2010 3. Taan S. ElAli, 'Discrete Systems and Digital Signal Processing with Mat Lab', CRC Press, 2009.

4. SenM.kuo, woonseng…s.gan, "Digital Signal Processors, Architecture, Implementations & Applications, Pearson,2013

5. DimitrisG.Manolakis, Vinay K. Ingle, applied Digital Signal Processing,Cambridge,2012

21153C56	**OBJECT ORIENTED PROGRAMMING**	**L T P C**
		3 0 0 3

OBJECTIVES:

- To understand Object Oriented Programming concepts and basic characteristics of Java
- To know the principles of packages, inheritance and interfaces
- To define exceptions and use I/O streams
- To develop a java application with threads and generics classes
- To design and build simple Graphical User Interfaces

UNIT I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 10

Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism- OOP in Java – Characteristics of Java – The Java Environment - Java Source File -Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers - static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays , Packages - JavaDoc comments.

UNIT II INHERITANCE AND INTERFACES 9

Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces - Object cloning -inner classes, Array Lists - Strings

UNIT III EXCEPTION HANDLING AND I/O 9

Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files

UNIT IV MULTITHREADING AND GENERIC PROGRAMMING 8

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations.

UNIT V EVENT DRIVEN PROGRAMMING 9

Graphics programming - Frame – Components - working with 2D shapes - Using color, fonts, and images - Basics of event handling - event handlers - adapter classes - actions - mouse events - AWT event hierarchy - Introduction to Swing – layout management - Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows –Menus – Dialog Boxes.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of the course, students will be able to:

- Develop Java programs using OOP principles
- Develop Java programs with the concepts inheritance and interfaces
- Build Java applications using exceptions and I/O streams
- Develop Java applications with threads and generics classes
- Develop interactive Java programs using swings

TEXT BOOKS

1. Herbert Schildt, “Java The complete reference”, 8th Edition, McGraw Hill Education, 2011.
2. Cay S. Horstmann, Gary cornell, “Core Java Volume –I Fundamentals”, 9th Edition, Prentice Hall, 2013.

REFERENCES

1. Paul Deitel, Harvey Deitel, “Java SE 8 for programmers”, 3rd Edition, Pearson, 2015.
2. Steven Holzner, “Java 2 Black book”, Dreamtech press, 2011.
3. Timothy Budd, “Understanding Object-oriented programming with Java”, Updated Edition, Pearson Education, 2000.

21153L57	CONTROL AND INSTRUMENTATION LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES:

- To provide knowledge on analysis and design of control system along with basics of instrumentation.

LIST OF EXPERIMENTS

CONTROLSYSTEMS:

1. P, PI and PID controllers
2. Stability Analysis
3. Modeling of Systems – Machines, Sensors and Transducers
4. Design of Lag, Lead and Lag-Lead Compensators
5. Position Control Systems
6. Synchro-Transmitter- Receiver and Characteristics
7. Simulation of Control Systems by Mathematical development tools.

INSTRUMENTATION:

8. Bridge Networks –AC and DC Bridges
9. Dynamics of Sensors/Transducers

   (a) Temperature (b) pressure (c) Displacement (d) Optical (e) Strain (f) Flow

10 Power and Energy Measurement

11 Signal Conditioning

   (a) Instrumentation Amplifier

   (b) Analog – Digital and Digital –Analog converters (ADC and DACs)

12 Process Simulation

TOTAL: 60 PERIODS

OUTCOMES:

- Ability to understand control theory and apply them to electrical engineering problems.
- Ability to analyze the various types of converters.
- Ability to design compensators
- Ability to understand the basic concepts of bridge networks.
- Ability to the basics of signal conditioning circuits.
- Ability to study the simulation packages.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CONTROLSYSTEMS:

1. PID controller simulation and learner kit – 1 No.
2. Digital storage Oscilloscope for capturing transience- 1 No

   2 Personal Computer with control system

   simulation packages - 10 Nos

3. DC motor –Generator test set-up for evaluation of motor parameters
4. CRO 30MHz – 1 No.
5. 2MHz Function Generator – 1No.
6. Position Control Systems Kit (with manual) – 1 No., Tacho Generator Coupling set
7. AC Synchro transmitter& receiver – 1No.
8. Sufficient number of Digital multi meters, speed and torque sensors

INSTRUMENTATION:

9. R, L, C Bridge kit (with manual)
10. a) Electric heater – 1No.
    Thermometer – 1No.Thermistor (silicon type) RTD nickel type – 1No.

    b) 30 psi Pressure chamber (complete set) – 1No. Current generator (0 – 20mA) Air foot pump – 1 No. (with necessary connecting tubes)

    c) LVDT20mm core length movability type – 1No. CRO 30MHz – 1No. d)

    Optical sensor – 1 No. Light source

    e) Strain Gauge Kit with Handy lever beam – 1No.

100gm weights – 10 nos
f) Flow measurement Trainer kit – 1 No.
(1/2 HP Motor, Water tank, Digital Milliammeter, complete set)

11. Single phase Auto transformer – 1No. Watt-hour meter (energy meter) – 1No. Ammeter Voltmeter Rheostat Stop watch
Connecting wires (3/20)
12. IC Transistor kit – 1No.
13. Instrumentation Amplifier kit-1 No
14. Analog – Digital and Digital –Analog converters (ADC and DACs)- 1 No

21153L58	**OBJECT ORIENTED PROGRAMMING LABORATORY**	**LT P C** **0 0 3 2**

COURSE OBJECTIVES

- To build software development skills using java programming for real-world applications.
- To understand and apply the concepts of classes, packages, interfaces, arraylist, exception handling and file processing.
- To develop applications using generic programming and event handling.

List of experiments

1. Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection(i.e domestic or commercial). Compute the bill amount using the following tariff. If the type of the EB connection is domestic, calculate the amount to be paid as follows:
   - First 100 units - Rs. 1 per unit
   - 101-200 units - Rs. 2.50 per unit
   - 201 -500 units - Rs. 4 per unit
   - > 501 units - Rs. 6 per unit

   If the type of the EB connection is commercial, calculate the amount to be paid as follows:
   - First 100 units - Rs. 2 per unit
   - 101-200 units - Rs. 4.50 per unit
   - 201 -500 units - Rs. 6 per unit
   - > 501 units - Rs. 7 per unit
2. Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa) , time converter (hours to minutes, seconds and vice versa) using packages.
3. Develop a java application with Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
4. Design a Java interface for ADT Stack. Implement this interface using array. Provide necessary exception handling in both the implementations.
5. Write a program to perform string operations using ArrayList. Write functions for the following

   a. Append - add at end
   b. Insert – add at particular index c.
   Search
   d. List all string starts with given letter

6. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.
7. Write a Java program to implement user defined exception handling.
8. Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes.
9. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
10. Write a java program to find the maximum value from the given type of elements using a generic function.
11. Design a calculator using event-driven programming paradigm of Java with the following options.

    a) Decimal manipulations b)
    Scientific manipulations
12. Develop a mini project for any application using Java concepts.

COURSE OUTCOMES **TOTAL : 60 PERIODS**

Upon completion of the course, the students will be able to
- Develop and implement Java programs for simple applications that make use of classes, packages and interfaces.
- Develop and implement Java programs with arraylist, exception handling and multithreading .
- Design applications using file processing, generic programming and event handling.

21153L59 PROFESSIONAL COMMUNICATION **L T P C**
0 0 2 1

OBJECTIVES: The course aims to:

- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employability Graduates
- Develop their confidence and help them attend interviews successfully.

UNIT I

Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs

UNIT II

Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations

UNIT III

Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic -– questioning and clarifying –GD strategies- activities to improve GD skills

UNIT IV

Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews

UNIT V

Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long- term career plan-making career changes.

TOTAL : 30 PERIODS

OUTCOMES: At the end of the course Learners will be ability to:

- Make effective presentations
- Participate confidently in Group Discussions.
- Attend job interviews and be successful in them.
- Develop adequate Soft Skills required for the workplace

Recommended Software

1. **Globearena**
2. **Win English**

REFERENCES:

1. Butterfield, Jeff **Soft Skills for Everyone.** Cengage Learning: New Delhi, 2015
2. **Interact** English Lab Manual for Undergraduate Students,. OrientBalckSwan: Hyderabad, 2016.
3. E. Suresh Kumar et al. **Communication for Professional Success.** Orient Blackswan: Hyderabad, 2015
4. Raman, Meenakshi and Sangeeta Sharma. **Professional Communication**. Oxford University Press: Oxford, 2014
5. S. Hariharanetal. **Soft Skills**. MJP Publishers: Chennai, 2010.

SOLID STATE DRIVES

21153C61

L	T	P	C
3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Steady state operation and transient dynamics of a motor load system.
- Analyze the operation of the converter/chopper fed dc drive, both qualitatively and quantitatively.
- Operation and performance of AC motor drives.
- Analyze and design the current and speed controllers for a closed loop solid state DC motor drive.

UNIT I DRIVE CHARACTERISTICS 9

Electric drive – Equations governing motor load dynamics – steady state stability – multi quadrant Dynamics: acceleration, deceleration, starting & stopping – typical load torque characteristics – Selection of motor.

UNIT II CONVERTER / CHOPPER FED DC MOTOR DRIVE 9

Steady state analysis of the single and three phase converter fed separately excited DC motor drive– continuous conduction – Time ratio and current limit control – 4 quadrant operation of converter / chopper fed drive- Applications.

UNIT III INDUCTION MOTOR DRIVES 9

Stator voltage control–V/f control– Rotor Resistance control-qualitative treatment of slip power recovery drives-closed loop control–– vector control- Applications.

UNIT IV SYNCHRONOUS MOTOR DRIVES 9

V/f control and self-control of synchronous motor: Margin angle control and power factor control- Three phase voltage/current source fed synchronous motor- Applications.

UNIT V DESIGN OF CONTROLLERS FOR DRIVES 9

Transfer function for DC motor / load and converter – closed loop control with Current and speed feedback–armature voltage control and field weakening mode – Design of controllers; current controller and speed controller- converter selection and characteristics.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and suggest a converter for solid state drive.
- Ability to select suitability drive for the given application.
- Ability to study about the steady state operation and transient dynamics of a motor load system.
- Ability to analyze the operation of the converter/chopper fed dc drive.
- Ability to analyze the operation and performance of AC motor drives.
- Ability to analyze and design the current and speed controllers for a closed loop solid state DC motor drive.

TEXT BOOKS:

1. Gopal K.Dubey, Fundamentals of Electrical Drives, Narosa Publishing House, 1992.
2. Bimal K.Bose. Modern Power Electronics and AC Drives, Pearson Education, 2002.
3. R.Krishnan, Electric Motor & Drives: Modeling, Analysis and Control, Pearson, 2001.

REFERENCES

1. Vedam Subramanyam, " Electric Drives Concepts and Applications ", 2e, McGraw Hill, 2016

2. Shaahin Felizadeh, "Electric Machines and Drives", CRC Press (Taylor and Francis Group), 2013.
3. John Hindmarsh and Alasdain Renfrew, "Electrical Machines and Drives System," Elsevier 2012.
4. Theodore Wildi, " Electrical Machines ,Drives and power systems ,6th edition, Pearson Education ,2015
5. N.K. De., P.K. SEN" Electric drives" PHI, 2012.

21153C62 **PROTECTION AND SWITCHGEAR**

L	T	P	C
3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Causes of abnormal operating conditions (faults, lightning and switching surges) of the apparatus and system.
- Characteristics and functions of relays and protection schemes.
- Apparatus protection, static and numerical relays
- Functioning of circuit breaker

UNIT I PROTECTION SCHEMES 9

Principles and need for protective schemes – nature and causes of faults – types of faults – Methods of Grounding - Zones of protection and essential qualities of protection – Protection scheme

UNIT II ELECTROMAGNETIC RELAYS 9

Operating principles of relays - the Universal relay – Torque equation – R-X diagram – Electromagnetic Relays – Over current, Directional, Distance, Differential, Negative sequence and Under frequency relays.

UNIT III APPARATUS PROTECTION 9

Current transformers and Potential transformers and their applications in protection schemes - Protection of transformer, generator, motor, bus bars and transmission line.

UNIT IV STATIC RELAYS AND NUMERICAL PROTECTION 9

Static relays – Phase, Amplitude Comparators – Synthesis of various relays using Static comparators – Block diagram of Numerical relays – Over current protection, transformer differential protection, distant protection of transmission lines.

UNIT V CIRCUIT BREAKERS 9

Physics of arcing phenomenon and arc interruption - DC and AC circuit breaking – re-striking voltage and recovery voltage - rate of rise of recovery voltage - resistance switching - current chopping - interruption of capacitive current - Types of circuit breakers – air blast, air break, oil, SF6, MCBs, MCCBs and vacuum circuit breakers – comparison of different circuit breakers – Rating and selection of Circuit breakers.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze Electromagnetic and Static Relays.
- Ability to suggest suitability circuit breaker.
- Ability to find the causes of abnormal operating conditions of the apparatus and system.

- Ability to analyze the characteristics and functions of relays and protection schemes.
- Ability to study about the apparatus protection, static and numerical relays.
- Ability to acquire knowledge on functioning of circuit breaker.

TEXT BOOKS:

1. Sunil S.Rao, 'Switchgear and Protection', Khanna Publishers, New Delhi, 2008.
2. B.Rabindranath and N.Chander, 'Power System Protection and Switchgear', New Age International (P) Ltd., First Edition 2011.
3. Arun Ingole, 'Switch Gear and Protection' Pearson Education, 2017.

REFERENCES

1. BadriRam ,B.H. Vishwakarma, 'Power System Protection and Switchgear', New Age InternationalPvt Ltd Publishers, Second Edition 2011.
2. Y.G.Paithankar and S.R.Bhide, 'Fundamentals of power system protection', Second Edition,Prentice Hall of India Pvt. Ltd., New Delhi, 2010.
3. C.L.Wadhwa, 'Electrical Power Systems', 6th Edition, New Age International (P) Ltd., 2010
4. RavindraP.Singh, 'Switchgear and Power System Protection', PHI Learning Private Ltd., NewDelhi, 2009.
5. VK Metha," Principles of Power Systems" S. Chand, 2005.
6. Bhavesh Bhalja, R.P. Maheshwari, Nilesh G. Chotani,'Protection and Switchgear' Oxford University Press, 2011.

21153C63	EMBEDDED SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES
:

To impart knowledge on the following Topics

- Building Blocks of Embedded System
- Various Embedded Development Strategies
- Bus Communication in processors, Input/output interfacing.
- Various processor scheduling algorithms.
- Basics of Real time operating system and example tutorials to discuss on one real time operating system tool.

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS 9

Introduction to Embedded Systems –Structural units in Embedded processor , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging.

UNIT II EMBEDDED NETWORKING 9

Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols RS232 standard – RS422 – RS 485 - CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I^2C) –need for device drivers.

UNIT III EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT 9

Embedded Product Development Life Cycle- objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model.

UNIT IV RTOS BASED EMBEDDED SYSTEM DESIGN 9

Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication shared memory, message passing-, Inter process Communication– synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance.

UNIT V EMBEDDED SYSTEM APPLICATION AND DEVELOPMENT 9

Case Study of Washing Machine- Automotive Application- Smart card System Application-ATM machine –Digital camera

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze Embedded systems.
- Ability to suggest an embedded system for a given application.
- Ability to operate various Embedded Development Strategies
- Ability to study about the bus Communication in processors.
- Ability to acquire knowledge on various processor scheduling algorithms.
- Ability to understand basics of Real time operating system.

TEXT BOOKS:

1. Peckol, "Embedded system Design", John Wiley & Sons,2010
2. Lyla B Das," Embedded Systems-An Integrated Approach", Pearson, 2013
3. Shibu. K.V, "Introduction to Embedded Systems", 2e, Mc graw Hill, 2017.

REFERENCES

1. Raj Kamal, 'Embedded System-Architecture, Programming, Design', Mc Graw Hill, 2013.
2. C.R.Sarma, "Embedded Systems Engineering", University Press (India) Pvt. Ltd, 2013.
3. Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2006.
4. Han-Way Huang, "Embedded system Design Using C8051", Cengage Learning, 2009.
5. Rajib Mall "Real-Time systems Theory and Practice" Pearson Education, 2007.

		L	T	P	C
21153L66	**POWER ELECTRONICS AND DRIVES LABORATORY**	**0**	**0**	**3**	**2**

OBJECTIVES:

- To provide hands on experience with power electronic converters and testing.

LIST OF EXPERIMENTS

1 Gate Pulse Generation using R, RC and UJT.
2 Characteristics of SCR and TRIAC
3 Characteristics of MOSFET and IGBT
4 AC to DC half controlled converter
5 AC to DC fully controlled Converter
6 Step down and step up MOSFET based choppers
7 IGBT based single phase PWM inverter

8 IGBT based three phase PWM inverter
9 AC Voltage controller
10 Switched mode power converter.
11 Simulation of PE circuits (1Φ & 3Φ semi converters, 1Φ & 3Φ full converters, DC-DC converters, AC voltage controllers).
12 Characteristics of GTO & IGCT.
13 Characteristics of PMBLDC motor

TOTAL: 60 PERIODS

OUTCOMES:

- Ability to practice and understand converter and inverter circuits and apply software for engineering problems.
- Ability to experiment about switching characteristics various switches.
- Ability to analyze about AC to DC converter circuits.
- Ability to analyze about DC to AC circuits.
- Ability to acquire knowledge on AC to AC converters
- Ability to acquire knowledge on simulation software.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Device characteristics(for SCR, MOSFET, TRIAC,GTO,IGCT and IGBT kit with built-in / discrete power supply and meters) - 2 each
2. SinglephaseSCRbasedhalfcontrolledconverterandfullycontrolledconverteralong with built-in/separate/firing circuit/module and meter – 2 each
3. MOSFET based step up and step down choppers (Built in/ Discrete) – 1 each
4. IGBT based single phase PWM inverter module/Discrete Component – 2
5. IGBT based three phase PWM inverter module/Discrete Component – 2
6. Switched mode power converter module/Discrete Component – 2
7. SCR &TRIAC based 1 phase AC controller along with lamp or rheostat load - 2
8. Cyclo converter kit with firing module – 1
9. Dual regulated DC power supply with common ground
10. Cathode ray Oscilloscope –10
11. Isolation Transformer – 5
12. Single phase Auto transformer –3
13. Components (Inductance, Capacitance) 3 set for each
14. Multimeter – 5
15. LCR meter – 3
16. Rheostats of various ranges – 2 sets of 10 value
17. Work tabilitys – 10
18. DC and AC meters of required ranges – 20
19. Component data sheets to be provided

21153L67 **MICROPROCESSORS AND MICROCONTROLLERS LABORATORY**

L	T	P	C
0	0	3	2

OBJECTIVES:

- To provide training on programming of microprocessors and microcontrollers and understand the interface requirements.
- To simulate various microprocessors and microcontrollers using KEIL or Equivalent simulator.

LIST OF EXPERIMENTS

1 Simple arithmetic operations: addition / subtraction / multiplication / division.

2 Programming with control instructions:

(i) Ascending / Descending order, Maximum / Minimum of numbers. (ii) Programs using Rotate instructions.

(iii) Hex / ASCII / BCD code conversions.

3 Interface Experiments: with 8085

(i) A/D Interfacing. & D/A Interfacing.

4 Traffic light controller.

5 I/O Port / Serial communication

6 Programming Practices with Simulators/Emulators/open source

7 Read a key ,interface display

8 Demonstration of basic instructions with 8051 Micro controller execution, including: (i) Conditional jumps & looping

(ii) Calling subroutines.

9 Programming I/O Port and timer of 8051 (i) study on interface with A/D & D/A

(ii) Study on interface with DC & AC motors

10 Application hardware development using embedded processors.

TOTAL: 60 PERIODS

OUTCOMES:

- Ability to understand and apply computing platform and software for engineering problems.
- Ability to programming logics for code conversion.
- Ability to acquire knowledge on A/D and D/A.
- Ability to understand basics of serial communication.
- Ability to understand and impart knowledge in DC and AC motor interfacing.
- Ability to understand basics of software simulators.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Sl.No.	**Description of Equipment**	**Quantity required**
1.	8085 Microprocessor Trainer with Power Supply	15
2.	8051 Micro Controller Trainer Kit with power supply	15
3.	8255 Interface boards	5
4.	8251 Interface boards	5

5.	8259 Interface boards	5
6.	8279 Keyboard / Display Interface boards	5
7.	8254 timer/ counters	5
8.	ADC and DAC cards	5
9.	AC & DC motor with Controller s	5
10.	Traffic Light Control Systems	5

21153MP68 **MINI PROJECT** **LT P C**
0 0 4 2

OBJECTIVES:

- To develop their own innovative prototype of ideas.
- To train the students in preparing mini project reports and examination.

The students in a group of 5 to 6 works on a topic approved by the head of the department and prepares a comprehensive mini project report after completing the work to the satisfaction. The progress of the project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department. A mini project report is required at the end of the semester. The mini project work is evaluated based on oral presentation and the mini project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 60 PERIODS

OUTCOMES:

- On Completion of the mini project work students will be in a position to take up their final year project work and find solution by formulating proper methodology.

21153C71	HIGH VOLTAGE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Various types of over voltages in power system and protection methods.
- Generation of over voltages in laboratories.
- Measurement of over voltages.
- Nature of Breakdown mechanism in solid, liquid and gaseous dielectrics.
- Testing of power apparatus and insulation coordination

UNIT I OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS 9

Causes of over voltages and its effects on power system – Lightning, switching surges and temporary over voltages, Corona and its effects – Bewley lattice diagram- Protection against over voltages.

UNIT II DIELECTRIC BREAKDOWN 9

Properties of Dielectric materials - Gaseous breakdown in uniform and non-uniform fields – Corona discharges – Vacuum breakdown – Conduction and breakdown in pure and commercial liquids, Maintenance of oil Quality – Breakdown mechanisms in solid and composite dielectrics- Applications of insulating materials in electrical equipments.

UNIT III GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS 9

Generation of High DC voltage: Rectifiers, voltage multipliers, vandigraff generator: generation of high impulse voltage: single and multistage Marx circuits – generation of high AC voltages: cascaded transformers, resonant transformer and tesla coil- generation of switching surges – generation of impulse currents - Triggering and control of impulse generators.

UNIT IV MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS 9

High Resistance with series ammeter – Dividers, Resistance, Capacitance and Mixed dividers - Peak Voltmeter, Generating Voltmeters - Capacitance Voltage Transformers, Electrostatic Voltmeters – Sphere Gaps - High current shunts- Digital techniques in high voltage measurement.

UNIT V HIGH VOLTAGE TESTING & INSULATION COORDINATION 9

High voltage testing of electrical power apparatus as per International and Indian standards – Power frequency, impulse voltage and DC testing of Insulators, circuit breakers, bushing, isolators and transformers- Insulation Coordination& testing of cabilitys.

OUTCOMES: **TOTAL : 45 PERIODS**

- Ability to understand Transients in power system.
- Ability to understand Generation and measurement of high voltage.
- Ability to understand High voltage testing.
- Ability to understand various types of over voltages in power system.
- Ability to measure over voltages.
- Ability to test power apparatus and insulation coordination

TEXT BOOKS:

1. S.Naidu and V. Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, Fifth Edition, 2013.

2. E. Kuffel and W.S. Zaengl, J.Kuffel, 'High voltage Engineering fundamentals', Newnes Second Edition Elsevier , New Delhi, 2005.

3. C.L. Wadhwa, 'High voltage Engineering', New Age International Publishers, Third Edition, 2010.

REFERENCES

1. L.L. Alston, 'High Voltage Technology', Oxford University Press, First Indian Edition, 2011.

2. Mazen Abdel – Salam, Hussein Anis, Ahdab A-Morshedy, Roshday Radwan, High Voltage Engineering – Theory &Practice, Second Edition Marcel Dekker, Inc., 2010.

3. Subir Ray,' An Introduction to High Voltage Engineering' PHI Learning Private Limited, New Delhi, Second Edition, 2013.

21153C72	**POWER SYSTEM OPERATION AND CONTROL**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

To impart knowledge on the following topics

- Significance of power system operation and control.
- Real power-frequency interaction and design of power-frequency controller.
- Reactive power-voltage interaction and the control actions to be implemented for maintaining the voltage profile against varying system load.
- Economic operation of power system.
- SCADA and its application for real time operation and control of power systems

UNIT I PRELIMINARIES ON POWER SYSTEM OPERATION AND CONTROL 9

Power scenario in Indian grid – National and Regional load dispatching centers – requirements of good power system - necessity of voltage and frequency regulation - real power vs frequency and reactive power vs voltage control loops - system load variation, load curves and basic concepts of load dispatching - load forecasting - Basics of speed governing mechanisms and modeling - speed load characteristics - regulation of two generators in parallel.

UNIT II REAL POWER - FREQUENCY CONTROL 9

Load Frequency Control (LFC) of single area system-static and dynamic analysis of uncontrolled and controlled cases - LFC of two area system - tie line modeling - block diagram representation of two area system - static and dynamic analysis - tie line with frequency bias control – state variability model - integration of economic dispatch control with LFC.

UNIT III REACTIVE POWER – VOLTAGE CONTROL 9

Generation and absorption of reactive power - basics of reactive power control – Automatic Voltage Regulator (AVR) – brushless AC excitation system – block diagram representation of AVR loop - static and dynamic analysis – stability compensation – voltage drop in transmission line - methods of reactive power injection - tap changing transformer, SVC (TCR + TSC) and STATCOM for voltage control.

UNIT IV ECONOMIC OPERATION OF POWER SYSTEM 9

Statement of economic dispatch problem - input and output characteristics of thermal plant - incremental cost curve - optimal operation of thermal units without and with transmission losses (no derivation of transmission loss coefficients) - base point and participation factors method - statement of unit commitment (UC) problem - constraints on UC problem - solution of UC problem using priority list – special aspects of short term and long term hydrothermal problems.

UNIT V COMPUTER CONTROL OF POWER SYSTEMS 9

Need of computer control of power systems-concept of energy control centers and functions – PMU - system monitoring, data acquisition and controls - System hardware configurations - SCADA and EMS functions - state estimation problem – measurements and errors - weighted least square estimation - various operating states - state transition diagram.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand the day-to-day operation of electric power system.
- Ability to analyze the control actions to be implemented on the system to meet the minute- to-minute variation of system demand.
- Ability to understand the significance of power system operation and control.
- Ability to acquire knowledge on real power-frequency interaction.
- Ability to understand the reactive power-voltage interaction.
- Ability to design SCADA and its application for real time operation

TEXT BOOKS:

1. Olle.I.Elgerd, 'Electric Energy Systems theory - An introduction', McGraw Hill Education Pvt. Ltd., New Delhi, 34th reprint, 2010.

2. Allen. J. Wood and Bruce F. Wollen berg, 'Power Generation, Operation and Control', John Wiley & Sons, Inc., 2016.

3. Abhijit Chakrabarti and Sunita Halder, 'Power System Analysis Operation and Control', PHI learning Pvt. Ltd., New Delhi, Third Edition, 2010.

REFERENCES

1. Kothari D.P. and Nagrath I.J., 'Power System Engineering', Tata McGraw-Hill Education, Second Edition, 2008.

2. Hadi Saadat, 'Power System Analysis', McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.

3. Kundur P., 'Power System Stability and Control, McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.

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21153C73 **RENEWABLE ENERGY SYSTEMS**

L	T	P	C
3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Awareness about renewable Energy Sources and technologies.
- Adequate inputs on a variety of issues in harnessing renewable Energy.
- Recognize current and possible future role of renewable energy sources.

UNIT I RENEWABLE ENERGY (RE) SOURCES 9

Environmental consequences of fossil fuel use, Importance of renewable sources of energy, Sustainable Design and development, Types of RE sources, Limitations of RE sources, Present Indian and international energy scenario of conventional and RE sources.

UNIT II WIND ENERGY 9

Power in the Wind – Types of Wind Power Plants(WPPs)–Components of WPPs-Working of WPPs-Siting of WPPs-Grid integration issues of WPPs.

UNIT III SOLAR PV AND THERMAL SYSTEMS 9

Solar Radiation, Radiation Measurement, Solar Thermal Power Plant, Central Receiver Power Plants, Solar Ponds.- Thermal Energy storage system with PCM- Solar Photovoltaic systems : Basic Principle of SPV conversion – Types of PV Systems- Types of Solar Cells, Photovoltaic cell concepts: Cell, module, array ,PV Module I-V Characteristics, Efficiency & Quality of the Cell, series and parallel connections, maximum power point tracking, Applications.

UNIT IV BIOMASS ENERGY 9

Introduction-Bio mass resources –Energy from Bio mass: conversion processes-Biomass Cogeneration-Environmental Benefits. Geothermal Energy: Basics, Direct Use, Geothermal Electricity. Mini/micro hydro power: Classification of hydropower schemes, Classification of water turbine, Turbine theory, Essential components of hydroelectric system.

UNIT V OTHER ENERGY SOURCES 9

Tidal Energy: Energy from the tides, Barrage and Non Barrage Tidal power systems. Wave Energy: Energy from waves, wave power devices. Ocean Thermal Energy Conversion (OTEC)- Hydrogen Production and Storage- Fuel cell : Principle of working- various types - construction and applications. Energy Storage System- Hybrid Energy Systems.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to create awareness about renewable Energy Sources and technologies.
- Ability to get adequate inputs on a variety of issues in harnessing renewable Energy.
- Ability to recognize current and possible future role of renewable energy sources.
- Ability to explain the various renewable energy resources and technologies and their applications.
- Ability to understand basics about biomass energy.
- Ability to acquire knowledge about solar energy.

TEXT BOOKS:

1. Joshua Earnest, Tore Wizeliu, 'Wind Power Plants and Project Development', PHI Learning Pvt.Ltd, New Delhi, 2011.

2. D.P.Kothari, K.C Singal, Rakesh Ranjan "Renewable Energy Sources and Emerging Technologies", PHI Learning Pvt.Ltd, New Delhi, 2013.

3. Scott Grinnell, "Renewable Energy & Sustainable Design", CENGAGE Learning, USA, 2016.

REFERENCES

1. A.K.Mukerjee and Nivedita Thakur," Photovoltaic Systems: Analysis and Design", PHI Learning Private Limited, New Delhi, 2011

2. Richard A. Dunlap," Sustainable Energy" Cengage Learning India Private Limited, Delhi, 2015.

3. Chetan Singh Solanki, " Solar Photovoltaics : Fundamentals, Technologies and Applications", PHI Learning Private Limited, New Delhi, 2011

4. Bradley A. Striebig,Adebayo A.Ogundipe and Maria Papadakis," Engineering Applications in Sustainable Design and Development", Cengage Learning India Private Limited, Delhi, 2016.

5. Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.

6. Shobh Nath Singh, 'Non-conventional Energy resources' Pearson Education ,2015.

21153L77	**POWER SYSTEM SIMULATION LABORATORY**	**L**	**T**	**P**	**C**
			0 0	**3**	**2**

OBJECTIVES:

- To provide better understanding of power system analysis through digital simulation.

LIST OF EXPERIMENTS

1 Computation of Transmission Line Parameters
2 Formation of Bus Admittance and Impedance Matrices and Solution of Networks
3 Power Flow Analysis using Gauss-Seidel Method
4 Power Flow Analysis using Newton Raphson Method
5 Symmetric and unsymmetrical fault analysis
6 Transient stability analysis of SMIB System
7 Economic Dispatch in Power Systems
8 Load – Frequency Dynamics of Single- Area and Two-Area Power Systems
9 State estimation: Weighted least square estimation
10 Electromagnetic Transients in Power Systems : Transmission Line Energization

OUTCOMES: **TOTAL: 60 PERIODS**

- Ability to understand power system planning and operational studies.
- Ability to acquire knowledge on Formation of Bus Admittance and Impedance Matrices and Solution of Networks.
- Ability to analyze the power flow using GS and NR method
- Ability to find Symmetric and Unsymmetrical fault
- Ability to understand the economic dispatch.
- Ability to analyze the electromagnetic transients.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Personal computers (Intel i3, 80GB, 2GBRAM) – 30 nos
2. Printer laser- 1 No.
3. Dot matrix- 1 No.
4. Server (Intel i5, 80GB, 2GBRAM) (High Speed Processor) – 1 No.
5. Software: any power system simulation software with 5 user license
6. Compliers: C, C++, VB, VC++ - 30 users

RENEWABLE ENERGY SYSTEMS LABORATORY	L	T	P	C
	0	0	3	2

OBJECTIVES:

- To train the students in Renewable Energy Sources and technologies.
- To provide adequate inputs on a variety of issues in harnessing Renewable Energy.
- To recognize current and possible future role of Renewable energy sources.

LIST OF EXPERIMENTS

1 Simulation study on Solar PV Energy System.

2 Experiment on "VI-Characteristics and Efficiency of 1kWp Solar PV System".

3 Experiment on "Shadowing effect & diode based solution in 1kWp Solar PV System".

4 Experiment on Performance assessment of Grid connected and Standalone 1kWp Solar Power System.

5 Simulation study on Wind Energy Generator.

6 Experiment on Performance assessment of micro Wind Energy Generator.

7 Simulation study on Hybrid (Solar-Wind) Power System.

8 Experiment on Performance Assessment of Hybrid (Solar-Wind) Power System.

9 Simulation study on Hydel Power.

10 Experiment on Performance Assessment of 100W Fuel Cell.

11 Simulation study on Intelligent Controllers for Hybrid Systems.

OUTCOMES:

- Ability to understand and analyze Renewable energy systems.

TOTAL: 60 PERIODS

- Ability to train the students in Renewable Energy Sources and technologies.
- Ability to provide adequate inputs on a variety of issues in harnessing Renewable Energy.
- Ability to simulate the various Renewable energy sources.
- Ability to recognize current and possible future role of Renewable energy sources.
- Ability to understand basics of Intelligent Controllers.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S.No	Name of the equipments / Components	Quantity Required	Remarks
1.	Personal computers (Intel i3, 80GB, 2GBRAM)	15	-
2.	CRO	9	30MHz
3.	Digital Multimeter	10	Digital
4.	PV panels - 100W, 24V	1	
5.	Battery storage system with charge and discharge control 40Ah	1	
6.	PV Emulator	1	
7.	Micro Wind Energy Generator module	1	

Consumabilitys (Minimum of 5 Nos. each)			
8.	Potentiometer	5	-
9.	Step-down transformer	5	230V/12-0-12V
10	Component data sheets to be provided		

21153P83PW	**PROJECT WORK**	**L T P C** **0 0 20 10**

OBJECTIVES:

To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

OUTCOMES: **TOTAL: 300 PERIODS**

On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

21153CEC -COMPS **0 0 2 2**

Electric Circuits and Fields:

Network graph, KCL, KVL, node and mesh analysis, transient response of dc and ac networks; sinusoidal steady-state analysis, resonance, basic filter concepts; ideal current and voltage sources, Thevenin's, Norton's and Superposition and Maximum Power Transfer theorems, two-port networks, three phase circuits; Gauss Theorem, electric field and potential due to point, line, plane and spherical charge distributions; Ampere's and Biot-Savart's laws; inductance; dielectrics; capacitance.

Signals and Systems:

Representation of continuous and discrete-time signals; shifting and scaling operations; linear, time-invariant and causal systems; Fourier series representation of continuous periodic signals; sampling theorem; Fourier, Laplace and Z transforms.

Electrical Machines:

Single phase transformer – equivalent circuit, phasor diagram, tests, regulation and efficiency; three phase transformers – connections, parallel operation; auto-transformer; energy conversion principles; DC machines – types, windings, generator characteristics, armature reaction and commutation, starting and speed control of motors; three phase induction motors – principles, types, performance characteristics, starting and speed control; single phase induction motors; synchronous machines – performance, regulation and parallel operation of generators, motor starting, characteristics and applications; servo and stepper motors.

Power Systems:

Basic power generation concepts; transmission line models and performance; cable performance, insulation; corona and radio interference; distribution systems; per-unit quantities; bus impedance and admittance matrices; load flow; voltage control; power factor correction; economic operation; symmetrical components; fault analysis; principles of over-current, differential and distance protection; solid state relays and digital protection; circuit breakers; system stability concepts, swing curves and equal area criterion; HVDC transmission and FACTS concepts.

Control Systems:

Principles of feedback; transfer function; block diagrams; steady-state errors; Routh and Niquist techniques; Bode plots; root loci; lag, lead and lead-lag compensation; state space model; state transition matrix, controllability and observability.

Electrical and Electronic Measurements:

Bridges and potentiometers; PMMC, moving iron, dynamometer and induction type instruments; measurement of voltage, current, power, energy and power factor; instrument transformers; digital voltmeters and multimeters; phase, time and frequency measurement; Q-meters; oscilloscopes; potentiometric recorders; error analysis.

Analog and Digital Electronics:

Characteristics of diodes, BJT, FET; amplifiers – biasing, equivalent circuit and frequency response; oscillators and feedback amplifiers; operational amplifiers – characteristics and applications; simple active filters; VCOs and timers; combinational and sequential logic circuits; multiplexer; Schmitt trigger; multi-vibrators; sample and hold circuits; A/D and D/A converters; 8-bit microprocessor basics, architecture, programming and interfacing.

Power Electronics and Drives:

Semiconductor power diodes, transistors, thyristors, triacs, GTOs, MOSFETs and IGBTs – static characteristics and principles of operation; triggering circuits; phase control rectifiers; bridge converters – fully controlled and half controlled; principles of choppers and inverters; basis concepts of adjustable speed dc and ac drives.

21153E64A **ADVANCED CONTROL SYSTEM** **LT P C**
2 2 0 3

OBJECTIVES

i. To provide knowledge on design state feedback control and state observer.
ii. To provide knowledge in phase plane analysis.
iii. To give basic knowledge in describing function analysis.
iv. To study the design of optimal controller.
v. To study the design of optimal estimator including Kalman Filter

UNIT I STATE VARIABLE ANALYSIS 6+6

Introduction- concepts of state variables and state model-State model for linear continuous time systems, Diagonalisation- solution of state equations- Concepts of controllability and observability.

UNIT II STATE VARIABLE DESIGN 6+6

Introduction to state model: Effect of state feedback - Pole placement design: Necessary and sufficient condition for arbitrary pole placement, State regulator design Design of state observers- Separation principle- Design of servo systems: State feedback with integral control.

UNIT III SAMPLED DATA ANALYSIS 6+6

Introduction spectrum analysis of sampling process signal reconstruction difference equations The Z transform function, the inverse Z transform function, response of Linear discrete system, the Z transform analysis of sampled data control systems, response between sampling instants, the Z and S domain relationship. Stability analysis and compensation techniques.

UNIT IV NON LINEAR SYSTEMS 6+6

Introduction, common physical nonlinearites, The phase plane method: concepts, singular points, stability of non linear systems, construction of phase trajectories system analysis by phase plane method. The describing function method, stability analysis by describing function method, Jump resonance.

UNIT V OPTIMAL CONTROL 6+6

Introduction: Classical control and optimization, formulation of optimal control problem, Typical optimal control performance measures - Optimal state regulator design: Lyapunov equation, Matrix Riccati equation - LQR steady state optimal control – Application examples.

OUTCOMES: **TOTAL: 60 PERIODS**

i. Able to design state feedback controller and state observer.
ii. Able to understand and analyse linear and nonlinear systems using phase plane method.
iii. Able to understand and analyse nonlinear systems using describing function method.
iv. Able to understand and design optimal controller.
v. Able to understand optimal estimator including Kalman Filter.
vi. Ability to apply advanced control strategies to practical engineering problems.

TEXT BOOKS:

1. M.Gopal, “Digital Control and State Variable Methods”, 4th edition, Mc Graw Hill India, 2012
2. K. Ogata, ‘Modern Control Engineering’, 5th Edition, Pearson, 2012.
3. K. P. Mohandas, “Modern Control Engineering”, Sanguine Technical Publishers, 2006.

REFERENCES:

1. M.Gopal, Modern Control System Theory, 3rd edition, New Age International Publishers, 2014.
2. William S Levine, “Control System Fundamentals,” The Control Handbook, CRC Press, Tayler and Francies Group, 2011.
3. Ashish Tewari, ‘Modern Control Design with Matlab and Simulink’, John Wiley, New Delhi, 2002.
4. T. Glad and L. Ljung,, “Control Theory –Multivariable and Non-Linear Methods”, Taylor & Francis, 2002.

21153E64B **VISUAL LANGUAGES AND APPLICATIONS**

L	T	P	C
3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- To study about the concepts of windows programming models, MFC applications, drawing with the GDI, getting inputs from Mouse and the Keyboard.
- To study the concepts of Menu basics, menu magic and classic controls of the windows programming using VC++.
- To study the concept of Document/View Architecture with single & multiple document interface, toolbars, status bars and File I/O Serialization.
- To study about the integrated development programming event driven programming, variabilitys, constants, procedures and basic ActiveX controls in visual basic.
- To understand the database and the database management system, visual data manager, data bound controls and ADO controls in VB.

UNIT I FUNDAMENTALS OF WINDOWS AND MFC 9

Messages - Windows programming - SDK style - Hungarian notation and windows data types - SDK programming in perspective. The benefits of C++ and MFC - MFC design philosophy – Document / View architecture - MFC class hierarchy - AFX functions. Application object - Frame window object - Message map. Drawing the lines – Curves – Ellipse – Polygons and other shapes. GDI pens – Brushes - GDI fonts - Deleting GDI objects and deselecting GDI objects. Getting input from the mouse: Client & Non-client - Area mouse messages - Mouse wheel - Cursor. Getting input from the keyboard: Input focus - Keystroke messages - Virtual key codes - Character & dead key messages.

UNIT II RESOURCES AND CONTROLS 9

Creating a menu – Loading and displaying a menu – Responding to menu commands – Command ranges - Updating the items in menu, update ranges – Keyboard accelerators. Creating menus programmatically - Modifying menus programmatically - The system menu - Owner draw menus – Cascading menus - Context menus. The C button class – C list box class – C static class - The font view application – C edit class – C combo box class – C scrollbar class. Model dialog boxes – Modeless dialog boxes.

UNIT III DOCUMENT / VIEW ARCHITECTURE 9

The in existence function revisited – Document object – View object – Frame window object – Dynamic object creation. SDI document template - Command routing. Synchronizing multiple views of a document – Mid squares application – Supporting multiple document types – Alternatives to MDI. Splitter Windows: Dynamic splitter window – Static splitter windows. Creating & initializing a toolbar - Controlling the toolbar's visibility – Creating & initializing a status bar - Creating custom status bar panes – Status bar support in appwizard. Opening, closing and creating the files - Reading & Writing – C file derivatives – Serialization basics - Writing serializability classes.

UNIT IV FUNDAMENTALS OF VISUAL BASIC 9

Menu bar – Tool bar – Project explorer – Toolbox – Properties window – Form designer – Form layout – Intermediate window. Designing the user interface: Aligning the controls – Running the application – Visual development and event driven programming.

Variabilitys: Declaration – Types – Converting variability types – User defined data types - Lifetime of a variability. Constants - Arrays – Types of arrays. Procedures: Subroutines – Functions – Calling procedures. Text box controls – List box & Combo box controls – Scroll bar and slider controls – File controls.

UNIT V DATABASE PROGRAMMING WITH VB 9

Record sets – Data control – Data control properties, methods. Visual data manager: Specifying indices with the visual data manager – Entering data with the visual data manager. Data bound list control – Data bound combo box – Data bound grid control. Mapping databases: Database object – Tability def object, Query def object. Programming the active database objects – ADO object model – Establishing a connection - Executing SQL statements – Cursor types and locking mechanism – Manipulating the record set object – Simple record editing and updating.

OUTCOMES:

- Ability to understand and apply computing platform and software for engineering problems
- Ability to study about the concepts of windows programming models.
- Ability to study the concepts of Menu basics, menu magic and classic controls.
- Ability to study the concept of Document/View Architecture with single & multiple document interface.
- Ability to study about the integrated development programming event driven programming.
- Ability to understand the database and the database management system.

TEXT BOOKS:

1. Jeff Prosise, 'Programming Windows With MFC', Second Edition, WP Publishers & Distributors (P) Ltd, Reprinted, 2002.
2. Evangelos Petroutsos, 'Mastering Visual Basic 6.0', BPB Publications, 2002.

REFERENCES

1. Herbert Schildt, 'MFC Programming From the Ground Up', Second Edition, McGraw Hill, reprinted, 2002.
2. John Paul Muller, 'Visual C++ 6 From the Ground Up Second Edition', McGraw Hill, Reprinted, 2002.
3. Curtis Smith & Micheal Amundsen, 'Teach Yourself Database Programming with Visual Basic 6 in 21 days', Techmedia Pub, 1999.

21153E64C	DESIGN OF ELECTRICAL APPARATUS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Magnetic circuit parameters and thermal rating of various types of electrical machines.
- Armature and field systems for D.C. machines.
- Core, yoke, windings and cooling systems of transformers.
- Design of stator and rotor of induction machines and synchronous machines.
- The importance of computer aided design method.

UNIT I DESIGN OF FIELD SYSTEM AND ARMATURE 9

Major considerations in Electrical Machine Design – Materials for Electrical apparatus – Design of Magnetic circuits – Magnetising current – Flux leakage – Leakage in Armature. Design of lap winding and wave winding.

UNIT II DESIGN OF TRANSFORMERS 9

Construction - KVA output for single and three phase transformers – Overall dimensions – design of yoke, core and winding for core and shell type transformers – Estimation of No load current – Temperature rise in Transformers – Design of Tank and cooling tubes of Transformers. Computer program: Complete Design of single phase core transformer

UNIT III DESIGN OF DC MACHINES 9

Construction - Output Equations – Main Dimensions – Choice of specific loadings – Selection of number of poles – Design of Armature – Design of commutator and brushes – design of field Computer program: Design of Armature main dimensions

UNIT IV DESIGN OF INDUCTION MOTORS 9

Construction - Output equation of Induction motor – Main dimensions – choice of specific loadings – Design of squirrel cage rotor and wound rotor –Magnetic leakage calculations – Operating characteristics : Magnetizing current - Short circuit current – Circle diagram - Computer program: Design of slip-ring rotor

UNIT V DESIGN OF SYNCHRONOUS MACHINES 9

Output equations – choice of specific loadings – Design of salient pole machines – Short circuit ratio – Armature design – Estimation of air gap length – Design of rotor –Design of damper winding – Determination of full load field MMF – Design of field winding – Design of turbo alternators -Computer program: Design of Stator main dimensions-Brushless DC Machines

OUTCOMES: **TOTAL : 45 PERIODS**

- Ability to understand basics of design considerations for rotating and static electrical machines
- Ability to design of field system for its application.
- Ability to design sing and three phase transformer.
- Ability to design armature and field of DC machines.
- Ability to design stator and rotor of induction motor.

TEXT BOOKS:

1. Sawhney, A.K., ‘A Course in Electrical Machine Design’, Dhanpat Rai& Sons, New Delhi, Fifth Edition, 1984.

2. M V Deshpande ‘Design and Testing of Electrical Machines’ PHI learning Pvt Lt, 2011.

3. Sen, S.K., ‘Principles of Electrical Machine Designs with Computer Programmes’, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, Second Edition, 2009.

REFERENCES

1. A.Shanmugasundaram, G.Gangadharan, R.Palani ‘Electrical Machine Design Data Book’, New Age International Pvt. Ltd., Reprint 2007.

2. ‘Electrical Machine Design’, Balbir Singh, Vikas Publishing House Private Limited, 1981.

3. V Rajini, V.S Nagarajan, ‘Electrical Machine Design’, Pearson, 2017.

4. K.M.Vishnumurthy ‘Computer aided design of electrical machines’ B S Publications,2008

21153E64D	POWER SYSTEM STABILITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamental concepts of stability of power systems and its classification.
- To expose the students to dynamic behaviour of the power system for small and large disturbances.
- To understand and enhance the stability of power systems.

UNIT I INTRODUCTION TO STABILITY 9

Fundamental concepts - Stability and energy of a system - Power System Stability: Definition, Causes, Nature and Effects of disturbances, Classification of stability, Modelling of electrical components - Basic assumptions made in stability studies- Modelling of Synchronous machine for stability studies(classical model) - Rotor dynamics and the swing equation.

UNIT II SMALL-SIGNAL STABILITY 9

Basic concepts and definitions – State space representation, Physical Interpretation of small–signal stability, Eigen properties of the state matrix: Eigenvalues and eigenvectors, modal matrices, eigenvalue and stability, mode shape and participation factor. Small– signal stability analysis of a Single-Machine Infinite Bus (SMIB) Configuration with numerical example.

UNIT III TRANSIENT STABILITY 9

Review of numerical integration methods: modified Euler and Fourth Order Runge-Kutta methods, Numerical stability,. Interfacing of Synchronous machine (classical machine) model to the transient stability algorithm (TSA) with partitioned – explicit approaches- Application of TSA to SMIB system.

UNIT IV VOLTAGE STABILITY 9

Factors affecting voltage stability- Classification of Voltage stability-Transmission system characteristics- Generator characteristics- Load characteristics- Characteristics of reactive power compensating Devices- Voltage collapse.

UNIT V ENHANCEMENT OF SMALL-SIGNAL STABILITY AND TRANSIENT STABILITY 9

Power System Stabilizer –. Principle behind transient stability enhancement methods: high-speed fault clearing, regulated shunt compensation, dynamic braking, reactor switching, independent pole-operation of circuit-breakers, single-pole switching, fast- valving, high-speed excitation systems.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will attain knowledge about the stability of power system
- Learners will have knowledge on small-signal stability, transient stability and voltage stability.
- Learners will be able to understand the dynamic behaviour of synchronous generator for different disturbances.
- Learners will be able to understand the various methods to enhance the stability of a power system.

TEXT BOOKS:

1. Power system stability and control ,P. Kundur ; edited by Neal J. Balu, Mark G. Lauby, McGraw-Hill, 1994.
2. R.Ramnujam," Power System Dynamics Analysis and Simulation, PHI Learning Private Limited, New Delhi, 2009
3. T.V. Cutsem and C.Vournas, "Voltage Stability of Electric Power Systems", Kluwer publishers, 1998.

REFERENCES

1 Peter W., Saucer, Pai M.A., "Power System Dynamics and Stability, Pearson Education (Singapore), 9th Edition, 2007.

2 EW. Kimbark., "Power System Stability", John Wiley & Sons Limited, New Jersey, 2013.

3 SB. Crary., "Power System Stability", John Wiley & Sons Limited, New Jersey, 1955.

4 K.N. Shubhanga,"Power System Analysis" Pearson, 2017.

5 Power systems dynamics: Stability and control / K.R. Padiyar, BS Publications, 2008

6 Power system control and Stability P.M. Anderson, A.A. Foud, Iowa State University Press, 1977.

21153E64E	MODERN POWER CONVERTERS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Switched mode power supplies
- Matrix Converter
- Soft switched converters

UNIT I SWITCHED MODE POWER SUPPLIES (SMPS) 9

DC Power supplies and Classification; Switched mode dc power supplies - with and without isolation, single and multiple outputs; Closed loop control and regulation; Design examples on converter and closed loop performance.

UNIT II AC-DC CONVERTERS 9

Switched mode AC-DC converters. synchronous rectification - single and three phase topologies - switching techniques - high input power factor . reduced input current harmonic distortion. improved efficiency. with and without input-output isolation. performance indices design examples

UNIT III DC-AC CONVERTERS 9

Multi-level Inversion - concept, classification of multilevel inverters, Principle of operation, main features and analysis of Diode clamped, Flying capacitor and cascaded multilevel inverters; Modulation schemes.

UNIT IV AC-AC CONVERTERS WITH AND WITHOUT DC LINK 9

Matrix converters. Basic topology of matrix converter; Commutation – current path; Modulation techniques - scalar modulation, indirect modulation; Matrix converter as only AC-DC converter; AC-AC converter with DC link - topologies and operation - with and without resonance link - converter with dc link converter; Performance comparison with matrix converter with DC link converters.

UNIT V SOFT-SWITCHING POWER CONVERTERS 9

Soft switching techniques. ZVS, ZCS, quasi resonance operation; Performance comparison hard switched and soft switched converters.AC-DC converter, DC-DC converter, DC-AC converter.; Resonant DC power supplies .

OUTCOMES: **TOTAL : 45 PERIODS**

- Ability to suggest converters for AC-DC conversion and SMPS

TEXT BOOKS:

1. Power Electronics Handbook, M.H.Rashid, Academic press, New york, 2000.
2. Advanced DC/DC Converters, Fang Lin Luo and Fang Lin Luo, CRC Press, NewYork, 2004.
3. Control in Power Electronics- Selected Problem, Marian P.Kazmierkowski, R.Krishnan and Frede Blaabjerg, Academic Press (Elsevier Science), 2002.

REFERENCES

1. Power Electronic Circuits, Issa Batarseh, John Wiley and Sons, Inc.2004
2. Power Electronics for Modern Wind Turbines, Frede Blaabjerg and Zhe Chen, Morgan & Claypool Publishers series, United States of America, 2006.
3. Krein Philip T, Elements of Power Electronics,Oxford University press, 2008
4. Agarwal ,Power Electronics: Converters, Applications, and Design, 3rd edition, Jai P, Prentice Hall,2000
5. L. Umanand, Power Electronics: Essentials & Applications, John Wiley and Sons, 2009.

21153E64F	**INTELLECTUAL PROPERTY RIGHTS**	**L T P C**
		3 0 0 3

OBJECTIVE:

- To give an idea about IPR, registration and its enforcement.

UNIT I INTRODUCTION 9

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II REGISTRATION OF IPRs 10

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III AGREEMENTS AND LEGISLATIONS 10

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV DIGITAL PRODUCTS AND LAW 9

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT V ENFORCEMENT OF IPRs 7

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL:45 PERIODS

OUTCOME:

- Ability to manage Intellectual Property portfolio to enhance the value of the firm.

TEXT BOOKS

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. S. V. Satakar, "Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002

REFERENCES:

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli,"Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

21153E65A **PRINCIPLES OF ROBOTICS** **L T P C**
3 0 0 3

OBJECTIVES:

- To introduce the functional elements of Robotics
- To impart knowledge on the direct and inverse kinematics
- To introduce the manipulator differential motion and control
- To educate on various path planning techniques
- To introduce the dynamics and control of manipulators

UNIT I BASIC CONCEPTS 9

Brief history-Types of Robot–Technology-Robot classifications and specifications-Design and controlissues- Various manipulators – Sensors - work cell - Programming languages.

UNIT II DIRECT AND INVERSE KINEMATICS 9

Mathematical representation of Robots - Position and orientation – Homogeneous transformation-Various joints- Representation using the Denavit Hattenberg parameters -Degrees of freedom-Direct kinematics-Inverse kinematics- SCARA robots- Solvability – Solution methods-Closed form solution.

UNIT III MANIPULATOR DIFFERENTIAL MOTION AND STATICS 9

Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints–Inverse -Wrist and arm singularity - Static analysis - Force and moment Balance.

UNIT IV PATH PLANNING 9

Definition-Joint space technique-Use of p-degree polynomial-Cubic polynomial-Cartesian space technique - Parametric descriptions - Straight line and circular paths - Position and orientation planning.

UNIT V DYNAMICS AND CONTROL 9

Lagrangian mechanics-2DOF Manipulator-Lagrange Euler formulation-Dynamic model – Manipulator control problem-Linear control schemes-PID control scheme-Force control of robotic manipulator.

TOTAL: 45 PERIOD

OUTCOMES:

- Ability to understand basic concept of robotics.
- To analyze Instrumentation systems and their applications to various
- To know about the differential motion add statics in robotics
- To know about the various path planning techniques.
- To know about the dynamics and control in robotics industrie.

TEXT BOOKS:

1. R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi,4th Reprint, 2005.
2. JohnJ.Craig ,Introduction to Robotics Mechanics and Control, Third edition, Pearson Education, 2009.
3. M.P.Groover, M.Weiss, R.N. Nageland N. G.Odrej, Industrial Robotics, McGraw-Hill Singapore, 1996.

REFERENCES:

1. Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis', Oxford University Press, Sixth impression, 2010.
2. K. K.Appu Kuttan, Robotics, I K International, 2007.
3. Edwin Wise, Applied Robotics, Cengage Learning, 2003.
4. R.D.Klafter,T.A.Chimielewski and M.Negin, Robotic Engineering–An Integrated Approach, Prentice Hall of India, New Delhi, 1994.
5. B.K.Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers,Chennai, 1998.
6. S.Ghoshal, " Embedded Systems & Robotics" – Projects using the 8051 Microcontroller", Cengage Learning, 2009.

21153E65B	**SPECIAL ELECTRICAL MACHINES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

To impart knowledge on the following Topics

- Construction, principle of operation, control and performance of stepping motors.
- Construction, principle of operation, control and performance of switched reluctance motors.
- Construction, principle of operation, control and performance of permanent magnet brushless D.C. motors.
- Construction, principle of operation and performance of permanent magnet synchronous motors.
- Construction, principle of operation and performance of other special Machines.

UNIT I STEPPER MOTORS 9

Constructional features –Principle of operation –Types – Torque predictions – Linear Analysis – Characteristics – Drive circuits – Closed loop control – Concept of lead angle - Applications.

UNIT II SWITCHED RELUCTANCE MOTORS (SRM) 9

Constructional features –Principle of operation- Torque prediction–Characteristics Steady state performance prediction – Analytical Method – Power controllers – Control of SRM drive- Sensor less operation of SRM – Applications.

UNIT III PERMANENT MAGNET BRUSHLESS D.C. MOTORS 9

Fundamentals of Permanent Magnets- Types- Principle of operation- Magnetic circuit analysis- EMF and Torque equations- Power Converter Circuits and their controllers - Characteristics and control- Applications.

UNIT IV PERMANENT MAGNET SYNCHRONOUS MOTORS (PMSM) 9

Constructional features -Principle of operation – EMF and Torque equations - Sine wave motor with practical windings - Phasor diagram - Power controllers – performance characteristics - Digital controllers – Applications.

UNIT V OTHER SPECIAL MACHINES 9

Constructional features – Principle of operation and Characteristics of Hysteresis motor-Synchronous Reluctance Motor–Linear Induction motor-Repulsion motor- Applications.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to analyze and design controllers for special Electrical Machines.
- Ability to acquire the knowledge on construction and operation of stepper motor.
- Ability to acquire the knowledge on construction and operation of stepper switched reluctance motors.
- Ability to construction, principle of operation, switched reluctance motors.
- Ability to acquire the knowledge on construction and operation of permanent magnet brushless D.C. motors.
- Ability to acquire the knowledge on construction and operation of permanent magnet synchronous motors.
- Ability to select a special Machine for a particular application.

TEXT BOOKS:

- K.Venkataratnam, ‘Special Electrical Machines’, Universities Press (India) Private Limited, 2008.
- T. Kenjo, ‘Stepping Motors and Their Microprocessor Controls’, Clarendon Press London, 1984
- E.G. Janardanan, ‘Special electrical machines’, PHI learning Private Limited, Delhi, 2014.

REFERENCES

1. R.Krishnan, ‘Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application’, CRC Press, New York, 2001.
2. T. Kenjo and S. Nagamori, ‘Permanent Magnet and Brushless DC Motors’, Clarendon Press, London, 1988.
3. T.J.E.Miller,‘Brushless Permanent-Magnet and Reluctance Motor Drives’, Oxford University Press, 1989.
4. R.Srinivasan, ‘Special Electrical Machines’, Lakshmi Publications, 2013.

21153E65C	POWER QUALITY	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Causes & Mitigation techniques of various PQ events.
- Various Active & Passive power filters.

UNIT I INTRODUCTION TO POWER QUALITY 9

Terms and definitions & Sources – Overloading, under voltage, over voltage - Concepts of transients - Short duration variations such as interruption - Long duration variation such as sustained interruption - Sags and swells - Voltage sag - Voltage swell - Voltage imbalance – Voltage fluctuations - Power frequency variations - International standards of power quality – Computer Business Equipment Manufacturers Associations (CBEMA) curve

UNIT II VOLTAGE SAG AND SWELL 9

Estimating voltage sag performance - Thevenin’s equivalent source - Analysis and calculation of various faulted condition - Estimation of the sag severity - Mitigation of voltage sag, Static transfer switches and fast transfer switches. - Capacitor switching – Lightning - Ferro resonance - Mitigation of voltage swell.

UNIT III HARMONICS 9

Harmonic sources from commercial and industrial loads - Locating harmonic sources – Power system response characteristics - Harmonics Vs transients. Effect of harmonics – Harmonic distortion - Voltage and current distortions - Harmonic indices - Inter harmonics – Resonance Harmonic distortion evaluation, IEEE and IEC standards.

UNIT IV PASSIVE POWER COMPENSATORS 9

Principle of Operation of Passive Shunt and Series Compensators, Analysis and Design of Passive Shunt Compensators Simulation and Performance of Passive Power Filters- Limitations of Passive Filters Parallel Resonance of Passive Filters with the Supply System and Its Mitigation. Fundamentals of load compensation – voltage regulation & power factor correction.

UNIT V POWER QUALITY MONITORING & CUSTOM POWER DEVICES 9

Monitoring considerations - Monitoring and diagnostic techniques for various power quality problems - Quality measurement equipment - Harmonic / spectrum analyzer - Flicker meters Disturbance analyzer - Applications of expert systems for power quality monitoring. Principle& Working of DSTATCOM – DSTATCOM in Voltage control mode, current control mode, DVR Structure – Rectifier supported DVR – DC Capacitor supported DVR -Unified power quality conditioner.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand various sources, causes and effects of power quality issues, electrical systems and their measures and mitigation.
- Ability to analyze the causes & Mitigation techniques of various PQ events.
- Ability to study about the various Active & Passive power filters.
- Ability to understand the concepts about Voltage and current distortions, harmonics.
- Ability to analyze and design the passive filters.
- Ability to acquire knowledge on compensation techniques.
- Ability to acquire knowledge on DVR.

TEXT BOOKS:

1. Roger. C. Dugan, Mark. F. Mc Granagham, Surya Santoso, H.WayneBeaty, “Electrical Power Systems Quality”, McGraw Hill,2003
2. J. Arrillaga, N.R. Watson, S. Chen, “Power System Quality Assessment”, (New York : Wiley),2000.
3. Bhim Singh, Ambrish Chandra, Kamal Al-Haddad,” Power Quality Problems & Mitigation Techniques” Wiley, 2015.

REFERENCES

1. G.T. Heydt, “Electric Power Quality”, 2nd Edition. (West Lafayette, IN, Stars in a Circle Publications, 1994.
2. M.H.J Bollen, “Understanding Power Quality Problems: Voltage Sags and Interruptions”, (New York: IEEE Press), 2000.

21153E65D **EHVAC TRANSMISSION**

L	T	P	C
3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- EHVAC Transmission lines
- Electrostatic field of AC lines
- Corona in E.H.V. lines

UNIT I INTRODUCTION 9

EHVAC Transmission line trends and preliminary aspect - standard transmission voltages – Estimation at line and ground parameters-Bundle conductors: Properties -Inductance and Capacitance of EHV lines – Positive, negative and zero sequence impedance – Line Parameters for Modes of Propagation.

UNIT II ELECTROSTATIC FIELDS 9

Electrostatic field and voltage gradients – Calculations of electrostatic field of AC lines – Effect of high electrostatic field on biological organisms and human beings - Surface voltage gradients and Maximum gradients of actual transmission lines – Voltage gradients on sub conductor.

UNIT III POWER CONTROL 9

Electrostatic induction in un energized lines – Measurement of field and voltage gradients for three phase single and double circuit lines – Un energized lines. Power Frequency Voltage control and overvoltage in EHV lines: No load voltage – Charging currents at power frequency-Voltage control – Shunt and Series compensation – Static VAR compensation.

UNIT IV CORONA EFFECTS AND RADIO INTERFERENCE 9

Corona in EHV lines – Corona loss formulae-Charge voltage diagram- Attenuation of traveling waves due to Corona – Audio noise due to Corona, its generation, characteristic and limits. Measurements of audio noise radio interference due to Corona - properties of radio noise – Frequency spectrum of RI fields – Measurements of RI and RIV.

UNIT V STEADY STATE AND TRANSIENT LIMITS 9

Design of EHV lines based on steady state and transient limits - EHV cabilitys and their characteristics-Introduction six phase transmission – UHV.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand the principles and types of EHVAC system.
- Ability to analyze the electrostatic field of AC lines
- Ability to study about the compensation.
- Ability to study about the corona in E.H.V. lines
- Ability to understand the EHV cabilitys.
- Ability to analyze the steady state and transient limits.

TEXT BOOKS:

1. Rokosh Das Begamudre, ”Extra High Voltage AC Transmission Engineering”– Wiley Eastern LTD., NEW DELHI 1990.

2. S. Rao, “HVAC and HVDC Transmission, Engineering and Practice” Khanna Publisher, Delhi, 1990.

REFERENCES

1. Subir Ray, “An Introduction to High Voltage Engineering”, Prentice Hall of India Private Limited, 2013.

2. RD Begamudre, “Extra High Voltage AC Transmission Engineering”– New Academic Science Ltd; 4 edition 2011.
3. Edison,” EHV Transmission line”- Electric Institution, GEC, 1968.

21153E65E **COMMUNICATION ENGINEERING** **L T P C**
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To study the various analog and digital modulation techniques
- To study the principles behind information theory and coding
- To study the various digital communication techniques

UNIT I ANALOG MODULATION 9

Amplitude Modulation – AM, DSBSC, SSBSC, VSB – PSD, modulators and demodulators – Angle modulation – PM and FM – PSD, modulators and demodulators – Superheterodyne receivers

UNITII PULSE MODULATION 9

Low pass sampling theorem – Quantization – PAM – Line coding – PCM, DPCM, DM, and ADPCM And ADM, Channel Vocoder - Time Division Multiplexing, Frequency Division Multiplexing

UNIT III DIGITAL MODULATION AND TRANSMISSION 9

Phase shift keying – BPSK, DPSK, QPSK – Principles of M-ary signaling M-ary PSK & QAM – Comparison, ISI – Pulse shaping – Duo binary encoding – Cosine filters – Eye pattern, equalizers

UNIT IV INFORMATION THEORY AND CODING 9

Measure of information – Entropy – Source coding theorem – Shannon–Fano coding, Huffman Coding, LZ Coding – Channel capacity – Shannon-Hartley law – Shannon's limit – Error control codes – Cyclic codes, Syndrome calculation – Convolution Coding, Sequential and Viterbi decoding

UNIT V SPREAD SPECTRUM AND MULTIPLE ACCESS 9

PN sequences – properties – m-sequence – DSSS – Processing gain, Jamming – FHSS – Synchronisation and tracking – Multiple Access – FDMA, TDMA, CDMA,

OUTCOMES:

At the end of the course, the student should be able to:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- Apply analog and digital communication techniques.
- Use data and pulse communication techniques.
- Analyze Source and Error control coding.
-

TEXT BOOKS:

1. H Taub, D L Schilling, G Saha, “Principles of Communication Systems” TMH 2007
2. S. Haykin “Digital Communications” John Wiley 2005

REFERENCES:

1
. B.P.Lathi, “Modern Digital and Analog Communication Systems”, 3rd edition, Oxford University
2. H P Hsu, Schaum Outline Series – “Analog and Digital Communications” TMH 2006
3. B.Sklar, Digital Communications Fundamentals and Applications” 2/e Pearson Education 2007.

21153E75A **DISASTER MANAGEMENT** **LT P C**
3 0 0 3

OBJECTIVES:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA)
– Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:

The students will be ability to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.

- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.

TEXTBOOKS:

1. Singhal J.P. “Disaster Management”, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-**13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerability India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

21153E75B	**HUMAN RIGHTS**	**LT P C** **3 0 0 3**

OBJECTIVES :

- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I **9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II **9**

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III **9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV **9**

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V **9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabilityd persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO’s, Media, Educational Institutions, Social Movements.

TOTAL : 45 PERIODS

OUTCOME :

- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:
1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

21153E75C	OPERATIONS RESEARCH	L T P C
		3 0 0 3

OBJECTIVES:
- To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

UNIT I LINEAR MODELS 15

The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.

UNIT II TRANSPORTATION MODELS AND NETWORK MODELS 8

Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route – Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks – Critical path scheduling – Sequencing models.

UNIT III INVENTORY MODELS 6

Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

UNIT IV QUEUEING MODELS 6

Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

UNIT V DECISION MODELS 10

Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life – Economic life– Single / Multi variability search technique – Dynamic Programming – Simple Problem.

TOTAL: 45 PERIODS

OUTCOMES:
- Upon completion of this course, the students can ability to use the optimization techniques for use engineering and Business problems

TEXT BOOK:
1. Hillier and Libeberman, "Operations Research", Holden Day, 2005
2. Taha H.A., "Operations Research", Sixth Edition, Prentice Hall of India, 2003.

REFERENCES:
1. Bazara M.J., Jarvis and Sherali H., "Linear Programming and Network Flows", John Wiley, 2009.

2. Budnick F.S., “Principles of Operations Research for Management”, Richard D Irwin, 1990.
3. Philip D.T. and Ravindran A., “Operations Research”, John Wiley, 1992.
4. Shennoy G.V. and Srivastava U.K., “Operation Research for Management”, Wiley Eastern, 1994.
5. Tulsian and Pasdey V., “Quantitative Techniques”, Pearson Asia, 2002.

21153E75D **PROBABILITY AND STATISTICS**

L	T	P	C
3	0	0	3

OBJECTIVES :

- This course aims at providing the required skill to apply the statistical tools in engineering problems.
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two dimensional random variables.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.

UNIT I PROBABILITY AND RANDOM VARIABLES 12

Probability – The axioms of probability – Conditional probability – Baye’s theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT II TWO - DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTING OF HYPOTHESIS 12

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT IV DESIGN OF EXPERIMENTS 12

One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design - 2^2 factorial design.

UNIT V STATISTICAL QUALITY CONTROL `12

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL : 60 PERIODS

OUTCOMES :

Upon successful completion of the course, students will be able to:

- Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
- Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

TEXT BOOKS :

1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8^{th} Edition, 2015.

2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4^{th} Edition, 2007.

REFERENCES :

1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8^{th} Edition, 2014.
2. Papoulis, A. and Unnikrishnapillai, S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4^{th} Edition, New Delhi, 2010.
3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3^{rd} Edition, Elsevier, 2004.
4. Spiegel. M.R., Schiller. J. and Srinivasan, R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.
5. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8^{th} Edition, 2007.

21153E75E **FIBRE OPTICS AND LASER INSTRUMENTS** **LT P C**
3 0 0 3

AIM :

To contribute to the knowledge of Fibre optics and Laser Instrumentation and its Industrial andMedical Application.

COURSE OBJECTIVES

- To expose the students to the basic concepts of optical fibres and their properties.
- To provide adequate knowledge about the Industrial applications of optical fibres.
- To expose the students to the Laser fundamentals.
- To provide adequate knowledge about Industrial application of lasers.
- To provide adequate knowledge about holography and Medical applications of Lasers.

UNIT I OPTICAL FIBRES AND THEIR PROPERTIES 9

Construction of optical fiber cable: Guiding mechanism in optical fiber and Basic component of optical fiber communication, –Principles of light propagation through a fibre: Total internal reflection, Acceptance angle (θa), Numerical aperture and Skew mode, –Different types of fibres and their properties: Single and multimode fibers and Step index and graded index fibers,– fibrecharacteristics: Mechanical characteristics and Transmission characteristics, – Absorption losses – Scattering losses – Dispersion – Connectors and splicers –Fibre termination – Optical sources: Light Emitting Diode (LED), – Optical detectors: PIN Diode.

UNIT II INDUSTRIAL APPLICATION OF OPTICAL FIBRES 9

Fibre optic sensors: Types of fiber optics sensor, Intrinsic sensor- Temperature/ Pressure sensor, Extrinsic sensors, Phase Modulated Fibre Optic Sensor and Displacementsensor (Extrinsic Sensor) – Fibre optic instrumentation system: Measurement of attenuation (by cut back method), Optical domain reflectometers, Fiber Scattering loss Measurement, Fiber Absorption Measurement, Fiber dispersion measurements, End reflection method and Near field scanning techniques – Different types of modulators: Electro-optic modulator (EOM) –Interferometric method of measurement of length – Moire fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain.

UNIT III LASER FUNDAMENTALS 9

Fundamental characteristics of lasers – Level Lasers: Two-Level Laser, Three Level Laser, Quasi Three and four level lasers – Properties of laser: Monochromaticity, Coherence, Divergence and Directionality and Brightness –Laser modes – Resonator configuration – Q-switching and mode locking – Cavity damping – Types of lasers; – Gas lasers, solid lasers, liquid lasers and semiconductor lasers.

UNIT IV INDUSTRIAL APPLICATION OF LASERS 9

Laser for measurement of distance, Laser for measurement of length, Laser for measurement of velocity, Laser for measurement of acceleration, Laser for measurement of current, voltage and Laser for measurement of Atmospheric Effect: Types of LIDAR, Construction And Working, and LIDAR Applications – Material processing: Laser instrumentation for material processing, Powder Feeder, Laser Heating, Laser Welding, Laser Melting, Conduction Limited Melting and Key Hole Melting – Laser trimming of material: Process Of Laser Trimming, Types Of Trim, Construction And Working Advantages – Material Removal and vaporization: Process Of Material Removal.

UNIT V HOLOGRAM AND MEDICAL APPLICATIONS 9

Holography: Basic Principle, Holography vs. photography, Principle Of Hologram Recording, Condition For Recording A Hologram, Reconstructing and viewing the holographic image– Holography for non-destructive testing – Holographic components – Medical applications of lasers, laser-Tissue Interactions Photochemical reactions, Thermalisation, collisional relaxation, Types of Interactions and Selecting an Interaction Mechanism – Laser instruments for surgery, removal of tumors of vocal cards, brain surgery, plastic surgery, gynaecology and oncology.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs):

1. Understand the principle, transmission, dispersion and attenuation characteristics of opticalfibers
2. Apply the gained knowledge on optical fibers for its use as communication medium and as sensor as well which have important applications in production, manufacturing industrial and biomedical applications.
3. Understand laser theory and laser generation system.
4. Students will gain ability to apply laser theory for the selection of lasers for a specific Industrial and medical application.

TEXT BOOKS:

1. J.M. Senior, 'Optical Fibre Communication – Principles and Practice', Prentice Hall of India,1985.
2. J. Wilson and J.F.B. Hawkes, 'Introduction to Opto Electronics', Prentice Hall of India, 2001.
3. Eric Udd, William B., and Spillman, Jr., "Fiber Optic Sensors: An Introduction for Engineers and Scientists ", John Wiley & Sons, 2011.

REFERENCES:

1. G. Keiser, 'Optical Fibre Communication', McGraw Hill, 1995.
2. M. Arumugam, 'Optical Fibre Communication and Sensors', Anuradha Agencies, 2002.
3. John F. Ready, "Industrial Applications of Lasers", Academic Press, Digitized in 2008.

4. Monte Ross, ‘Laser Applications’, McGraw Hill, 1968.
5. John and Harry, “Industrial lasers and their application”, McGraw-Hill, 2002.
6. Keiser, G., “Optical Fiber Communication”, McGraw-Hill, 3rd Edition, 2000. http://nptel.ac.in/courses/117101002/

21153E81A	**FLEXIBLE AC TRANSMISSION SYSTEMS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES: To impart knowledge about the following topics:

- The start-of-art of the power system
- Performance of power systems with FACTS controllers.
- FACTS controllers for load flow and dynamic analysis

UNIT I INTRODUCTION 9

Real and reactive power control in electrical power transmission lines–loads & system compensation-Uncompensated transmission line–shunt and series compensation.

UNIT II STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS 9

Voltage control by SVC–Advantages of slope in dynamic characteristics–Influence of SVC on system voltage–Design of SVC voltage regulator–TCR-FC-TCR-Modeling of SVC for power flow and fast transient stability– Applications: Enhancement of transient stability – Steady state power transfer –Enhancement of power system damping.

UNIT III THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) AND APPLICATIONS 9

Operation of the TCSC–Different modes of operation–Modelling of TCSC, Variability reactance model– Modelling for Power Flow and stability studies. Applications: Improvement of the system stability limit–Enhancement of system damping.

UNIT IV VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS 9

Static Synchronous Compensator (STATCOM)–Principle of operation–V-I Characteristics. Applications: Steady state power transfer-enhancement of transient stability-prevention of voltage instability. SSSC-operation of SSSC and the control of power flow–modelling of SSSC in load flow and transient stability studies- Dynamic voltage restorer(DVR).

UNIT V ADVANCED FACTS CONTROLLERS 9

Interline DVR(IDVR) - Unified Power flow controller (UPFC) - Interline power flow controller (IPFC) - Unified Power quality conditioner (UPQC).

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand, analyze and develop analytical model of FACTS controller for power system application.
- Ability to understand the concepts about load compensation techniques.
- Ability to acquire knowledge on facts devices.
- Ability to understand the start-of-art of the power system
- Ability to analyze the performance of steady state and transients of facts controllers.
- Ability to study about advanced FACTS controllers.

TEXT BOOKS:

1. R.Mohan Mathur, Rajiv K.Varma,"Thyristor–Based Facts Controllers for Electrical Transmission Systems", IEEE press andJohnWiley&Sons,Inc,2002.
2. NarainG. Hingorani, "Understanding FACTS-Concepts and Technology of Flexible AC Transmission Systems", Standard Publishers Distributors,Delhi-110006,2011.
3. T.J.E Miller, Power Electronics in power systems, John Wiley and sons.

REFERENCES

1. K.R. Padiyar, "FACTS Controllers in Power Transmission and Distribution", New Age International (P) Limited, Publishers, New Delhi, 2008
2. A.T.John,"FlexibleA.C.TransmissionSystems",InstitutionofElectricalandElectronic Engineers(IEEE), 1999.
3. V.K.Sood, HVDC and FACTS controllers–Applications of Static Converters in Power System, APRIL2004,KluwerAcademic Publishers,2004.

SOFT COMPUTING TECHNIQUES

	L	T	P	C
21153E81B	3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Basics of artificial neural network.
- Concepts of modelling and control of neural and fuzzy control schemes.
- Features of hybrid control schemes.

UNIT I ARTIFICIAL NEURAL NETWORK 9

Review of fundamentals – Biological neuron, artificial neuron, activation function, single layer perceptron – Limitation – Multi layer perceptron – Back Propagation Algorithm (BPA) – Recurrent Neural Network (RNN) – Adaptive Resonance Theory (ART) based network – Radial basis function network – online learning algorithms, BP through time – RTRL algorithms – Reinforcement learning.

UNIT II NEURAL NETWORKS FOR MODELING AND CONTROL 9

Modelling of non-linear systems using ANN – Generation of training data – Optimal architecture– Model validation – Control of non-linear systems using ANN – Direct and indirect neuro control schemes – Adaptive neuro controller – Familiarization with neural network toolbox.

UNIT III FUZZY SET THEORY 9

Fuzzy set theory – Fuzzy sets – Operation on fuzzy sets – Scalar cardinality, fuzzy cardinality, union and intersection, complement (Yager and Sugeno), equilibrium points, aggregation, projection, composition, cylindrical extension, fuzzy relation – Fuzzy membership functions.

UNIT IV FUZZY LOGIC FOR MODELING AND CONTROL 9

Modelling of non-linear systems using fuzzy models – TSK model – Fuzzy logic controller – Fuzzification – Knowledge base – Decision making logic – Defuzzification – Adaptive fuzzy systems – Familiarization with fuzzy logic toolbox.

UNIT V HYBRID CONTROL SCHEMES 9

Fuzzification and rule base using ANN – Neuro fuzzy systems – ANFIS – Fuzzy neuron– GA – Optimization of membership function and rule base using Genetic Algorithm – Introduction to other evolutionary optimization techniques, support vector machine– Case study – Familiarization with ANFIS toolbox.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand the concepts of ANN, different features of fuzzy logic and their modelling, control aspects and different hybrid control schemes.
- Ability to understand the basics of artificial neural network.
- Ability to get knowledge on modelling and control of neural.

- Ability to get knowledge on modelling and control of fuzzy control schemes.
- Ability to acquire knowledge on hybrid control schemes.
- Ability to understand the concepts of Adaptive Resonance Theory

TEXT BOOKS:

1. Laurence Fausett, “Fundamentals of Neural Networks”, Prentice Hall, Englewood Cliffs, N.J., 1992
2. Timothy J. Ross, “Fuzzy Logic with Engineering Applications”, McGraw Hill Inc., 2000.

REFERENCES

1. Goldberg, “Genetic Algorithm in Search, Optimization and Machine learning”, Addison Wesley Publishing Company Inc. 1989
2. Millon W.T., Sutton R.S. and Webrose P.J., “Neural Networks for Control”, MIT press, 1992
3. Ethem Alpaydin, “Introduction to Machine learning (Adaptive Computation and Machine Learning series)’, MIT Press, Second Edition, 2010.
4. Zhang Huaguang and Liu Derong, “Fuzzy Modeling and Fuzzy Control Series: Control Engineering”, 2006

21153E81C	POWER SYSTEMS DYNAMICS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Basics of dynamics and stability problems
- Modeling of synchronous machines
- Excitation system and speed-governing controllers.
- Small signal stability of a single-machine infinite bus system with excitation system and power system stabilizer.
- Transient stability simulation of multi machine power system.

UNIT I INTRODUCTION 9

Basics of system dynamics – numerical techniques – introduction to software packages to study the responses. Concept and importance of power system stability in the operation and design - distinction between transient and dynamic stability - complexity of stability problem in large system – necessity for reduced models - stability of interconnected systems.

UNIT II SYNCHRONOUS MACHINE MODELLING 9

Synchronous machine - flux linkage equations - Park's transformation - per unit conversion - normalizing the equations - equivalent circuit - current space model - flux linkage state space model. Sub-transient and transient inductances - time constants. Simplified models (one axis and constant flux linkage) - steady state equations and phasor diagrams.

UNIT III MACHINE CONTROLLERS 9

Exciter and voltage regulators - function and types of excitation systems - typical excitation system configuration - block diagram and state space representation of IEEE type 1 excitation system - saturation function - stabilizing circuit. Function of speed governing systems - block diagram and state space representation of IEEE mechanical hydraulic governor and electrical hydraulic governors for hydro turbines and steam turbines.

UNIT IV TRANSIENT STABILITY 9

State equation for multi machine system with one axis model and simulation – modelling of multi machine power system with one axis machine model including excitation system and speed governing system and simulation using R-K method of fourth order (Gill's technique) for transient stability analysis - power system stabilizer. For all simulations, the algorithm and flow chart have to be discussed.

UNIT V DYNAMIC STABILITY 9

System response to small disturbances - linear model of the unregulated synchronous machine and its modes of oscillation - regulated synchronous machine - distribution of power impact - linearization of the load equation for the one machine problem – simplified linear model - effect of excitation on dynamic stability - approximate system representation - supplementary stabilizing signals - dynamic performance measure - small signal performance measures.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.
- Ability to get knowledge on the basics of dynamics and stability problems
- Ability to design and modelling of synchronous machines

- Ability to study about excitation system and speed-governing controllers.
- Ability to understand the concept of small signal stability of a single-machine infinite bus system with excitation system.
- Ability to analyze the transient stability simulation.

TEXT BOOKS:

1. P.M. Anderson and A.A.Fouad, 'Power System Control and Stability', Galgotia Publications, New Delhi, 2003.
2. P. Kundur, 'Power System Stability and Control', McGraw Hill Inc., USA, 1994.
3. R.Ramanujam, "Power System Dynamics – Analysis and Simulation", PHI, 2009.

REFERENCES

1. M.A.Pai and W.Sauer, 'Power System Dynamics and Stability', Pearson Education Asia, India, 2002.
2. James A.Momoh, Mohamed. E. EI-Hawary. " Electric Systems, Dynamics and Stability with Artificial Intelligence applications", Marcel Dekker, USA First Edition, 2000.
3. C.A.Gross, "Power System Analysis," Wiley India, 2011.
4. B.M.Weedy, B.J.Lory, N.Jenkins, J.B.Ekanayake and G.Strbac," Electric Power Systems", Wiley India, 2013.
5. K.Umarao, "Computer Techniques and Models in Power System," I.K. International, 2007.

21153E81D	SMPS AND UPS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Modern power electronic converters and its applications in electric power utility.
- Resonant converters and UPS

UNIT I DC-DC CONVERTERS 9

Principles of step down and step up converters – Analysis and state space modeling of Buck, Boost, Buck- Boost and Cuk converters.

UNIT II SWITCHED MODE POWER CONVERTERS 9

Analysis and state space modeling of fly back, Forward, Push pull, Luo, Half bridge and full bridge converters- control circuits and PWM techniques.

UNIT III RESONANT CONVERTERS 9

Introduction- classification- basic concepts- Resonant switch- Load Resonant converters- ZVS , Clamped voltage topologies- DC link inverters with Zero Voltage Switching- Series and parallel Resonant inverters- Voltage control.

UNIT IV DC-AC CONVERTERS 9

Single phase and three phase inverters, control using various (sine PWM, SVPWM and PSPWM) techniques, various harmonic elimination techniques- Multilevel inverters- Concepts - Types: Diode clamped- Flying capacitor- Cascaded types- Applications.

UNIT V POWER CONDITIONERS, UPS & FILTERS 9

Introduction- Power line disturbances- Power conditioners –UPS: offline UPS, Online UPS, Applications – Filters: Voltage filters, Series-parallel resonant filters, filter without series capacitors, filter for PWM VSI, current filter, DC filters – Design of inductor and transformer for PE applications – Selection of capacitors.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to analyze the state space model for DC – DC converters
- Ability to acquire knowledge on switched mode power converters.
- Ability to understand the importance of Resonant Converters.
- Ability to analyze the PWM techniques for DC-AC converters
- Ability to acquire knowledge on modern power electronic converters and its applications in electric power utility.
- Ability to acquire knowledge on filters and UPS

TEXT BOOKS:

1. Simon Ang, Alejandro Oliva,” Power-Switching Converters”, Third Edition, CRC Press, 2010.
2. KjeldThorborg, “Power Electronics – In theory and Practice”, Overseas Press, First Indian Edition 2005.
3. M.H. Rashid – Power Electronics handbook, Elsevier Publication, 2001.

REFERENCES

1. Philip T Krein, “ Elements of Power Electronics”, Oxford University Press
2. Ned Mohan, Tore.M.Undeland, William.P.Robbins, Power Electronics converters,

Applications and design- Third Edition- John Wiley and Sons- 2006
3. M.H. Rashid – Power Electronics circuits, devices and applications- third edition Prentice Hall of India New Delhi, 2007.
4. Erickson, Robert W, "Fundamentals of Power Electronics", Springer, second edition, 2010.

21153E81E	ELECTRIC ENERGY GENERATION, UTILIZATION CONSERVATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- To study the generation, conservation of electrical power and energy efficient equipments.
- To understand the principle, design of illumination systems and energy efficiency lamps.
- To study the methods of industrial heating and welding.
- To understand the electric traction systems and their performance.

UNIT I ILLUMINATION 9

Importance of lighting – properties of good lighting scheme – laws of illumination – photometry - types of lamps – lighting calculations – basic design of illumination schemes for residential, commercial, street lighting, factory lighting and flood lighting – LED lighting and energy efficient lamps.

UNIT II REFRIGERATION AND AIR CONDITIONING 9

Refrigeration-Domestic refrigerator and water coolers - Air-Conditioning-Various types of air-conditioning system and their applications, smart air conditioning units - Energy Efficient motors: Standard motor efficiency, need for efficient motors, Motor life cycle, Direct Savings and payback analysis, efficiency evaluation factor.

UNIT III HEATING AND WELDING 9

Role of electric heating for industrial applications – resistance heating – induction heating – dielectric heating - electric arc furnaces. Brief introduction to electric welding – welding generator, welding transformer and the characteristics.

UNIT IV TRACTION 9

Merits of electric traction – requirements of electric traction system – supply systems – mechanics of train movement – traction motors and control – braking – recent trends in electric traction.

UNIT V DOMESTIC UTILIZATION OF ELECTRICAL ENERGY 9

Domestic utilization of electrical energy – House wiring. Induction based appliances, Online and OFF line UPS, Batteries - Power quality aspects – nonlinear and domestic loads – Earthing – Domestic, Industrial and Substation.

TOTAL : 45 PERIODS

OUTCOMES:

- To understand the main aspects of generation, utilization and conservation.
- To identify an appropriate method of heating for any particular industrial application.
- To evaluate domestic wiring connection and debug any faults occurred.
- To construct an electric connection for any domestic appliance like refrigerator as well as to design a battery charging circuit for a specific household application.

- To realize the appropriate type of electric supply system as well as to evaluate the performance of a traction unit.
- To understand the main aspects of Traction.

TEXT BOOKS:

1. Wadhwa, C.L. "Generation, Distribution and Utilization of Electrical Energy", New Age International Pvt. Ltd, 2003.
2. Dr. Uppal S.L. and Prof. S. Rao, 'Electrical Power Systems', Khanna Publishers, New Delhi, 15th Edition, 2014.
3. Energy Efficiency in Electric Utilities, BEE Guide Book, 2010

REFERENCES

1. Partab.H, "Art and Science of Utilisation of Electrical Energy", Dhanpat Rai and Co, New Delhi, 2004.
2. Openshaw Taylor.E, "Utilization of Electrical Energy in SI Units", Orient Longman Pvt. Ltd, 2003.
3. Gupta.J.B, "Utilization of Electric Power and Electric Traction", S.K.Kataria and Sons, 2002.
4. Cleaner Production – Energy Efficiency Manual for GERIAP, UNEP, Bangkok prepared by National Productivity Council.

21153E81F **PROFESSIONAL ETHICS IN ENGINEERING** **LT P C**
3 0 0 3

OBJECTIVES:

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I HUMAN VALUES 10

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT V GLOBAL ISSUES 8

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of the course, the student should be ability to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

TEXT BOOKS:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd.,New Delhi, 2013.
6. World Community Service Centre, ' Value Education', Vethathiri publications, Erode, 2011.

Web sources:

1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

21153E81G	**PRINCIPLES OF MANAGEMENT**	**LT P C**
		3 0 0 3

OBJECTIVES:

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization.

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

UNIT II PLANNING **9**

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT III ORGANISING **9**

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

UNIT IV DIRECTING **9**

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

UNIT V CONTROLLING **9**

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

OUTCOMES: **TOTAL: 45 PERIODS**

- Upon completion of the course, students will be ability to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

TEXT BOOKS:

1. JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", 6th Edition, Pearson Education, 2004.
2. Stephen P. Robbins & Mary Coulter, "Management", Prentice Hall (India)Pvt. Ltd., 10th Edition, 2009.

REFERENCES:

1. Harold Koontz & Heinz Weihrich, "Essentials of Management", Tata McGraw Hill, 1998.
2. Robert Kreitner & Mamata Mohapatra, "Management", Biztantra, 2008.
3. Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management", 7th Edition, Pearson Education, 2011.
4. Tripathy PC & Reddy PN, "Principles of Management", Tata Mcgraw Hill, 1999

21153E82A	ENERGY MANAGEMENT AND AUDITING	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- To impact concepts behind economic analysis and Load management.
- Energy management on various electrical equipments and metering.
- Concept of lighting systems and cogeneration.

UNIT I INTRODUCTION 9

Basics of Energy – Need for energy management – Energy accounting - Energy monitoring, targeting and reporting - Energy audit process.

UNIT II ENERGY MANAGEMENT FOR MOTORS AND COGENERATION 9

Energy management for electric motors – Transformer and reactors - Capacitors and synchronous machines, energy management by cogeneration – Forms of cogeneration – Feasibility of cogeneration – Electrical interconnection.

UNIT III LIGHTING SYSTEMS 9

Energy management in lighting systems – Task and the working space - Light sources – Ballasts – Lighting controls – Optimizing lighting energy – Power factor and effect of harmonics, lighting and energy standards.

UNIT IV METERING FOR ENERGY MANAGEMENT 9

Metering for energy management – Units of measure - Utility meters – Demand meters – Paralleling of current transformers – Instrument transformer burdens – Multi tasking solid state meters, metering location vs requirements, metering techniques and practical examples.

UNIT V ECONOMIC ANALYSIS AND MODELS 9

Economic analysis – Economic models - Time value of money - Utility rate structures – Cost of electricity – Loss evaluation, load management – Demand control techniques – Utility monitoring and control system – HVAC and energy management – Economic justification.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand the basics of Energy audit process.
- Ability to understand the basics of energy management by cogeneration
- Ability to acquire knowledge on Energy management in lighting systems
- Ability to impact concepts behind economic analysis and Load management.
- Ability to understand the importance of Energy management on various electrical equipment and metering.
- Ability to acquire knowledge on HVAC.

TEXT BOOKS:

1. Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, Guide to Energy Management, Fifth Edition, The Fairmont Press, Inc., 2006
2. Eastop T.D & Croft D.R, Energy Efficiency for Engineers and Technologists,.Logman Scientific & Technical, ISBN-0-582-03184 , 1990.

REFERENCES

1. Reay D.A, Industrial Energy Conservation, 1st edition, Pergamon Press, 1977.
2. IEEE Recommended Practice for Energy Management in Industrial and Commercial Facilities, IEEE, 196.
3. Amit K. Tyagi, Handbook on Energy Audits and Management, TERI, 2003.
4. Electricity in buildings good practice guide, McGraw-Hill Education, 2016.
5. National Productivity Council Guide Books

21153E82B **DATA STRUCTURES** **LT P C**
3 0 0 3

OBJECTIVES:

- To understand the concepts of ADTs
- To Learn linear data structures – lists, stacks, and queues
- To understand sorting, searching and hashing algorithms
- To apply Tree and Graph structures

UNIT I LINEAR DATA STRUCTURES – LIST 9

Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation –– singly linked lists- circularly linked lists- doubly-linked lists – applications of lists –Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).

UNIT II LINEAR DATA STRUCTURES – STACKS, QUEUES 9

Stack ADT – Operations - Applications - Evaluating arithmetic expressions- Conversion of Infix to postfix expression - Queue ADT – Operations - Circular Queue – Priority Queue - deQueue – applications of queues.

UNIT III NON LINEAR DATA STRUCTURES – TREES 9

Tree ADT – tree traversals - Binary Tree ADT – expression trees – applications of trees – binary search tree ADT –Threaded Binary Trees- AVL Trees – B-Tree - B+ Tree - Heap – Applications of heap.

UNIT IV NON LINEAR DATA STRUCTURES - GRAPHS 9

Definition – Representation of Graph – Types of graph - Breadth-first traversal - Depth-first traversal – Topological Sort – Bi-connectivity – Cut vertex – Euler circuits – Applications of graphs.

UNIT V SEARCHING, SORTING AND HASHING TECHNIQUES 9

Searching- Linear Search - Binary Search. Sorting - Bubble sort - Selection sort - Insertion sort - Shell sort – Radix sort. Hashing- Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Implement abstract data types for linear data structures.
- Apply the different linear and non-linear data structures to problem solutions.
- Critically analyze the various sorting algorithms.

TEXT BOOKS:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education,1997.
2. Reema Thareja, "Data Structures Using C", Second Edition , Oxford University Press, 2011

REFERENCES:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", Second Edition, Mcgraw Hill, 2002.
2. Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education,1983.
3. Stephen G. Kochan, "Programming in C", 3rd edition, Pearson Education.
4. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, University Press, 2008

21153E82C	HIGH VOLTAGE DIRECT CURRENT TRANSMISSION	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Planning of DC power transmission and comparison with AC power transmission.
- HVDC converters.
- HVDC system control.
- Harmonics and design of filters.
- Power flow in HVDC system under steady state.

UNIT I INTRODUCTION 9

DC Power transmission technology–Comparison of AC and DC transmission–Application of DC transmission–Description of DC transmission system–Planning for HVDC transmission–Modern trends in HVDC technology–DC breakers–Operating problems– HVDC transmission based on VSC –Types and applications of MTDC systems.

UNIT II ANALYSIS OF HVDC CONVERTERS 9

Line commutated converter -Analysis of Graetz circuit with and without overlap -Pulse number– Choice of converter configuration – Converter bridge characteristics– Analysis of a 12 pulse converters– Analysis of VSC topologies and firing schemes.

UNIT III CONVERTER AND HVDC SYSTEM CONTROL 9

Principles of DC link control–Converter control characteristics–System control hierarchy– Firing angle control– Current and extinction angle control–Starting and stopping of DC link –Power control –Higher level controllers –Control of VSC based HVDC link.

UNIT IV REACTIVE POWER AND HARMONICS CONTROL 9

Reactive power requirements in steady state–Sources of reactive power–SVC and STATCOM– Generation of harmonics –Design of AC and DC filters– Active filters.

UNIT V POWER FLOW ANALYSIS IN AC/DC SYSTEMS 9

Per unit system for DC quantities–DC system model –Inclusion of constraints –Power flow analysis –case study

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand the principles and types of HVDC system.
- Ability to analyze and understand the concepts of HVDC converters.
- Ability to acquire knowledge on DC link control.
- Ability to understand the concepts of reactive power management, harmonics and

power flow analysis.

- Ability to get knowledge about Planning of DC power transmission and comparison with AC power transmission.
- Ability to understand the importance of power flow in HVDC system under steady state.

TEXT BOOKS:

1. Padiyar,K.R.,“HVDC power transmission system”, New Age International(P)Ltd. NewDelhi, Second Edition,2010.
2. Arrillaga,J.,“High Voltage Direct Current Transmission”, Peter Pregrinus, London,1983.

REFERENCES

1. Kundur P.,“ Power System Stability and Control”, McGraw-Hill,1993.
2. Colin Adamson and Hingorani NG,“ High Voltage Direct Current Power Transmission”, Garraway Limited, London, 1960.
3. Edward Wilson Kimbark,“ Direct Current Transmission”, Vol.I, Wiley inter science, New York, London, Sydney,1971.

21153E82D	MICROCONTROLLER BASED SYSTEM DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Architecture of PIC microcontroller
- Interrupts and timers
- Peripheral devices for data communication and transfer
- Functional blocks of ARM processor
- Architecture of ARM processors

UNIT I INTRODUCTION TO PIC MICROCONTROLLER 9

Introduction to PIC Microcontroller–PIC 16C6x and PIC16C7x Architecture–IC16cxx–-Pipelining - Program Memory considerations – Register File Structure - Instruction Set - Addressing modes – Simple Operations.

UNIT II INTERRUPTS AND TIMER 9

PIC micro controller Interrupts- External Interrupts-Interrupt Programming–Loop time subroutine Timers-Timer Programming– Front panel I/O-Soft Keys– State machines and key switches– Display of Constant and Variability strings.

UNIT III PERIPHERALS AND INTERFACING 9

I^2C Bus for Peripherals Chip Access– Bus operation-Bus subroutines– Serial EEPROM–– Analog to Digital Converter–UART-Baud rate selection–Data handling circuit–Initialization - LCD and keyboard Interfacing -ADC, DAC, and Sensor Interfacing.

UNIT IV INTRODUCTION TO ARM PROCESSOR 9

Architecture –ARM programmer’s model –ARM Development tools- Memory Hierarchy – ARM Assembly Language Programming–Simple Examples–Architectural Support for

Operating systems.

UNIT V ARM ORGANIZATION 9

3-Stage Pipeline ARM Organization– 5-Stage Pipeline ARM Organization–ARM Instruction Execution- ARM Implementation– ARM Instruction Set– ARM coprocessor interface– Architectural support for High Level Languages – Embedded ARM Applications.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and apply computing platform and software for engineering problems.
- Ability to understand the concepts of Architecture of PIC microcontroller
- Ability to acquire knowledge on Interrupts and timers.
- Ability to understand the importance of Peripheral devices for data communication.
- Ability to understand the basics of sensor interfacing
- Ability to acquire knowledge in Architecture of ARM processors

TEXT BOOKS:

1. Peatman,J.B., "Design with PIC Micro Controllers"PearsonEducation,3rd Edition, 2004.
2. Furber,S., "ARM System on Chip Architecture" Addison Wesley trade Computer Publication, 2000.

REFERENCES

1. Mazidi, M.A.,"PIC Microcontroller" Rollin Mckinlay, Danny causey ,Prentice Hall of India, 2007.

21153E82E **SMART GRID**

L	T	P	C
3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Smart Grid technologies, different smart meters and advanced metering infrastructure.
- The power quality management issues in Smart Grid.
- The high performance computing for Smart Grid applications

UNIT I INTRODUCTION TO SMART GRID 9

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, National and International Initiatives in Smart Grid.

UNIT II SMART GRID TECHNOLOGIES 9

Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/VAR control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plugin Hybrid Electric Vehicles(PHEV).

UNIT III SMART METERS AND ADVANCED METERING INFRASTRUCTURE 9

IntroductiontoSmartMeters,AdvancedMeteringinfrastructure(AMI)driversandbenefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU), Intelligent Electronic Devices(IED)&their application for monitoring & protection.

UNIT IV POWER QUALITY MANAGEMENT IN SMART GRID 9

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, W eb based Power Quality monitoring, Power Quality Audit.

UNIT V HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS 9

Local Area Network(LAN),House Area Network(HAN), Wide Area Network(WAN), Broad band over Power line(BPL),IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will develop more understanding on the concepts of Smart Grid and its present developments.
- Learners will study about different Smart Grid technologies.
- Learners will acquire knowledge about different smart meters and advanced metering infrastructure.
- Learners will have knowledge on power quality management in Smart Grids
- Learners will develop more understanding on LAN, WAN and Cloud Computing for Smart Grid applications.

TEXT BOOKS:

1. Stuart Borlase “Smart Grid: Infrastructure, Technology and Solutions”,CRCPress2012.
2. JanakaEkanayake,NickJenkins,KithsiriLiyanage,JianzhongWu,AkihikoYokoyama, “Smart Grid: TechnologyandApplications”,Wiley2012.

REFERENCES

- VehbiC. Güngör ,Dilan Sahin, Taskin Kocak, Salih Ergüt, Concettina Buccella, Carlo Cecati, and Gerhard P. Hancke, “Smart Grid Technologies: Communication Technologies and Standards” IEEE Transactions On Industrial Informatics, Vol.7,No.4, November2011.
- Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang “SmartGrid –The New and Improved Power Grid: A Survey” ,IEEE Transaction on Smart Grids,vol.14,2012.
- James Momohe “Smart Grid: Fundamentals of Design and Analysis,”, Wiley-IEEE Press , 2012.

21153E82F BIOMEDICAL INSTRUMENTATION

L T P C
3 0 0 3

OBJECTIVES:

- To Introduce Fundamentals of Biomedical Engineering
- To study the communication mechanics in a biomedical system with few examples
- To study measurement of certain important electrical and non-electrical parameters

- To understand the basic principles in imaging techniques
- To have a basic knowledge in life assisting and therapeutic devices

UNIT I FUNDAMENTALS OF BIOMEDICAL ENGINEERING 9

Cell and its structure – Resting and Action Potential – Nervous system and its fundamentals - Basic components of a biomedical system- Cardiovascular systems- Respiratory systems -Kidney and blood flow - Biomechanics of bone - Biomechanics of soft tissues -Physiological signals and transducers - Transducers – selection criteria – Piezo electric, ultrasonic transducers - Temperature measurements - Fibre optic temperature sensors

UNIT II NON ELECTRICAL PARAMETERS MEASUREMENT AND DIAGNOSTIC PROCEDURES 9

Measurement of blood pressure - Cardiac output - Heart rate - Heart sound - Pulmonary function measurements – spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analysers, pH of blood –measurement of blood pCO2, pO2, finger-tip oxymeter - ESR, GSR measurements.

UNIT III ELECTRICAL PARAMETERS ACQUISITION AND ANALYSIS 9

Electrodes – Limb electrodes –floating electrodes – pregelled disposability electrodes - Micro, needle and surface electrodes – Amplifiers, Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier - ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms - Electrical safety in medical environment, shock hazards – leakage current-Instruments for checking safety parameters of biomedical equipment.

UNIT IV IMAGING MODALITIES AND ANALYSIS 9

Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography –Different types of biotelemetry systems - Retinal Imaging - Imaging application in Biometric systems.

UNIT V LIFE ASSISTING, THERAPEUTIC AND ROBOTIC DEVICES 9

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialysers – Lithotripsy - ICCU patient monitoring system - Nano Robots - Robotic surgery –Orthopedic prostheses fixation.

TOTAL : 45 PERIODS

OUTCOMES: At the end of the course students will have the

- Ability to understand the philosophy of the heart, lung, blood circulation and respiration system.
- Ability to provide latest ideas on devices of non-electrical devices.
- Ability to gain knowledge on various sensing and measurement devices of electrical origin.
- Ability to understand the analysis systems of various organ types.
- Ability to bring out the important and modern methods of imaging techniques and their analysis.
- Ability to explain the medical assistance/techniques, robotic and therapeutic equipments.

TEXT BOOKS:

1. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, 2007.
2. Khandpur R.S, Handbook of Biomedical Instrumentation, Tata McGraw-Hill, New Delhi, 2nd edition, 2003
3. Joseph J Carr and John M.Brown, Introduction to Biomedical Equipment Technology, John

Wiley and sons, New York, 4th edition, 2012

REFERENCES

1. John G. Webster, Medical Instrumentation Application and Design, John Wiley and sons, New York, 1998.
2. Duane Knudson, Fundamentals of Biomechanics, Springer, 2nd Edition, 2007.
3. Suh, Sang, Gurupur, Varadraj P., Tanik, Murat M., Health Care Systems, Technology and Techniques, Springer, 1st Edition, 2011.
4. Ed. Joseph D. Bronzino, The Biomedical Engineering Hand Book, Third Edition, Boca Raton, CRC Press LLC, 2006.
5. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.

21153E82G FUNDAMENTALS OF NANOSCIENCE **L T P C**
3 0 0 3

OBJECTIVES:

To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION 8

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION 9

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS 12

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO_2,MgO, ZrO_2, NiO, nanoalumina, CaO, $AgTiO_2$, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications.

UNIT IV CHARACTERIZATION TECHNIQUES 9

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation.

UNIT V APPLICATIONS 7

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery.

TOTAL : 45 PERIODS

OUTCOMES:

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS :

1. A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, "Nanoscale Charecterisation of surfaces & Interfaces", 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

REFERENCES:

1. G Timp, "Nanotechnology", AIP press/Springer, 1999.
2. Akhlesh Lakhtakia,"The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007.

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SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

PROGRAM HANDBOOK

B.TECH FULLTIME
ELECTRICAL & ELECTRONICS ENGINEERING

[REGULATION 2020]
[for candidates admitted to B.Tech EEE program from June 2020 onwards]

Skill Development Employability Entrepreneurship

COURSE STRUCTURE

B.TECH-EEE
R 2020

Skill Development Employability Entrepreneurship

B.TECH (FT) EEE [REGULATION 2020]

SEMESTER I

S.No	Course Code	Course Name	L	T	P	C
1	20147S11	Communicative English	2	0	0	2
2	20148S12	Engineering Mathematics-I	3	1	0	4
3	20149S13	Engineering Physics	2	1	0	3
4	20149S14	Engineering Chemistry	2	1	0	3
5	20154S15	Engineering Graphics	1	0	4	3
6	20150S16	Problem Solving and Basics of Python programming	3	0	0	3
PRACTICAL						
7	20150L17	Problem Solving and Basics of Python programming Laboratory	0	0	4	2
8	20149L18	Physics and Chemistry Laboratory	0	0	4	2
				TOTAL CREDITS		**22**
AUDIT COURSE						
9	201AGIT	Induction Training Programme				2

SEMESTER II

S.No	Course Code	Course Name	L	T	P	C
1	20147S21	Technical English	2	0	0	2
2	20148S22	Engineering Mathematics –II	3	1	0	4
3	20149S23B	Physics for Electronics Engineering	3	0	0	3
4	20149S24A	Environmental Science and Engineering	3	0	0	3
5	20153S25C	Circuit Theory	2	1	0	3
6	20154S26C	Basic Civil and Mechanical Engineering	4	0	0	4
PRACTICAL						
7	20154L27	Engineering Practices Laboratory	1	0	4	3
8	20153L28C	Electric Circuits Laboratory	0	0	4	2
				TOTAL CREDITS		**24**
AUDIT COURSE						
1	201AGIC	Indian Constitution				2
SOFT SKILL COURSE						
2	201ASBE	Basic Behavioral Etiquette				2

SEMESTER III

S.No	Course Code	Course Name	L	T	P	C
1	20148S31C	Transforms and Partial Differential Equations	3	1	0	4
2	20153S32	Digital Logic Circuits	2	2	0	3
3	20153C33	Electromagnetic Theory	2	2	0	3
4	20153C34	Electrical Machines-I	2	2	0	3
5	20153C35	Electron Devices and Circuits	3	0	0	3
6	20153C36	Power Plant Engineering	3	0	0	3
		PRACTICAL				
7	20153L37	Electronics Laboratory	0	0	4	2
8	20153L38	Electrical Machines Laboratory-I	0	0	4	2
9	201AGGS	Introduction to Gender studies				2
					TOTAL CREDITS	**23**

SEMESTER IV

S.No	Course Code	Course Name	L	T	P	C
1	20148S41C	Numerical Methods	3	1	0	4
2	20153C42	Electrical Machines –II	2	2	0	3
3	20153C43	Transmission and Distribution	3	0	0	3
4	20153C44	Measurements and Instrumentation	3	0	0	3
5	20153C45	Linear Integrated Circuits and Applications	3	0	0	3
6	20153C46	Control Systems	3	2	0	4
		PRACTICAL				
7	20153L47	Electrical Machines Laboratory-II	0	0	4	2
8	20153L48	Linear and Digital Integrated Circuits Laboratory	0	0	4	2
9	20153L49	Technical Seminar	0	0	2	1
10	201AGCE	Community Engagement				2
11	201ASGS	Technical, General Aptitude and Skill set Development				2
					TOTAL CREDITS	**25**

SEMESTER V

S.No	Course Code	Course Name	L	T	P	C
1	20153C51	Power System Analysis	3	0	0	3
2	20153C52	Microprocessors and Microcontrollers	3	0	0	3
3	20153C53	Power Electronics	3	0	0	3
4	201_OE54_	OPEN Elective-I	3	0	0	3
5	20153S55	Digital Signal Processing	2	2	0	3
6	20153S56	Object Oriented Programming	3	0	0	3
PRACTICAL						
7	20153L57	Control and Instrumentation Laboratory	0	0	4	2
8	20153L58	Object Oriented Programming Laboratory	0	0	4	2
9	20153L59	Professional Communication	0	0	2	1
RESEARCH SKILL DEVELOPMENT(RSD)COURSE						
10	201AGIE	Innovation and Entrepreneurship				2
					TOTAL CREDITS	**23**

SEMESTER –VI

S.No	Course Code	Course Name	L	T	P	C
1	20153C61	Solid State Drives	3	0	0	3
2	20153C62	Protection and Switchgear	3	0	0	3
3	20153S63	Embedded Systems	3	0	0	3
4	20153E64_	Elective –I	3	0	0	3
5	20153E65_	Elective –II	3	0	0	3
PRACTICAL						
6	20153L66	Power Electronics and Drives Laboratory	0	0	4	2
7	20153L67	Microprocessors and Microcontrollers Laboratory	0	0	4	2
8	20153MP68	Mini Project	-	-	4	2
RESEARCH SKILL DEVELOPMENT (RSD) COURSE						
9	201ASTT	Technical Training				2
					TOTAL CREDITS	**21**

SEMESTER –VII

S.No	Course Code	Course Name	L	T	P	C
1	20153C71	High Voltage Engineering	3	0	0	3
2	20153C72	Power System Operation and Control	3	0	0	3
3	20153C73	Renewable Energy Systems	3	0	0	3
4	201_OE74_	OPEN Elective –II	3	0	0	3
5	20153E75_	Elective –III	3	0	0	3
6	20153E76_	Elective –IV	3	0	0	3
PRACTICAL						
7	20153L77	Power System Simulation Laboratory	0	0	4	2
8	20153L78	Renewable Energy Systems Laboratory	0	0	4	2
					TOTAL CREDITS	**22**

SEMESTER –VIII

S.No	Course Code	Course Name	L	T	P	C
1	20153E81_	Elective –V	3	0	0	3
2.	20153E82_	Elective –VI	3	0	0	3
PRACTICAL						
3.	20153P83	Project Work	0	0	12	6
4.	201AGPE	Professional Ethics and Human Values				2
5.	201ASIM	Interview Skills Training and Mock Test				2
					TOTAL CREDITS	**12**
TOTAL NO.OF CREDITS=172						

**-Experiential based learning courses (Theory)

##-Highly Significant Laboratory Courses (Practical)

LIST OF ELECTIVES

ELECTIVE –I (VI SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1.	20153E64A	Advanced Control System	3	0	0	3
2.	20153E64B	Visual Languages and Applications	3	0	0	3
3.	20153E64C	Design of Electrical Apparatus	3	0	0	3
4.	20153E64D	Power Systems Stability	3	0	0	3
5.	20153E64E	Modern Power Converters	3	0	0	3
6..	20153E64F	Intellectual Property Rights	3	0	0	3

ELECTIVE–II (VI SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1.	20153E65A	Principles of Robotics	3	0	0	3
2.	20153E65B	Special Electrical Machines	3	0	0	3
3.	20153E65C	Power Quality	3	0	0	3
4.	20153E65D	EHVAC Transmission	3	0	0	3
5.	20153E65E	Communication Engineering	3	0	0	3

ELECTIVE –III (VII SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1	20153E75A	Disaster Management	3	0	0	3
2	20153E75B	Human Rights	3	0	0	3
3	20153E75C	Operations Research	3	0	0	3
4	20153E75D	Probability and Statistics	3	0	0	3
5.	20153E75E	Fiber Optics and Laser Instrumentation	3	0	0	3

ELECTIVE –IV (VII SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1.	20153E76A	System Identification and Adaptive Control	3	0	0	3
2.	20153E76B	Computer Architecture	3	0	0	3
3.	20153E76C	Control of Electrical Drives	3	0	0	3
4.	20153E76D	VLSI Design	3	0	0	3
5.	20153E76E	Power Systems Transients	3	0	0	3
6.	20153E76F	Total Quality Management	3	0	0	3

ELECTIVE –V (VIII SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1.	20153E81A	Flexible AC Transmission Systems	3	0	0	3
2.	20153E81B	Soft Computing Techniques	3	0	0	3
3.	20153E81C	Power Systems Dynamics	3	0	0	3
4.	20153E81D	SMPS and UPS	3	0	0	3
5.	20153E81E	Electric Energy Generation, Utilization and Conservation	3	0	0	3
6.	20153E81F	Professional Ethics in Engineering	3	0	0	3
7.	20153E81G	Principles of Management	3	0	0	3

ELECTIVE –VI (VIII SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1.	20153E82A	Energy Management and Auditing	3	0	0	3
2.	20153E82B	Data Structures	3	0	0	3
3.	20153E82C	High Voltage Direct Current Transmission	3	0	0	3
4.	20153E82D	Microcontroller Based System Design	3	0	0	3
5.	20153E82E	Smart Grid	3	0	0	3
6.	20153E82F	Biomedical Instrumentation	3	0	0	3
7.	20153E82G	Fundamentals of Nano Science	3	0	0	3

FREE ELECTIVE (V SEM)

S.No	Course Code	Course Name	L	T	P	C
1	20150FE54A	Database Management System	3	0	0	3
2	20152FE54A	Basics of Biomedical Instrumentation	3	0	0	3
3	20154FE54A	Renewable Energy Sources	3	0	0	3
4	20155FE54A	Air Pollution and Control Engineering	3	0	0	3
5	20150FE54B	Cloud computing	3	0	0	3
6	20152FE54B	Sensors and Transducers	3	0	0	3
7	20154FE54B	Automatic System	3	0	0	3
8	20155FE54B	Geographic Information System	3	0	0	3

FREE ELECTIVE (VII SEM)

S.No	Course Code	Course Name	L	T	P	C
1	20150FE74A	Introduction to C Programming	3	0	0	3
2	20152FE74A	Robotics	3	0	0	3
3	20154FE74A	Industrial safety	3	0	0	3
4	20155FE74A	Green Building Design	3	0	0	3
5	20150FE74B	Datastructures and Algorithms	3	0	0	3
6	20152FE74B	Electronic Devices	3	0	0	3
7	20154FE74B	Testing of Materials	3	0	0	3
8	20155FE74B	Waste water Treatment	3	0	0	3

20147S11

COMMUNICATIVE ENGLISH

L	T	P	C
5	1	0	4

OBJECTIVES:

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills

UNIT I SHARING INFORMATION RELATED TO ONESELF/FAMILY& FRIENDS 12

Reading- short comprehension passages, practice in skimming-scanning and predicting- **Writing-** completing sentences- - developing hints. **Listening-** short texts- short formal and informal conversations. **Speaking-** introducing oneself - exchanging personal information- **Language development-** Wh- Questions- asking and answering-yes or no questions- parts of speech. **Vocabulary development--** prefixes- suffixes- articles.- count/ uncount nouns.

UNIT II GENERAL READING AND FREE WRITING 12

Reading - comprehension-pre-reading-post reading- comprehension questions (multiple choice questions and /or short questions/ open-ended questions)-inductive reading- short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts)- register- **Writing** – paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions using some suggested vocabulary and structures –**Listening-** telephonic conversations. **Speaking –** sharing information of a personal kind—greeting – taking leave- **Language development**
– prepositions, conjunctions **Vocabulary development-** guessing meanings of words in context.

UNIT III GRAMMAR AND LANGUAGE DEVELOPMENT 12

Reading- short texts and longer passages (close reading) **Writing-** understanding text structure- use of reference words and discourse markers-coherence-jumbled sentences **Listening** – listening to longer texts and filling up the table- product description- narratives from different sources. **Speaking-** asking about routine actions and expressing opinions. **Language development-** degrees of comparison- pronouns- direct vs indirect questions- **Vocabulary development –** single word substitutes- adverbs.

UNIT IV READING AND LANGUAGE DEVELOPMENT 12

Reading- comprehension-reading longer texts- reading different types of texts- magazines **Writing-** letter writing, informal or personal letters-e-mails-conventions of personal email- **Listening-** listening to dialogues or conversations and completing exercises based on them. **Speaking-** speaking about oneself- speaking about one's friend- **Language development-** Tenses- simple present-simple past- present continuous and past continuous- **Vocabulary development-** synonyms-antonyms- phrasal verbs

UNIT V EXTENDED WRITING 12

Reading- longer texts- close reading –**Writing-** brainstorming -writing short essays – developing an outline- identifying main and subordinate ideas- dialogue writing-**Listening** – listening to talks- conversations- **Speaking –** participating in conversations- short group conversations-**Language development**-modal verbs- present/ past perfect tense - **Vocabulary development**-collocations- fixed and semi-fixed expressions

REFERENCES

1. Bailey, Stephen. **Academic Writing: A practical guide for students**. New York: Rutledge,2011.
2. Comfort, Jeremy, et al. **Speaking Effectively : Developing Speaking Skillsfor BusinessEnglish.** Cambridge University Press, Cambridge: Reprint 2011
3. Dutt P. Kiranmai and RajeevanGeeta. **Basic Communication Skills,** Foundation Books: 2013
4. Means,L. Thomas and Elaine Langlois. **English & Communication For Colleges.** CengageLearning ,USA: 2007
5. Redston, Chris &Gillies Cunningham **Face2Face** (Pre-intermediate Student's Book& Workbook) Cambridge University Press, New Delhi: 2005
.

20148S12	ENGINEERING MATHEMATICS - I	L	T	P	C
		5	1	0	4

OBJECTIVES :

- The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

UNIT I DIFFERENTIAL CALCULUS 12

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

UNIT II FUNCTIONS OF SEVERAL VARIABLES 12

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT III INTEGRAL CALCULUS 12

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT IV MULTIPLE INTEGRALS 12

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

UNIT V DIFFERENTIAL EQUATIONS 12

Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients - Method of undetermined coefficients.

TOTAL : 60 PERIODS

OUTCOMES :

After completing this course, students should demonstrate competency in the following skills:

- Use both the limit definition and rules of differentiation to differentiate functions.
- Apply differentiation to solve maxima and minima problems.
- Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
- Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
- Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
- Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
- Apply various techniques in solving differential equations.

TEXT BOOKS :

1. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015. [For Units I & III - Sections 1.1, 2.2, 2.3, 2.5, 2.7(Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1(Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCES :

1. Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10th Edition, 2016.
2. Jain R.K. and Iyengar S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, New Delhi, 3rd Edition, 2007.
3. Narayanan, S. and Manicavachagom Pillai, T. K., “Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.
4. Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.
5. Weir, M.D and Joel Hass, "Thomas Calculus", 12th Edition, Pearson India, 2016.

20149S13 **ENGINEERING PHYSICS**

L	T	P	C
5	1	0	4

OBJECTIVES :

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I PROPERTIES OF MATTER 9

Elasticity – Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment - I-shaped girders - stress due to bending in beams.

UNIT II WAVES AND FIBER OPTICS 9

Oscillatory motion – forced and damped oscillations: differential equation and its solution – plane progressive waves – wave equation. Lasers : population of energy levels, Einstein's A and B coefficients derivation – resonant cavity, optical amplification (qualitative) – Semiconductor lasers: homojunction and heterojunction – Fiber optics: principle, numerical aperture and acceptance angle -types of optical fibres (material, refractive index, mode) – losses associated with optical fibers - fibre optic sensors: pressure and displacement.

UNIT III THERMAL PHYSICS 9

Transfer of heat energy – thermal expansion of solids and liquids – expansion joints - bimetallic strips - thermal conduction, convection and radiation – heat conductions in solids – thermal conductivity - Forbe's and Lee's disc method: theory and experiment - conduction through compound media (series and parallel) – thermal insulation – applications: heat exchangers, refrigerators, ovens and solar water heaters.

UNIT IV QUANTUM PHYSICS 9

Black body radiation – Planck's theory (derivation) – Compton effect: theory and experimental verification – wave particle duality – electron diffraction – concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box – tunnelling (qualitative) - scanning tunnelling microscope.

UNIT V CRYSTAL PHYSICS 9

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - crystal imperfections: point defects, line defects – Burger vectors, stacking faults – role of imperfections in plastic deformation - growth of single crystals: solution and melt growth techniques.

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course,

- the students will gain knowledge on the basics of properties of matter and its applications,
- the students will acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics,
- the students will have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers,
- the students will get knowledge on advanced physics concepts of quantum theory and its applications in tunneling microscopes, and
- the students will understand the basics of crystals, their structures and different crystal growth techniques.

TEXT BOOKS:

1. Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2015.
2. Gaur, R.K. & Gupta, S.L. "Engineering Physics". Dhanpat Rai Publishers, 2012.
3. Pandey, B.K. & Chaturvedi, S. "Engineering Physics". Cengage Learning India, 2012.

REFERENCES:

1. Halliday, D., Resnick, R. & Walker, J. "Principles of Physics". Wiley, 2015.
2. Serway, R.A. & Jewett, J.W. "Physics for Scientists and Engineers". Cengage Learning, 2010.
3. Tipler, P.A. & Mosca, G. "Physics for Scientists and Engineers with Modern Physics'. W.H.Freeman, 2007.

20149S14	ENGINEERING CHEMISTRY	L T P C
		5 1 0 4

OBJECTIVES:

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.

UNIT I WATER AND ITS TREATMENT **9**

Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA – numerical problems – boiler troubles (scale and sludge) – treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) external treatment
– Ion exchange process, zeolite process – desalination of brackish water - Reverse Osmosis.

UNIT II SURFACE CHEMISTRY AND CATALYSIS **9**

Adsorption: Types of adsorption – adsorption of gases on solids – adsorption of solute from solutions
– adsorption isotherms – Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – contact theory – kinetics of surface reactions, unimolecular reactions, Langmuir - applications of adsorption on pollution abatement.

Catalysis: Catalyst – types of catalysis – criteria – autocatalysis – catalytic poisoning and catalytic promoters - acid base catalysis – applications (catalytic convertor) – enzyme catalysis– Michaelis – Menten equation.

UNIT III ALLOYS AND PHASE RULE **9**

Alloys: Introduction- Definition- properties of alloys- significance of alloying, functions and effect of alloying elements- Nichrome and stainless steel (18/8) – heat treatment of steel. Phase rule: Introduction, definition of terms with examples, one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system - Pattinson process.

UNIT IV FUELS AND COMBUSTION **9**

Fuels: Introduction - classification of fuels - coal - analysis of coal (proximate and ultimate) - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum - manufacture of synthetic petrol (Bergius process) - knocking - octane number - diesel oil - cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) - power alcohol and biodiesel. Combustion of fuels: Introduction - calorific value - higher and lower calorific values- theoretical calculation of calorific value - ignition temperature - spontaneous ignition temperature - explosive range - flue gas analysis (ORSAT Method).

UNIT V ENERGY SOURCES AND STORAGE DEVICES **9**

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells
– H_2-O_2 fuel cell.

TOTAL: 45 PERIODS

OUTCOMES:

- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

TEXT BOOKS:

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015
2. P. C. Jain and Monika Jain, "Engineering Chemistry" Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.

REFERENCES:

1. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
2. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
3. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.

20154S15	ENGINEERING GRAPHICS	L T P C
		5 1 0 4

OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (Not for Examination) **1**

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREEHAND SKETCHING 7+12

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 5+12

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 5+12

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+12

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

TOTAL: 90 PERIODS

OUTCOMES:

On successful completion of this course, the student will be able to

- familiarize with the fundamentals and standards of Engineering graphics
- perform freehand sketching of basic geometrical constructions and multiple views of objects.
- project orthographic projections of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- visualize and to project isometric and perspective sections of simple solids.

TEXT BOOK:

1. Natrajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.
2. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.

REFERENCES:

1. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
2. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50th Edition, 2010.
3. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
4. Luzzader, Warren.J. and Duff,John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
5. N S Parthasarathy And Vela Murali, “Engineering Graphics”, Oxford University, Press, New Delhi, 2015.
6. S M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2nd Edition, 2009.

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

20150S16 PROBLEM SOLVING AND PYTHON PROGRAMMING **L T P C**
5 1 0 4

COURSE OBJECTIVES:

- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures –- lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT I ALGORITHMIC PROBLEM SOLVING 9

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS 9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

UNIT V FILES, MODULES, PACKAGES 9

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

- Develop algorithmic solutions to simple computational problems
- Read, write, execute by hand simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python Programs.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)

2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

REFERENCES:

1. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem- Solving Focus, Wiley India Edition, 2013.
2. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press , 2013
3. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
4. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013.
5. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
6. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd.,, 2015.

20150L17	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY	L T P C 0 0 3 2

COURSE OBJECTIVES:

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

LIST OF PROGRAMS

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

PLATFORM NEEDED
Python 3 interpreter for Windows/Linux

COURSE OUTCOMES:
Upon completion of the course, students will be able to

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

TOTAL :60 PERIODS

20149L18 **PHYSICS AND CHEMISTRY LABORATORY**
(Common to all branches of B.E. / B.Tech Programmes)

L	T	P	C
0	0	3	2

OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young's modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser
   (b) Determination of acceptance angle in an optical fiber.
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method

OUTCOMES:
Upon completion of the course, the students will be able to **TOTAL: 30 PERIODS**

- apply principles of elasticity, optics and thermal properties for engineering applications.

CHEMISTRY LABORATORY: (Any seven experiments to be conducted) OBJECTIVES:

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by viscometery.

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10- Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
11. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
12. Pseudo first order kinetics-ester hydrolysis.
13. Corrosion experiment-weight loss method.
14. Determination of CMC.
15. Phase change in a solid.
16. Conductometric titration of strong acid vs strong base.

OUTCOMES:

- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

TOTAL: 30

PERIODS TEXTBOOKS:

1. Vogel's Textbook of Quantitative Chemical Analysis (8TH edition, 2014)

20147S21

TECHNICAL ENGLISH **L T P C**

OBJECTIVES: The Course prepares second semester engineering and Technology students to: **3 1 0 4**

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations , participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialisation.

UNIT I INTRODUCTION TECHNICAL ENGLISH 12

Listening- Listening to talks mostly of a scientific/technical nature and completing information-gap exercises- **Speaking** –Asking for and giving directions- **Reading** – reading short technical texts from journals- newsapapers- **Writing-** purpose statements – extended definitions – issue- writing instructions – checklists-recommendations-**Vocabulary Development-** technical vocabulary **Language Development** –subject verb agreement **-** compound words.

UNIT II READING AND STUDY SKILLS 12

Listening- Listening to longer technical talks and completing exercises based on them-**Speaking** – describing a process-**Reading** – reading longer technical texts- identifying the various transitions in a text- paragraphing- **Writing-** interpreting cgarts, graphs- **Vocabulary Development-**vocabularyused in formal letters/emails and reports **Language Development-** impersonal passive voice, numerical adjectives.

UNIT III TECHNICAL WRITING AND GRAMMAR 12

Listening- Listening to classroom lectures/ talkls on engineering/technology **-Speaking** – introduction to technical presentations- **Reading** – longer texts both general and technical, practice in speed reading; **Writing**-Describing a process, use of sequence words- **Vocabulary Development-** sequence words- Misspelled words. **Language Development-** embedded sentences

UNIT IV REPORT WRITING 12

Listening- Listening to documentaries and making notes. **Speaking** – mechanics of presentations- **Reading** – reading for detailed comprehension- **Writing-** email etiquette- job application – cover letter – Résumé preparation(via email and hard copy)- analytical essays and issue based essays-- **Vocabulary Development-** finding suitable synonyms-paraphrasing-. **Language Development-** clauses- if conditionals.

UNIT V GROUP DISCUSSION AND JOB APPLICATIONS 12

Listening- TED/Ink talks; **Speaking** –participating in a group discussion **-Reading**– reading and understanding technical articles **Writing**– Writing reports- minutes of a meeting- accident and survey- **Vocabulary Development- verbal analogies Language Development-** reported speech

TOTAL : 60 PERIODS

OUTCOMES: At the end of the course learners will be able to:

- Read technical texts and write area- specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialisation successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write reports and winning job applications.

TEXT BOOKS:

1. Board of editors. **Fluency in English A Course book for Engineering and Technology.** Orient Blackswan, Hyderabad: 2016
2. Sudharshana.N.P and Saveetha. C. **English for Technical Communication**. Cambridge University Press: New Delhi, 2016.

REFERENCES

1. Booth-L. Diana**, Project Work,** Oxford University Press**,** Oxford: 2014.
2. Grussendorf, Marion, **English for Presentations,** Oxford University Press, Oxford: 2007
3. Kumar, Suresh. E. **Engineering English**. Orient Blackswan: Hyderabad,2015
4. Means, L. Thomas and Elaine Langlois, **English & Communication For Colleges.** Cengage Learning, USA: 2007
5. Raman, Meenakshi and Sharma, Sangeetha- **Technical Communication Principles and Practice.**Oxford University Press: New Delhi,2014.

Students can be asked to read Tagore, Chetan Bhagat and for suplementary reading.

20148S22A	**ENGINEERING MATHEMATICS – II**	**L**	**T**	**P**	**C**
		5	**1**	**0**	**4**

OBJECTIVES :

- This course is designed to cover topics such as Matrix Algebra, Vector Calculus, Complex Analysis and Laplace Transform. Matrix Algebra is one of the powerful tools to handle practical problems arising in the field of engineering. Vector calculus can be widely used for modelling the various laws of physics. The various methods of complex analysis and Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

UNIT I MATRICES **12**

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II VECTOR CALCULUS **12**

Gradient and directional derivative – Divergence and curl - Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III ANALYTIC FUNCTIONS **12**

Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions $w = z + c, cz, \frac{1}{z}, z^2$ - Bilinear transformation.

UNIT IV COMPLEX INTEGRATION **12**

Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour.

UNIT V LAPLACE TRANSFORMS **12**

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear second order ordinary differential equations with constant coefficients.

OUTCOMES : **TOTAL: 60 PERIODS**

After successfully completing the course, the student will have a good understanding of the following topics and their applications:

- Eigenvalues and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.
- Gradient, divergence and curl of a vector point function and related identities.
- Evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems and their verification.
- Analytic functions, conformal mapping and complex integration.
- Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.

TEXT BOOKS :

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.

REFERENCES :

1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
2. Jain R.K. and Iyengar S.R.K., " Advanced Engineering Mathematics ", Narosa Publications, New Delhi , 3rd Edition, 2007.
3. O'Neil, P.V. "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.
4. Sastry, S.S, "Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi, 2014.
5. Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

20149S23B	**PHYSICS FOR ELECTRONICS ENGINEERING**	**L**	**T**	**P**	**C**
		5	**1**	**0**	**3**

(Common to BME, ME, CC, ECE, EEE, E&I, ICE)

OBJECTIVES:

- To understand the essential principles of Physics of semiconductor device and Electron transport properties. Become proficient in magnetic, dielectric and optical properties of materials and nano devices.

UNIT I ELECTRICAL PROPERTIES OF MATERIALS 9

Classical free electron theory - Expression for electrical conductivity – Thermal conductivity, expression - Wiedemann-Franz law – Success and failures - electrons in metals – Particle in a three dimensional box – degenerate states – Fermi- Dirac statistics – Density of energy states – Electron in periodic potential: Bloch thorem – metals and insulators - Energy bands in solids– tight binding approximation - Electron effective mass – concept of hole.

UNIT II SEMICONDUCTOR PHYSICS 9

Intrinsic Semiconductors – Energy band diagram – direct and indirect semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Carrier transport: Velocity-electric field relations – drift and diffusion transport - Einstein's relation – Hall effect and devices – Zener and avalanche breakdown in p-n junctions - Ohmic contacts – tunnel diode - Schottky diode – MOS capacitor - power transistor.

UNIT III MAGNETIC AND DIELECTRIC PROPERTIES OF MATERIALS 9

Magnetism in materials – magnetic field and induction – magnetization - magnetic permeability and susceptibility–types of magnetic materials – microscopic classification of magnetic materials - Ferromagnetism: origin and exchange interaction- saturation magnetization and Curie temperature – Domain Theory. Dielectric materials: Polarization processes – dielectric loss – internal field –Clausius-Mosotti relation- dielectric breakdown – high-k dielectrics.

UNIT IV OPTICAL PROPERTIES OF MATERIALS 9

Classification of optical materials – carrier generation and recombination processes - Absorption emission and scattering of light in metals, insulators and Semiconductors (concepts only) - photo current in a P- N diode – solar cell –photo detectors - LED – Organic LED – Laser diodes – excitons - quantum confined Stark effect – quantum dot laser.

UNIT V NANOELECTRONIC DEVICES 9

Introduction - electron density in bulk material – Size dependence of Fermi energy– quantum confinement – quantum structures - Density of states in quantum well, quantum wire and quantum dot structures –Zener-Bloch oscillations – resonant tunneling – quantum interference effects – mesoscopic structures: conductance fluctuations and coherent transport – Coulomb blockade effects - Single electron phenomena and Single electron Transistor – magnetic semiconductors– spintronics - Carbon nanotubes: Properties and applications.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the students will able to

- gain knowledge on classical and quantum electron theories, and energy band structuues,
- acquire knowledge on basics of semiconductor physics and its applications in various devices,
- get knowledge on magnetic and dielectric properties of materials,
- have the necessary understanding on the functioning of optical materials for optoelectronics,
- understand the basics of quantum structures and their applications in spintronics and carbon electronics.

TEXT BOOKS:

1. Kasap, S.O. "Principles of Electronic Materials and Devices", McGraw-Hill Education, 2007.
2. Umesh K Mishra & Jasprit Singh, "Semiconductor Device Physics and Design", Springer, 2008.
3. Wahab, M.A. "Solid State Physics: Structure and Properties of Materials". Narosa Publishing House, 2009.

REFERENCES

1. Garcia, N. & Damask, A. "Physics for Computer Science Students". Springer-Verlag, 2012.
2. Hanson, G.W. "Fundamentals of Nanoelectronics". Pearson Education, 2009
3. Rogers, B., Adams, J. & Pennathur, S. "Nanotechnology: Understanding Small Systems". CRC Press, 2014

20149S24A	**ENVIRONMENTAL SCIENCE AND ENGINEERING**	**L T P C** **5 1 0 4**

OBJECTIVES:

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth‟s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY **14**

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION **8**

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES **10**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT **7**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT **6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL: 45 PERIODS

OUTCOMES:

- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXTBOOKS:

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.

REFERENCES :

1. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD,New Delhi, 2007.
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) PVT, LTD, Hydrabad, 2015.
3. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.

20153S25C **CIRCUIT THEORY**

L	T	P	C
5	1	0	4

OBJECTIVES:

- To introduce electric circuits and its analysis
- To impart knowledge on solving circuit equations using network theorems
- To introduce the phenomenon of resonance in coupled circuits.
- To educate on obtaining the transient response of circuits.
- To introduce Phasor diagrams and analysis of three phase circuits

UNIT I BASIC CIRCUITS ANALYSIS 6+6

Resistive elements - Ohm's Law Resistors in series and parallel circuits – Kirchoffs laws – Mesh current and node voltage - methods of analysis.

UNIT II NETWORK REDUCTION AND THEOREMS FOR DC AND AC IRCUITS 6+6

Network reduction: voltage and current division, source transformation – star delta conversion. Thevenins and Norton Theorems – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem – Millman's theorem.

UNIT III TRANSIENT RESPONSE ANALYSIS 6+6

L and C elements -Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. sinusoidal input.

UNIT IV THREE PHASE CIRCUITS 6+6

A.C. circuits – Average and RMS value - Phasor Diagram – Power, Power Factor and Energy.- Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents – power measurement in three phase circuits.

UNIT V RESONANCE AND COUPLED CIRCUITS 6+6

Series and parallel resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

OUTCOMES: **TOTAL : 60 PERIODS**

- Ability to analyse electrical circuits
- Ability to apply circuit theorems
- Ability to analyse transients

TEXT BOOKS:

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", McGraw Hill publishers, edition, New Delhi, 2013.
2. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, 2013.
3. Allan H. Robbins, Wilhelm C. Miller, "Circuit Analysis Theory and Practice", Cengage Learning India, 2013.

REFERENCES

1. Chakrabarti A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, 1999.
2. Jegatheesan, R., "Analysis of Electric Circuits," McGraw Hill, 2015.
3. Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, McGraw- Hill, New Delhi, 2010.
4. M E Van Valkenburg, "Network Analysis",Prentice-Hall of India Pvt Ltd, New Delhi,

2015.
5. Mahadevan, K., Chitra, C., "Electric Circuits Analysis," Prentice-Hall of India Pvt Ltd., New Delhi, 2015.
6. Richard C. Dorf and James A. Svoboda, "Introduction to Electric Circuits", 7th Edition, John Wiley & Sons, Inc. 2015.
7. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", McGraw Hill, 2015.

20154S26C **BASIC CIVIL AND MECHANICAL ENGINEERING** **L T P C**
5 1 0 4

OBJECTIVES:

- To impart basic knowledge on Civil and Mechanical Engineering.
- To familiarize the materials and measurements used in Civil Engineering.
- To provide the exposure on the fundamental elements of civil engineering structures.
- To enable the students to distinguish the components and working principle of power plant units, IC engines, and R & AC system.

A – OVER VIEW

UNIT I SCOPE OF CIVIL AND MECHANICAL ENGINEERING 10

Overview of Civil Engineering - Civil Engineering contributions to the welfare of Society – Specialized sub disciplines in Civil Engineering – Structural, Construction, Geotechnical, Environmental, Transportation and Water Resources Engineering

Overview of Mechanical Engineering - Mechanical Engineering contributions to the welfare of Society –Specialized sub disciplines in Mechanical Engineering - Production, Automobile, Energy Engineering - Interdisciplinary concepts in Civil and Mechanical Engineering.

B – CIVIL ENGINEERING

UNIT II SURVEYING AND CIVIL ENGINEERING MATERIALS 10

Surveying: Objects – classification – principles – measurements of distances – angles – leveling – determination of areas– contours - examples.

Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel - timber - modern materials

UNIT III BUILDING COMPONENTS AND STRUCTURES 15

Foundations: Types of foundations - Bearing capacity and settlement – Requirement of good foundations.

Civil Engineering Structures: Brickmasonry – stonemasonry – beams – columns – lintels – roofing – flooring – plastering – floor area, carpet area and floor space index - Types of Bridges and Dams – water supply - sources and quality of water - Rain water harvesting - introduction to high way and rail way.

C – MECHANICAL ENGINEERING

UNIT IV INTERNAL COMBUSTION ENGINES AND POWER PLANTS 15

Classification of Power Plants - Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Working principle of steam, Gas, Diesel, Hydro - electric and Nuclear Power plants –- working principle of Boilers, Turbines, Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps

UNIT V REFRIGERATION AND AIR CONDITIONING SYSTEM 10

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system–Layout of typical domestic refrigerator–Window and Split type room Air conditioner.

OUTCOMES: **TOTAL: 60 PERIODS**

On successful completion of this course, the student will be able to

- appreciate the Civil and Mechanical Engineering components of Projects.
- explain the usage of construction material and proper selection of construction materials.
- measure distances and area by surveying
- identify the components used in power plant cycle.
- demonstrate working principles of petrol and diesel engine.
- elaborate the components of refrigeration and Air conditioning cycle.

TEXTBOOKS:

1. Shanmugam Gand Palanichamy MS,“Basic Civil and Mechanical Engineering”,Tata McGraw Hill PublishingCo.,NewDelhi,1996.

REFERENCES:

1. Palanikumar, K. Basic Mechanical Engineering, ARS Publications, 2010.
2. Ramamrutham S.,“Basic Civil Engineering”, Dhanpat Rai Publishing Co.(P) Ltd.1999.
3. Seetharaman S.,“BasicCivil Engineering”,AnuradhaAgencies,2005.
4. ShanthaKumar SRJ.,“Basic Mechanical Engineering”, Hi-tech Publications, Mayiladuthurai, 2000.
5. Venugopal K. and Prahu Raja V., “Basic Mechanical Engineering”, Anuradha Publishers, Kumbakonam,2000.

20154L27 ENGINEERING PRACTICES LABORATORY L T P C
0 0 3 2

OBJECTIVES:

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE 13

Buildings:

(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works. (d) Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

(a) Study of the joints in roofs, doors, windows and furniture. (b) Hands-on-exercise:
Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE 18

Welding:

(a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding. (b) Gas welding practice

Basic Machining:

(a) Simple Turning and Taper turning
(b) Drilling Practice

Sheet Metal Work:

(a) Forming & Bending:
(b) Model making – Trays and funnels. (c) Different type of joints.

Machine assembly practice:

(a) Study of centrifugal pump
(b) Study of air conditioner

Demonstration on:

(a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.
(c) Fitting – Exercises – Preparation of square fitting and V – fitting models.

<u>GROUP B (ELECTRICAL & ELECTRONICS)</u>

III ELECTRICAL ENGINEERING PRACTICE 13

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of an electrical equipment.

IV ELECTRONICS ENGINEERING PRACTICE **16**

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

OUTCOMES:

On successful completion of this course, the student will be able to

TOTAL: 60 PERIODS

- fabricate carpentry components and pipe connections including plumbing works.
- use welding equipments to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metal works
- Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundary and fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, soldering practices.

CIVIL

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.	15 Sets.
2. Carpentry vice (fitted to work bench)	15 Nos.
3. Standard woodworking tools	15 Sets.
4. Models of industrial trusses, door joints, furniture joints	5 each
5. Power Tools: (a) Rotary Hammer	2 Nos
(b) Demolition Hammer	2 Nos (c)
Circular Saw	2 Nos (d)
Planer	2 Nos (e)
Hand Drilling Machine	2 Nos (f)
Jigsaw	2 Nos

MECHANICAL

1. Arc welding transformer with cables and holders	5 Nos.
2. Welding booth with exhaust facility	5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 Nos.
5. Centre lathe	2 Nos.
6. Hearth furnace, anvil and smithy tools	2 Sets.
7. Moulding table, foundry tools	2 Sets.
8. Power Tool: Angle Grinder	2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner	One each.

ELECTRICAL

1. Assorted electrical components for house wiring	15 Sets
2. Electrical measuring instruments	10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp	1 each
4. Megger (250V/500V)	1 No.
5. Power Tools: (a) Range Finder	2 Nos
(b) Digital Live-wire detector	2 Nos

ELECTRONICS

1. Soldering guns	10 Nos.
2. Assorted electronic components for making circuits	50 Nos.
3. Small PCBs	10 Nos.
4. Multimeters	10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply	

20153L28C ELECTRIC CIRCUITS LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:

- To simulate various electric circuits using Pspice/ Matlab/e-Sim / Scilab
- To gain practical experience on electric circuits and verification of theorems.

LIST OF EXPERIMENTS

1. Simulation and experimental verification of electrical circuit problems using Kirchhoff's voltage and current laws.
2. Simulation and experimental verification of electrical circuit problems using Thevenin's theorem.
3. Simulation and experimental verification of electrical circuit problems using Norton's theorem.
4. Simulation and experimental verification of electrical circuit problems using Superposition theorem.
5. Simulation and experimental verification of Maximum Power transfer Theorem.
6. Study of Analog and digital oscilloscopes and measurement of sinusoidal voltage, frequency and power factor.
7. Simulation and Experimental validation of R-C electric circuit transients.
8. Simulation and Experimental validation of frequency response of RLC electric circuit.
9. Design and Simulation of series resonance circuit.
10. Design and Simulation of parallel resonant circuits.
11. Simulation of three phase balanced and unbalanced star, delta networks circuits.

TOTAL: 60 PERIODS

OUTCOMES:

- Understand and apply circuit theorems and concepts in engineering applications.
- Simulate electric circuits.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1 Regulated Power Supply: 0 – 15 V D.C - 10 Nos / Distributed Power Source.
2 Function Generator (1 MHz) - 10 Nos.
3 Single Phase Energy Meter - 1 No.
4 Oscilloscope (20 MHz) 10 Nos.

5 Digital Storage Oscilloscope (20 MHz) – 1 No.

6 10 Nos. of PC with Circuit Simulation Software (min 10 Users) (e-Sim / Scilab/ Pspice / MATLAB /other Equivalent software Package) and Printer (1 No.)

7 AC/DC - Voltmeters (10 Nos.), Ammeters (10 Nos.) and Multi-meters (10 Nos.)

8 Single Phase Wattmeter – 3 Nos.

9 Decade Resistance Box, Decade Inductance Box, Decade Capacitance Box - 6 Nos each.

10 Circuit Connection Boards - 10 Nos.Necessary Quantities of Resistors,Inductors, Capacitors of various capacities (Quarter Watt to 10Watt

20149S31C TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS **L T P C**
3 1 0 4

OBJECTIVES :

- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations – Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II FOURIER SERIES 12

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12

Classification of PDE – Method of separation of variables - Fourier Series Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

UNIT IV FOURIER TRANSFORMS 12

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS 12

Z-transforms - Elementary properties – Inverse Z-transform (using partial fraction and residues) – Initial and final value theorems - Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

TOTAL : 60 PERIODS

OUTCOMES :

Upon successful completion of the course, students should be able to:

- Understand how to solve the given standard partial differential equations.
- Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
- Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
- Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

TEXT BOOKS :

1. Grewal B.S., “Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, New Delhi, 2014.
2. Narayanan S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.

REFERENCES :

1. Andrews, L.C and Shivamoggi, B, "Integral Transforms for Engineers" SPIE Press, 1999.
2. Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 9th Edition, Laxmi Publications Pvt. Ltd, 2014.
3. Erwin Kreyszig, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, India, 2016.
4. James, G., "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.
5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
6. Wylie, R.C. and Barrett, L.C., “Advanced Engineering Mathematics “Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

20153C32	**DIGITAL LOGIC CIRCUITS**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**3**

OBJECTIVES:

- To study various number systems and simplify the logical expressions using Boolean functions
- To study combinational circuits
- To design various synchronous and asynchronous circuits.
- To introduce asynchronous sequential circuits and PLDs
- To introduce digital simulation for development of application oriented logic circuits.

UNIT I NUMBER SYSTEMS AND DIGITAL LOGIC FAMILIES 6+6

Review of number systems, binary codes, error detection and correction codes (Parity and Hamming code) - Digital Logic Families -comparison of RTL, DTL, TTL, ECL and MOS families -operation, characteristics of digital logic family.

UNIT II COMBINATIONAL CIRCUITS 6+6

Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps - simplification and implementation of combinational logic – multiplexers and de multiplexers - code converters, adders, subtractors, Encoders and Decoders.

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS 6+6

Sequential logic- SR, JK, D and T flip flops - level triggering and edge triggering - counters - asynchronous and synchronous type - Modulo counters - Shift registers - design of synchronous sequential circuits – Moore and Melay models- Counters, state diagram; state reduction; state assignment.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS AND PROGRAMMABILITY LOGIC DEVICES 6+6

Asynchronous sequential logic circuits-Transition tability, flow tability-race conditions, hazards &errors in digital circuits; analysis of asynchronous sequential logic circuits- introduction to Programmability Logic Devices: PROM – PLA –PAL, CPLD-FPGA.

UNIT V VHDL 6+6

RTL Design – combinational logic – Sequential circuit – Operators – Introduction to Packages – Subprograms – Test bench. (Simulation /Tutorial Examples: adders, counters, flip flops, Multiplexers & De multiplexers).

OUTCOMES: **TOTAL : 60PERIODS**

- Ability to design combinational and sequential Circuits.
- Ability to simulate using software package.
- Ability to study various number systems and simplify the logical expressions using Boolean functions
- Ability to design various synchronous and asynchronous circuits.
- Ability to introduce asynchronous sequential circuits and PLDs
- Ability to introduce digital simulation for development of application oriented logic circuits.

TEXT BOOKS:

1. James W. Bignel, Digital Electronics, Cengage learning, 5th Edition, 2007.
2. M. Morris Mano, 'Digital Design with an introduction to the VHDL', Pearson Education, 2013.
3. Comer "Digital Logic & State Machine Design, Oxford, 2012.

REFERENCES

1. Mandal, "Digital Electronics Principles & Application, McGraw Hill Edu, 2013.
2. William Keitz, Digital Electronics-A Practical Approach with VHDL, Pearson, 2013.
3. Thomas L.Floyd, 'Digital Fundamentals', 11th edition, Pearson Education, 2015.
4. Charles H.Roth, Jr, Lizy Lizy Kurian John, 'Digital System Design using VHDL, Cengage, 2013.
5. D.P.Kothari,J.S.Dhillon, 'Digital circuits and Design',Pearson Education, 2016.

20153C33	ELECTROMAGNETIC THEORY	L	T	P	C
		2	2	0	3

OBJECTIVES:

- To introduce the basic mathematical concepts related to electromagnetic vector fields
- To impart knowledge on the concepts of
  - Electrostatic fields, electrical potential, energy density and their applications.
  - Magneto static fields, magnetic flux density, vector potential and its applicati Different methods of emf generation and Maxwell's equations
  - Electromagnetic waves and characterizing parameters

UNIT I ELECTROSTATICS – I 6+6

Sources and effects of electromagnetic fields – Coordinate Systems – Vector fields –Gradient, Divergence, Curl – theorems and applications - Coulomb's Law – Electric field intensity – Field due to discrete and continuous charges – Gauss's law and applications.

UNIT II ELECTROSTATICS – II 6+6

Electric potential – Electric field and equipotential plots, Uniform and Non-Uniform field, Utilization factor – Electric field in free space, conductors, dielectrics - Dielectric polarization – Dielectric strength - Electric field in multiple dielectrics – Boundary conditions, Poisson's and Laplace's equations, Capacitance, Energy density, Applications.

UNIT III MAGNETOSTATICS 6+6

Lorentz force, magnetic field intensity (H) – Biot–Savart's Law - Ampere's Circuit Law – H due to straight conductors, circular loop, infinite sheet of current, Magnetic flux density (B) – B in free space, conductor, magnetic materials – Magnetization, Magnetic field in multiple media – Boundary conditions, scalar and vector potential, Poisson's Equation, Magnetic force, Torque, Inductance, Energy density, Applications.

UNIT IV ELECTRODYNAMIC FIELDS 6+6

Magnetic Circuits - Faraday's law – Transformer and motional EMF – Displacement current - Maxwell's equations (differential and integral form) – Relation between field theory and circuit theory – Applications.

UNIT V ELECTROMAGNETIC WAVES 6+6

Electromagnetic wave generation and equations – Wave parameters; velocity, intrinsic impedance, propagation constant – Waves in free space, lossy and lossless dielectrics, conductors- skin depth - Poynting vector – Plane wave reflection and refraction.

TOTAL : 60 PERIODS

OUTCOMES:

- Ability to understand the basic mathematical concepts related to electromagnetic vector fields.
- Ability to understand the basic concepts about electrostatic fields, electrical potential, energy density and their applications.
- Ability to acquire the knowledge in magneto static fields, magnetic flux density, vector potential and its applications.
- Ability to understand the different methods of emf generation and Maxwell's equations
- Ability to understand the basic concepts electromagnetic waves and characterizing parameters
- Ability to understand and compute Electromagnetic fields and apply them for design and analysis of electrical equipment and systems

TEXT BOOKS:

1. Mathew N. O. Sadiku, 'Principles of Electromagnetics', 6th Edition, Oxford University Press Inc. Asian edition, 2015.
2. William H. Hayt and John A. Buck, 'Engineering Electromagnetics', McGraw Hill Special Indian edition, 2014.
3. Kraus and Fleish, 'Electromagnetics with Applications', McGraw Hill International Editions, Fifth Edition, 2010

REFERENCES

1. V.V.Sarwate, 'Electromagnetic fields and waves', First Edition, Newage Publishers, 1993.
2. J.P.Tewari, 'Engineering Electromagnetics - Theory, Problems and Applications', Second Edition, Khanna Publishers.
3. Joseph. A.Edminister, 'Schaum's Outline of Electromagnetics, Third Edition (Schaum's Outline Series), McGraw Hill, 2010.
4. S.P.Ghosh, Lipika Datta, 'Electromagnetic Field Theory', First Edition, McGraw Hill Education(India) Private Limited, 2012.
5. K A Gangadhar, 'Electromagnetic Field Theory', Khanna Publishers; Eighth Reprint : 2015

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20153C34	ELECTRICAL MACHINES – I	L	T	P	C
		2	2	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Magnetic-circuit analysis and introduce magnetic materials
- Constructional details, the principle of operation, prediction of performance, the methods of testing the transformers and three phase transformer connections.
- Working principles of electrical machines using the concepts of electromechanical energy conversion principles and derive expressions for generated voltage and torque developed in all Electrical Machines.
- Working principles of DC machines as Generator types, determination of their no-load/load characteristics, starting and methods of speed control of motors.
- Various losses taking place in D.C. Motor and to study the different testing methods to arrive at their performance.

UNIT I MAGNETIC CIRCUITS AND MAGNETIC MATERIALS 6+6

Magnetic circuits –Laws governing magnetic circuits - Flux linkage, Inductance and energy – Statically and Dynamically induced EMF - Torque – Properties of magnetic materials, Hysteresis and Eddy Current losses - AC excitation, introduction to permanent magnets-Transformer as a magnetically coupled circuit.

UNIT II TRANSFORMERS 6+6

Construction – principle of operation – equivalent circuit parameters – phasor diagrams, losses – testing – efficiency and voltage regulation-all day efficiency-Sumpner's test, per unit representation – inrush current - three phase transformers-connections – Scott Connection – Phasing of transformer– parallel operation of three phase transformers-auto transformer – tap changing transformers- tertiary winding.

UNIT III ELECTROMECHANICAL ENERGY CONVERSION AND CONCEPTS IN ROTATING MACHINES 6+6

Energy in magnetic system – Field energy and co energy-force and torque equations – singly and multiply excited magnetic field systems-mmf of distributed windings – Winding Inductances-, magnetic fields in rotating machines – rotating mmf waves – magnetic saturation and leakage fluxes.

UNIT IV DC GENERATORS 6+6

Construction and components of DC Machine – Principle of operation - Lap and wave windings-EMF equations– circuit model – armature reaction –methods of excitation- commutation - interpoles compensating winding –characteristics of DC generators.

UNIT V DC MOTORS 6+6

Principle and operations - types of DC Motors – Speed Torque Characteristics of DC Motors- starting and speed control of DC motors –Plugging, dynamic and regenerative braking- testing and efficiency – Retardation test- Swinburne's test and Hopkinson's test - Permanent Magnet DC (PMDC)motors-applications of DC Motor

OUTCOMES: **TOTAL : 60 PERIODS**

- Ability to analyze the magnetic-circuits.
- Ability to acquire the knowledge in constructional details of transformers.
- Ability to understand the concepts of electromechanical energy conversion.
- Ability to acquire the knowledge in working principles of DC Generator.
- Ability to acquire the knowledge in working principles of DC Motor
- Ability to acquire the knowledge in various losses taking place in D.C. Machines

TEXT BOOKS:

1. Stephen J. Chapman, 'Electric Machinery Fundamentals'4th edition, McGraw Hill Education Pvt. Ltd, 2010.
2. P.C. Sen'Principles of Electric Machines and Power Electronics' John Wiley & Sons; 3rd Edition 2013.
3. Nagrath, I.J. and Kothari.D.P., Electric Machines', McGraw-Hill Education, 2004

REFERENCES

1. Theodore Wildi, "Electrical Machines, Drives, and Power Systems", Pearson Education., (5th Edition), 2002.
2. B.R. Gupta ,'Fundamental of Electric Machines' New age International Publishers,3rd Edition ,Reprint 2015.
3. S.K. Bhattacharya, 'Electrical Machines' McGraw - Hill Education, New Delhi, 3rd Edition,2009.
4. Vincent Del Toro, 'Basic Electric Machines' Pearson India Education, 2016.
5. Surinder Pal Bali, 'Electrical Technology Machines & Measurements, Vol.II, Pearson, 2013.
6. Fitzgerald. A.E., Charles Kingsely Jr, Stephen D.Umans, 'Electric Machinery', Sixth edition, McGraw Hill Books Company, 2003.

20153C35 **ELECTRON DEVICES AND CIRCUITS** **L T P C**
3 0 0 3

OBJECTIVES:

The student should be made to:

- Understand the structure of basic electronic devices.
- Be exposed to active and passive circuit elements.
- Familiarize the operation and applications of transistor like BJT and FET.
- Explore the characteristics of amplifier gain and frequency response.
- Learn the required functionality of positive and negative feedback systems.

UNIT I PN JUNCTION DEVICES 9

PN junction diode –structure, operation and V-I characteristics, diffusion and transition capacitance - Rectifiers – Half Wave and Full Wave Rectifier,– Display devices- LED, Laser diodes, Zener diodecharacteristics- Zener Reverse characteristics – Zener as regulator

UNIT II TRANSISTORS AND THYRISTORS 9

BJT, JFET, MOSFET- structure, operation, characteristics and Biasing UJT, Thyristors and IGBT - Structure and characteristics.

UNIT III AMPLIFIERS 9

BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response –MOSFET small signal model– Analysis of CS and Source follower – Gain and frequency response- High frequency analysis.

UNIT IV MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER 9

BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis – FET input stages – Single tuned amplifiers – Gain and frequency response – Neutralization methods, power amplifiers –Types (Qualitative analysis).

UNIT V FEEDBACK AMPLIFIERS AND OSCILLATORS 9

Advantages of negative feedback – voltage / current, series , Shunt feedback –positive feedback – Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.

OUTCOMES: TOTAL : 45 PERIODS

Upon Completion of the course, the students will be ability to:

- Explain the structure and working operation of basic electronic devices.
- Able to identify and differentiate both active and passive elements
- Analyze the characteristics of different electronic devices such as diodes and transistors
- Choose and adapt the required components to construct an amplifier circuit.
- Employ the acquired knowledge in design and analysis of oscillators

TEXT BOOKS:

1. . David A. Bell ,"Electronic devices and circuits", Oxford University higher education, 5th edition 2008.
2. Sedra and smith, "Microelectronic circuits",7th Ed., Oxford University Press

REFERENCES:

1. Balbir Kumar, Shail.B.Jain, "Electronic devices and circuits" PHI learning private limited, 2nd edition 2014.
2. Thomas L.Floyd, "Electronic devices" Conventional current version, Pearson prentice hall, 10th Edition, 2020.
3. Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGraw Hill, 3rd Edition, 2003.
4. Robert L.Boylestad, "Electronic devices and circuit theory", 2002.
5. Robert B. Northrop, "Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation", CRC Press, 2004.

20153C36 **POWER PLANT ENGINEERING**

L	T	P	C
3	0	0	3

OBJECTIVE:

- Providing an overview of Power Plants and detailing the role of Mechanical Engineers in their operation and maintenance.

UNIT I COAL BASED THERMAL POWER PLANTS 9

Rankine cycle - improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.

UNIT II DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS 9

Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimisation. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.

UNIT III NUCLEAR POWER PLANTS 9

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : Boil*ing Water Reactor* (BWR), P*ressurized Water Reactor* (PW R), CANada Deuterium-Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

UNIT IV POWER FROM RENEWABLE ENERGY 9

Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, *Solar* Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.

UNIT V ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS 9

Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

OUTCOMES: **TOTAL : 45 PERIODS**

Upon the completion of this course the students will be able to

CO1 Explain the layout, construction and working of the components inside a thermal power plant.

CO2 Explain the layout, construction and working of the components inside a Diesel, Gas and Combined cycle power plants.

CO3 Explain the layout, construction and working of the components inside nuclear power plants.

CO4 Explain the layout, construction and working of the components inside Renewable energy power plants.

CO5 Explain the applications of power plants while extend their knowledge to power plant economics and environmental hazards and estimate the costs of electrical energy production.

TEXT BOOK:

1. Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008.

REFERENCES:

1. El-Wakil. M.M., "Power Plant Technology", Tata McGraw – Hill Publishing Company Ltd., 2010.

2. Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.
3. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, "Power Plant Engineering", Second Edition, Standard Handbook of McGraw – Hill, 1998.

20153L37	ELECTRONICS LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES:

- To enability the students to understand the behavior of semiconductor device based on experimentation.

LIST OF EXPERIMENTS

1. Characteristics of Semiconductor diode and Zener diode
2. Characteristics of a NPN Transistor under common emitter , common collector and common base configurations
3. Characteristics of JFET and draw the equivalent circuit
4. Characteristics of UJT and generation of saw tooth waveforms
5. Design and Frequency response characteristics of a Common Emitter amplifier
6. Characteristics of photo diode & photo transistor, Study of light activated relay circuit
7. Design and testing of RC phase shift and LC oscillators
8. Single Phase half-wave and full wave rectifiers with inductive and capacitive filters
9. Differential amplifiers using FET
10. Study of CRO for frequency and phase measurements
11. Realization of passive filters

OUTCOMES:

- Ability to understand and analyse electronic circuits**.**

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Semiconductor devices like Diode, Zener Diode, NPN Transistors, JFET, UJT, Photo diode, Photo Transistor
2. Resistors, Capacitors and inductors
3. Necessary digital IC 8
4. Function Generators 10
5. Regulated 3 output Power Supply 5, ± 15V 10
6. CRO 10
7. Storage Oscilloscope 1
8. Bread boards
9. Atleast one demo module each for the listed equipments.
10. Component data sheets to be provided

20153L38	ELECTRICAL MACHINES LABORATORY-I	L	T	P	C
		0	0	3	2

OBJECTIVES:

- To expose the students to the operation of D.C. machines and transformers and give them experimental skill.

LIST OF EXPERIMENTS

1. Open circuit and load characteristics of DC shunt generator- critical resistance and critical speed.
2. Load characteristics of DC compound generator with differential and cumulative connections.
3. Load test on DC shunt motor.
4. Load test on DC compound motor.
5. Load test on DC series motor.
6. Swinburne's test and speed control of DC shunt motor.
7. Hopkinson's test on DC motor – generator set.
8. Load test on single-phase transformer and three phase transformers.
9. Open circuit and short circuit tests on single phase transformer.
10. Sumpner's test on single phase transformers.
11. Separation of no-load losses in single phase transformer.
12. Study of starters and 3-phase transformers connections.

OUTCOMES: **TOTAL: 60 PERIODS**

- Ability to understand and analyze DC Generator
- Ability to understand and analyze DC Motor
- Ability to understand and analyse Transformers.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. DC Shunt Motor with Loading Arrangement – 3 nos
2. DC Shunt Motor Coupled with Three phase Alternator – 1 No.
3. Single Phase Transformer – 4 nos
4. DC Series Motor with Loading Arrangement – 1 No.
5. DC compound Motor with Loading Arrangement – 1 No.
6. Three Phase Induction Motor with Loading Arrangement – 2 nos
7. Single Phase Induction Motor with Loading Arrangement – 1 No.
8. DC Shunt Motor Coupled With DC Compound Generator – 2 nos
9. DC Shunt Motor Coupled With DC Shunt Motor – 1 No.
10. Tachometer -Digital/Analog – 8 nos
11. Single Phase Auto Transformer – 2 nos
12. Three Phase Auto Transformer – 1 No.
13. Single Phase Resistive Loading Bank – 2 nos
14. Three Phase Resistive Loading Bank. – 2 nos

20149S41C **NUMERICAL METHODS** **L T P C**
4 0 0 4

OBJECTIVES :

- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals in real life situations.
- To acquaint the student with understanding of numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.
- To understand the knowledge of various techniques and methods of solving various types of partial differential equations.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 12

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

UNIT II INTERPOLATION AND APPROXIMATION 12

Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Difference operators and relations - Interpolation with equal intervals - Newton's forward and backward difference formulae.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 12

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's Method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 12

Single step methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge - Kutta method for solving first order equations - Multi step methods - Milne's and Adams - Bash forth predictor corrector methods for solving first order equations.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 12

Finite difference methods for solving second order two - point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

TOTAL : 60 PERIODS

OUTCOMES :

Upon successful completion of the course, students should be able to:

- Understand the basic concepts and techniques of solving algebraic and transcendental equations.
- Appreciate the numerical techniques of interpolation and error approximations in various intervals in real life situations.
- Apply the numerical techniques of differentiation and integration for engineering problems.
- Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
- Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

TEXTBOOKS :

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.

REFERENCES :

1. Brian Bradie, "A Friendly Introduction to Numerical Analysis", Pearson Education, Asia, New Delhi, 2007.
2. Gerald. C. F. and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6th Edition, New Delhi, 2006.
3. Mathews, J.H. "Numerical Methods for Mathematics, Science and Engineering", 2nd Edition, Prentice Hall, 1992.
4. Sankara Rao. K., "Numerical Methods for Scientists and Engineers", Prentice Hall of India Pvt. Ltd, 3rd Edition, New Delhi, 2007.
5. Sastry, S.S, "Introductory Methods of Numerical Analysis", PHI Learning Pvt. Ltd, 5th Edition, 2015.

20153C42 ELECTRICAL MACHINES – II

L	T	P	C
2	2	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Construction and performance of salient and non – salient type synchronous generators.
- Principle of operation and performance of synchronous motor.
- Construction, principle of operation and performance of induction machines.
- Starting and speed control of three-phase induction motors.
- Construction, principle of operation and performance of single phase induction motors and special machines.

UNIT I SYNCHRONOUS GENERATOR 6+6

Constructional details – Types of rotors –winding factors- emf equation – Synchronous reactance – Armature reaction – Phasor diagrams of non salient pole synchronous generator connected to infinite bus--Synchronizing and parallel operation – Synchronizing torque -Change of excitation and mechanical input- Voltage regulation – EMF, MMF, ZPF and A.S.A methods – steady state power- angle characteristics– Two reaction theory –slip test -short circuit transients - Capability Curves

UNIT II SYNCHRONOUS MOTOR 6+6

Principle of operation – Torque equation – Operation on infinite bus bars - V and Inverted V curves – Power input and power developed equations – Starting methods – Current loci for constant power input, constant excitation and constant power developed-Hunting – natural frequency of oscillations – damper windings- synchronous condenser.

UNIT III THREE PHASE INDUCTION MOTOR 6+6

Constructional details – Types of rotors –- Principle of operation – Slip –cogging and crawling- Equivalent circuit – Torque-Slip characteristics - Condition for maximum torque – Losses and efficiency – Load test - No load and blocked rotor tests - Circle diagram – Separation of losses – Double cage induction motors –Induction generators – Synchronous induction motor.

UNIT IV STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR 6+6

Need for starting – Types of starters – DOL, Rotor resistance, Autotransformer and Star- delta starters – Speed control – Voltage control, Frequency control and pole changing – Cascaded connection-V/f control – Slip power recovery scheme-Braking of three phase induction motor: Plugging, dynamic braking and regenerative braking.

UNIT V SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES 6+6

Constructional details of single phase induction motor – Double field revolving theory and operation – Equivalent circuit – No load and blocked rotor test – Performance analysis – Starting methods of single-phase induction motors – Capacitor-start capacitor run Induction motor- Shaded pole induction motor - Linear induction motor – Repulsion motor - Hysteresis motor - AC series motor- Servo motors- Stepper motors - introduction to magnetic levitation systems.

TOTAL : 60 PERIODS

OUTCOMES:

- Ability to understand the construction and working principle of Synchronous Generator
- Ability to understand MMF curves and armature windings.
- Ability to acquire knowledge on Synchronous motor.
- Ability to understand the construction and working principle of Three phase Induction Motor
- Ability to understand the construction and working principle of Special Machines
- Ability to predetermine the performance characteristics of Synchronous Machines.

TEXT BOOKS:

1. A.E. Fitzgerald, Charles Kingsley, Stephen. D. Umans, 'Electric Machinery', Mc Graw Hill publishing Company Ltd, 2003.
2. Vincent Del Toro, 'Basic Electric Machines' Pearson India Education, 2016.
3. Stephen J. Chapman, 'Electric Machinery Fundamentals'4th edition, McGraw Hill Education Pvt. Ltd, 2010.

REFERENCES

1. D.P. Kothari and I.J. Nagrath, 'Electric Machines', McGraw Hill Publishing Company Ltd, 2002.
2. P.S. Bhimbhra, 'Electrical Machinery', Khanna Publishers, 2003.
3. M.N. Bandyopadhyay, Electrical Machines Theory and Practice, PHI Learning PVT LTD., New Delhi, 2009.
4. B.R.Gupta, 'Fundamental of Electric Machines' New age International Publishers,3rd Edition ,Reprint 2015.
5. Murugesh Kumar, 'Electric Machines', Vikas Publishing House Pvt. Ltd, 2002.
6. Alexander S. Langsdorf, 'Theory of Alternating-Current Machinery', McGraw Hill Publications, 2001.

20153C43	TRANSMISSION AND DISTRIBUTION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the structure of electric power system and to develop expressions for the computation of transmission line parameters.
- To obtain the equivalent circuits for the transmission lines based on distance and to determine voltage regulation and efficiency.
- To understand the mechanical design of transmission lines and to analyze the voltage distribution in insulator strings to improve the efficiency.
- To study the types, construction of cabilitys and methods to improve the efficiency.
- To study about distribution systems, types of substations, methods of grounding, EHVAC, HVDC and FACTS.

UNIT I TRANSMISSION LINE PARAMETERS 9

Structure of Power System - Parameters of single and three phase transmission lines with single and double circuits -Resistance, inductance and capacitance of solid, stranded and bundled conductors, Symmetrical and unsymmetrical spacing and transposition - application of self and mutual GMD; skin and proximity effects -Typical configurations, conductor types and electrical parameters of EHV lines.

UNIT II MODELLING AND PERFORMANCE OF TRANSMISSION LINES 9

Performance of Transmission lines - short line, medium line and long line - equivalent circuits, phasor diagram, attenuation constant, phase constant, surge impedance - transmission efficiency and voltage regulation, real and reactive power flow in lines - Power Circle diagrams - Formation of Corona – Critical Voltages – Effect on Line Performance.

UNIT III MECHANICAL DESIGN OF LINES 9

Mechanical design of OH lines – Line Supports –Types of towers – Stress and Sag Calculation – Effects of Wind and Ice loading. Insulators: Types, voltage distribution in insulator string, improvement of string efficiency, testing of insulators.

UNIT IV UNDER GROUND CABILITYS 9

Underground cabilitys - Types of cabilitys – Construction of single core and 3 core Cabilitys - Insulation Resistance – Potential Gradient - Capacitance of Single-core and 3 core cabilitys - Grading of cabilitys - Power factor and heating of cabilitys– DC cabilitys.

UNIT V DISTRIBUTION SYSTEMS 9

Distribution Systems – General Aspects – Kelvin's Law – AC and DC distributions - Techniques of Voltage Control and Power factor improvement – Distribution Loss –Types of Substations -Methods of Grounding – Trends in Transmission and Distribution: EHVAC, HVDC and FACTS (Qualitative treatment only).

TOTAL : 45 PERIODS

OUTCOMES:

- To understand the importance and the functioning of transmission line parameters.
- To understand the concepts of Lines and Insulators.
- To acquire knowledge on the performance of Transmission lines.
- To acquire knowledge on Underground Cabilitys
- To become familiar with the function of different components used in Transmission and Distribution levels of power system and modelling of these components.

TEXT BOOKS:

1. D.P.Kothari, I.J. Nagarath, 'Power System Engineering', Mc Graw-Hill Publishing Company limited, New Delhi, Second Edition, 2008.
2. C.L.Wadhwa, 'Electrical Power Systems', New Academic Science Ltd, 2009.
3. S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall of India Pvt. Ltd, New Delhi, Second Edition, 2011.

REFERENCES

1. B.R.Gupta, 'Power System Analysis and Design' S. Chand, New Delhi, Fifth Edition, 2008.
2. Luces M.Fualken berry, Walter Coffer, 'Electrical Power Distribution and Transmission', Pearson Education, 2007.
3. Arun Ingole, "power transmission and distribution" Pearson Education, 2017
4. J.Brian, Hardy and Colin R.Bayliss 'Transmission and Distribution in Electrical Engineering', Newnes; Fourth Edition, 2012.
5. G.Ramamurthy, "Handbook of Electrical power Distribution," Universities Press, 2013.
6. V.K.Mehta, Rohit Mehta, 'Principles of power system', S. Chand & Company Ltd, New Delhi, 2013

20153C44 MEASUREMENTS AND INSTRUMENTATION

L	T	P	C
3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Basic functional elements of instrumentation
- Fundamentals of electrical and electronic instruments
- Comparison between various measurement techniques
- Various storage and display devices
- Various transducers and the data acquisition systems

UNIT I INTRODUCTION 9

Functional elements of an instrument – Static and dynamic characteristics – Errors in measurement – Statistical evaluation of measurement data – Standards and calibration- Principle and types of analog and digital voltmeters, ammeters.

UNIT II ELECTRICAL AND ELECTRONIC INSTRUMENTS 9

Principle and types of multi meters – Single and three phase watt meters and energy meters – Magnetic measurements – Determination of B-H curve and measurements of iron loss – Instrument transformers – Instruments for measurement of frequency and phase.

UNIT III COMPARATIVE METHODS OF MEASUREMENTS 9

D.C potentiometers, D.C (Wheat stone, Kelvin and Kelvin Double bridge) & A.C bridges (Maxwell, Anderson and Schering bridges), transformer ratio bridges, self-balancing bridges. Interference & screening – Multiple earth and earth loops - Electrostatic and electromagnetic Interference – Grounding techniques.

UNIT IV STORAGE AND DISPLAY DEVICES 9

Magnetic disk and tape – Recorders, digital plotters and printers, CRT display, digital CRO, LED, LCD & Dot matrix display – Data Loggers.

UNIT V TRANSDUCERS AND DATA ACQUISITION SYSTEMS 9

Classification of transducers – Selection of transducers – Resistive, capacitive & inductive Transducers – Piezoelectric, Hall effect, optical and digital transducers – Elements of data acquisition system – Smart sensors-Thermal Imagers.

TOTAL : 45 PERIODS

OUTCOMES:

- To acquire knowledge on Basic functional elements of instrumentation
- To understand the concepts of Fundamentals of electrical and electronic instruments
- Ability to compare between various measurement techniques
- To acquire knowledge on Various storage and display devices
- To understand the concepts Various transducers and the data acquisition systems
- Ability to model and analyze electrical and electronic Instruments and understand the operational features of display Devices and Data Acquisition System.

TEXT BOOKS:

1. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2010.
2. J. B. Gupta, 'A Course in Electronic and Electrical Measurements', S. K. Kataria & Sons, Delhi, 2013.
3. Doebelin E.O. and Manik D.N., Measurement Systems – Applications and Design, Special Indian Edition, McGraw Hill Education Pvt. Ltd., 2007.

REFERENCES

1. H.S. Kalsi, 'Electronic Instrumentation', McGraw Hill, III Edition 2010.
2. D.V.S. Murthy, 'Transducers and Instrumentation', Prentice Hall of India Pvt Ltd, 2015.
3. David Bell, ' Electronic Instrumentation & Measurements', Oxford University Press,2013.
4. Martin Reissland, 'Electrical Measurements', New Age International (P) Ltd., Delhi, 2001.
5. Alan. S. Morris, Principles of Measurements and Instrumentation, 2nd Edition, Prentice Hall of India, 2003.

20153C45	LINEAR INTEGRATED CIRCUITS AND APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart knowledge on the following topics

- Signal analysis using Op-amp based circuits.
- Applications of Op-amp.
- Functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits.
- IC fabrication procedure.

UNIT I IC FABRICATION 9

IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realisation of monolithic ICs and packaging. Fabrication of diodes, capacitance, resistance, FETs and PV Cell.

UNIT II CHARACTERISTICS OF OPAMP 9

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – Inverting and Non-inverting Amplifiers, summer, differentiator and integrator-V/I & I/V converters.

UNIT III APPLICATIONS OF OPAMP 9

Instrumentation amplifier and its applications for transducer Bridge, Log and Antilog Amplifiers- Analog multiplier & Divider, first and second order active filters, comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R- 2R ladder and weighted resistor types), A/D converters using opamps.

UNIT IV SPECIAL ICs 9

Functional block, characteristics of 555 Timer and its PWM application - IC-566 voltage controlled oscillator IC; 565-phase locked loop IC, AD633 Analog multiplier ICs.

UNIT V APPLICATION ICs 9

AD623 Instrumentation Amplifier and its application as load cell weight measurement - IC voltage regulators –LM78XX, LM79XX; Fixed voltage regulators its application as Linear power supply - LM317, 723 Variability voltage regulators, switching regulator- SMPS - ICL 8038 function generator IC.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to acquire knowledge in IC fabrication procedure
- Ability to analyze the characteristics of Op-Amp
- To understand the importance of Signal analysis using Op-amp based circuits.
- Functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits.
- To understand and acquire knowledge on the Applications of Op-amp
- Ability to understand and analyse, linear integrated circuits their Fabrication and Application.

TEXT BOOKS:

1. David A. Bell, 'Op-amp & Linear ICs', Oxford, 2013.
2. D. Roy Choudhary, Sheil B. Jani, 'Linear Integrated Circuits', II edition, New Age, 2003.
3. Ramakant A.Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, 2003 / PHI. 2000.

REFERENCES

1. Fiore,"Opamps & Linear Integrated Circuits Concepts & applications", Cengage, 2010.
2. Floyd ,Buchla,"Fundamentals of Analog Circuits, Pearson, 2013.
3. Jacob Millman, Christos C.Halkias, 'Integrated Electronics - Analog and Digital circuits system', McGraw Hill, 2003.
4. Robert F.Coughlin, Fredrick F. Driscoll, 'Op-amp and Linear ICs', Pearson, 6th edition,2012.
5. Sergio Franco, 'Design with Operational Amplifiers and Analog Integrated Circuits', Mc Graw Hill, 2016.
6. Muhammad H. Rashid,' Microelectronic Circuits Analysis and Design' Cengage Learning, 2011.

20153C46	**CONTROL SYSTEMS**	**LT P C**
		3 2 0 4

COURSE OBJECTIVES

- To understand the use of transfer function models for analysis physical systems and introduce the control system components.
- To provide adequate knowledge in the time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of systems.
- To introduce stability analysis and design of compensators

UNIT I SYSTEMS AND REPRESENTATION 9

Basic elements in control systems: – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs.

UNIT II TIME RESPONSE 9

Time response: – Time domain specifications – Types of test input – I and II order system response – Error coefficients – Generalized error series – Steady state error – Root locus construction- Effects of P, PI, PID modes of feedback control –Time response analysis.

UNIT III FREQUENCY RESPONSE 9

Frequency response: – Bode plot – Polar plot – Determination of closed loop response from open loop response - Correlation between frequency domain and time domain specifications

UNIT IV STABILITY AND COMPENSATOR DESIGN 9

Characteristics equation – Routh Hurwitz criterion – Nyquist stability criterion- Performance criteria – Effect of Lag, lead and lag-lead compensation on frequency response-Design of Lag, lead and lag- lead compensator using bode plots.

UNIT V STATE VARIABLE ANALYSIS 9

Concept of state variables – State models for linear and time invariant Systems – Solution of state and output equation in controllable canonical form – Concepts of controllability and observability.

TOTAL (L: 45+T:30): 75 PERIODS

COURSE OUTCOMES

At the end of the course, the student should have the :

- Ability to develop various representations of system based on the knowledge of
- Mathematics, Science and Engineering fundamentals.
- Ability to do time domain and frequency domain analysis of various models of linear system.
- Ability to interpret characteristics of the system to develop mathematical model.
- Ability to design appropriate compensator for the given specifications.
- Ability to come out with solution for complex control problem.
- Ability to understand use of PID controller in closed loop system.

TEXT BOOKS

1. Nagarath, I.J. and Gopal, M., “Control Systems Engineering”, New Age International Publishers, 2017.
2. Benjamin C. Kuo, “Automatic Control Systems”, Wiley, 2014.

REFERENCES

1. Katsuhiko Ogata, “Modern Control Engineering”, Pearson, 2015.
2. Richard C.Dorf and Bishop, R.H., “Modern Control Systems”, Pearson Education,2009.
3. John J.D., Azzo Constantine, H. and Houpis Sttuart, N Sheldon, “Linear Control System Analysis and Design with MATLAB”, CRC Taylor& Francis Reprint 2009.
4. Rames C.Panda and T. Thyagarajan, “An Introduction to Process Modelling Identification and Control of Engineers”, Narosa Publishing House, 2017.
5. M.Gopal, “Control System: Principle and design”, McGraw Hill Education, 2012.
6. NPTEL Video Lecture Notes on “Control Engineering “by Prof. S. D. Agashe, IIT Bombay.

20153L47	ELECTRICAL MACHINES LABORATORY - II	L	T	P	C
		0	0	3	2

OBJECTIVES:

- To expose the students to the operation of synchronous machines and induction motors and give them experimental skill.

LIST OF EXPERIMENTS

1. Regulation of three phase alternator by EMF and MMF methods.
2. Regulation of three phase alternator by ZPF and ASA methods.
3. Regulation of three phase salient pole alternator by slip test.
4. Measurements of negative sequence and zero sequence impedance of alternators.
5. V and Inverted V curves of Three Phase Synchronous Motor.
6. Load test on three-phase induction motor.
7. No load and blocked rotor tests on three-phase induction motor (Determination of equivalent circuit parameters).
8. Separation of No-load losses of three-phase induction motor.
9. Load test on single-phase induction motor.
10. No load and blocked rotor test on single-phase induction motor.
11. Study of Induction motor Starters

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course, the student should have the :

- Ability to understand and analyze EMF and MMF methods
- Ability to analyze the characteristics of V and Inverted V curves
- Ability to understand the importance of Synchronous machines
- Ability to understand the importance of Induction Machines
- Ability to acquire knowledge on separation of losses

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Synchronous Induction motor 3HP – 1 No.
2. DC Shunt Motor Coupled With Three phase Alternator – 4 nos
3. DC Shunt Motor Coupled With Three phase Slip ring Induction motor – 1 No.
4. Three Phase Induction Motor with Loading Arrangement – 2 nos
5. Single Phase Induction Motor with Loading Arrangement – 2 nos
6. Tachometer -Digital/Analog – 8 nos
7. Single Phase Auto Transformer – 2 nos
8. Three Phase Auto Transformer – 3 nos
9. Single Phase Resistive Loading Bank – 2 nos
10. Three Phase Resistive Loading Bank – 2 nos
11. Capacitor Bank – 1 No.

20153L48 LINEAR AND DIGITAL INTEGRATED CIRCUITS LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:

- To learn design, testing and characterizing of circuit behavior with digital and analog ICs.

LIST OF EXPERIMENTS

1. Implementation of Boolean Functions, Adder and Subtractor circuits.
2. Code converters: Excess-3 to BCD and Binary to Gray code converter and vice-versa
3. Parity generator and parity checking
4. Encoders and Decoders
5. Counters: Design and implementation of 3-bit modulo counters as synchronous and Asynchronous types using FF IC's and specific counter IC.
6. Shift Registers: Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitability IC's.
7. Study of multiplexer and de multiplexer
8. Timer IC application: Study of NE/SE 555 timer in Astability, Monostability operation.
9. Application of Op-Amp: inverting and non-inverting amplifier, Adder, comparator, Integrator and Differentiator.
10. Voltage to frequency characteristics of NE/ SE 566 IC.
11. Variability Voltage Regulator using IC LM320.

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course, the student should have the :

- Ability to understand and implement Boolean Functions.
- Ability to understand the importance of code conversion
- Ability to Design and implement 4-bit shift registers
- Ability to acquire knowledge on Application of Op-Amp
- Ability to Design and implement counters using specific counter IC.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS: (3 per Batch)

S.No	Name of the equipments / Components	Quantity Required	Remarks
1	Dual ,(0-30V) variability Power Supply	10	-
2	CRO	9	30MHz
3	Digital Multimeter	10	Digital
4	Function Generator	8	1 MHz
5	IC Tester (Analog)	2	
6	Bread board	10	

7	Computer (PSPICE installed)	1	
Consumabilitys (sufficient quantity)			
1	IC 741/ IC NE555/566/565		
2	Digital IC types		
3	LED		
4	LM317		
5	LM723		
6	ICSG3524 / SG3525		
7	Transistor – 2N3391		
8	Diodes, IN4001,BY126		
9	Zener diodes		
10	Potentiometer		
11	Step-down transformer 230V/12-0-12V		
12	Capacitor		
13	Resistors 1/4 Watt Assorted		
14	Single Strand Wire		

20153C51 **POWER SYSTEM ANALYSIS**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To model the power system under steady state operating condition
- To understand and apply iterative techniques for power flow analysis
- To model and carry out short circuit studies on power system
- To model and analyze stability problems in power system

UNIT I POWER SYSTEM 9

Need for system planning and operational studies - Power scenario in India - Power system components – Representation - Single line diagram - per unit quantities - p.u. impedance diagram - p.u. reactance diagram - Network graph, Bus incidence matrix, Primitive parameters, Bus admittance matrix from primitive parameters - Representation of off- nominal transformer - Formation of bus admittance matrix of large power network.

UNIT II POWER FLOW ANALYSIS 9

Bus classification - Formulation of Power Flow problem in polar coordinates - Power flow solution using Gauss Seidel method - Handling of Voltage controlled buses - Power Flow Solution by Newton Raphson method.

UNIT III SYMMETRICAL FAULT ANALYSIS 9

Assumptions in short circuit analysis - Symmetrical short circuit analysis using Thevenin's theorem - Bus Impedance matrix building algorithm (without mutual coupling) - Symmetrical fault analysis through bus impedance matrix - Post fault bus voltages - Fault level - Current limiting reactors.

UNIT IV UNSYMMETRICAL FAULT ANALYSIS 9

Symmetrical components - Sequence impedances - Sequence networks - Analysis of unsymmetrical faults at generator terminals: LG, LL and LLG - unsymmetrical fault occurring at any point in a power system - computation of post fault currents in symmetrical component and phasor domains.

UNIT V STABILITY ANALYSIS 9

Classification of power system stability – Rotor angle stability - Swing equation - Swing curve - Power-Angle equation - Equal area criterion - Critical clearing angle and time - Classical step- by-step solution of the swing equation – modified Euler method.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to model the power system under steady state operating condition
- Ability to understand and apply iterative techniques for power flow analysis
- Ability to model and carry out short circuit studies on power system
- Ability to model and analyze stability problems in power system
- Ability to acquire knowledge on Fault analysis.
- Ability to model and understand various power system components and carry out power flow, short circuit and stability studies.

TEXT BOOKS:

1. John J. Grainger, William D. Stevenson, Jr, ‘Power System Analysis’, Mc Graw Hill Education (India) Private Limited, New Delhi, 2015.
2. Kothari D.P. and Nagrath I.J., ‘Power System Engineering’, Tata McGraw-Hill Education, Second Edition, 2008.
3. Hadi Saadat, ‘Power System Analysis’, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.

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1. Pai M A, ‘Computer Techniques in Power System Analysis’, Tata Mc Graw-Hill Publishing Company Ltd., New Delhi, Second Edition, 2007.
2. J. Duncan Glover, Mulukutla S.Sarma, Thomas J. Overbye, ‘Power System Analysis & Design’, Cengage Learning, Fifth Edition, 2012.
3. Gupta B.R., ‘Power System - Analysis and Design’, S. Chand Publishing, 2001.
4. Kundur P., ‘Power System Stability and Control’, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.

		L	T	P	C
20153C52	**MICROPROCESSORS AND MICROCONTROLLERS**	**3**	**0**	**0**	**3**

OBJECTIVES:

To impart knowledge on the following Topics

- Architecture of µP8085 & µC 8051
- Addressing modes & instruction set of 8085 & 8051.
- Need & use of Interrupt structure 8085 & 8051.
- Simple applications development with programming 8085 & 8051

UNIT I 8085 PROCESSOR 9

Hardware Architecture, pinouts – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts.

UNIT II PROGRAMMING OF 8085 PROCESSOR 9

Instruction -format and addressing modes – Assembly language format – Data transfer, data manipulation& control instructions – Programming: Loop structure with counting & Indexing – Look up tability - Subroutine instructions - stack.

UNIT III 8051 MICRO CONTROLLER 9

Hardware Architecture, pinouts – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts- Data Transfer, Manipulation, Control Algorithms& I/O instructions, Comparison to Programming concepts with 8085.

UNIT IV PERIPHERAL INTERFACING 9

Study on need, Architecture, configuration and interfacing, with ICs: 8255, 8259, 8254, 8279, - A/D and D/A converters &Interfacing with 8085& 8051.

UNIT V MICRO CONTROLLER PROGRAMMING & APPLICATIONS 9

Simple programming exercises- key board and display interface –Control of servo motor- stepper motor control- Application to automation systems.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to acquire knowledge in Addressing modes & instruction set of 8085 & 8051.
- Ability to need & use of Interrupt structure 8085 & 8051.
- Ability to understand the importance of Interfacing
- Ability to explain the architecture of Microprocessor and Microcontroller.
- Ability to write the assembly language programme.
- Ability to develop the Microprocessor and Microcontroller based applications.

TEXT BOOKS:

1. Sunil Mathur &Jeebananda Panda, "Microprocessor and Microcontrollers", PHI Learning Pvt. Ltd, 2016.

2. R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', with 8085, Wiley Eastern Ltd., New Delhi, 2013.

3. Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely 'The 8051 Micro Controller and Embedded Systems', PHI Pearson Education, 5th Indian reprint, 2003.

REFERENCES

1. Krishna Kant, "Microprocessor and Microcontrollers", Eastern Company Edition, Prentice Hall of India, New Delhi, 2007.

2. B.RAM," Computer Fundamentals Architecture and Organization" New age International Private Limited, Fifth edition, 2017.

3. Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051,McGraw Hill Edu,2013.

4. Ajay V.Deshmukh, 'Microcontroller Theory &Applications', McGraw Hill Edu,2016

5. Douglas V.Hall, 'Microprocessor and Interfacing', McGraw Hill Edu,2016.

20153C53	**POWER ELECTRONICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

To impart knowledge on the following Topics

- Different types of power semiconductor devices and their switching
- Operation, characteristics and performance parameters of controlled rectifiers
- Operation, switching techniques and basics topologies of DC-DC switching regulators.
- Different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
- Operation of AC voltage controller and various configurations.

UNIT I POWER SEMI-CONDUCTOR DEVICES 9

Study of switching devices, SCR, TRIAC, GTO, BJT, MOSFET, IGBT and IGCT- Static characteristics: SCR, MOSFET and IGBT - Triggering and commutation circuit for SCR- Introduction to Driver and snubber circuits.

UNIT II PHASE-CONTROLLED CONVERTERS 9

2-pulse, 3-pulse and 6-pulseconverters– performance parameters –Effect of source inductance– – Firing Schemes for converter–Dual converters, Applications-light dimmer, Excitation system, Solar PV systems.

UNIT III DC TO DC CONVERTERS 9

Step-down and step-up chopper-control strategy– Introduction to types of choppers-A, B, C, D and E -Switched mode regulators- Buck, Boost, Buck- Boost regulator, Introduction to Resonant Converters, Applications-Battery operated vehicles.

UNIT IV INVERTERS 9

Single phase and three phase voltage source inverters (both 120^0 mode and 180^0 mode)– Voltage& harmonic control--PWM techniques: Multiple PWM, Sinusoidal PWM, modified sinusoidal PWM – Introduction to space vector modulation –Current source inverter, Applications-Induction heating, UPS.

UNIT V AC TO AC CONVERTERS 9

Single phase and Three phase AC voltage controllers–Control strategy- Power Factor Control – Multistage sequence control -single phase and three phase cyclo converters – Introduction to Matrix converters, Applications –welding .

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to analyse AC-AC and DC-DC and DC-AC converters.
- Ability to choose the converters for real time applications.

TEXT BOOKS:

1. M.H. Rashid, 'Power Electronics: Circuits, Devices and Applications', Pearson Education, Third Edition, New Delhi, 2004.

2. P.S.Bimbra "Power Electronics" Khanna Publishers, third Edition, 2003.

3. Ashfaq Ahmed 'Power Electronics for Technology', Pearson Education, Indian reprint, 2003.

REFERENCES

1. Joseph Vithayathil,' Power Electronics, Principles and Applications', McGraw Hill Series, 6th Reprint, 2013.

2. Philip T. Krein, "Elements of Power Electronics" Oxford University Press, 2004 Edition.

3. L. Umanand, "Power Electronics Essentials and Applications", Wiley, 2010.

4. Ned Mohan Tore. M. Undel and, William. P. Robbins, 'Power Electronics: Converters, Applications and Design', John Wiley and sons, third edition, 2003.

5. S.Rama Reddy, 'Fundamentals of Power Electronics', Narosa Publications, 2014.

6. M.D. Singh and K.B. Khanchandani, "Power Electronics," Mc Graw Hill India, 2013.

7. JP Agarwal," Power Electronic Systems: Theory and Design" 1e, Pearson Education, 2002.

20153C55 **DIGITAL SIGNAL PROCESSING**

L	T	P	C
2	2	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Signals and systems & their mathematical representation.
- Discrete time systems.
- Transformation techniques & their computation. Filters and
- their design for digital implementation. Programmability digital
- signal processor & quantization effects.

UNIT I INTRODUCTION 6+6

Classification of systems: Continuous, discrete, linear, causal, stability, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect.

UNIT II DISCRETE TIME SYSTEM ANALYSIS 6+6

Z-transform and its properties, inverse z-transforms; difference equation – Solution by z-transform, application to discrete systems - Stability analysis, frequency response – Convolution – Discrete Time Fourier transform , magnitude and phase representation.

UNIT III DISCRETE FOURIER TRANSFORM & COMPUTATION 6+6

Discrete Fourier Transform- properties, magnitude and phase representation - Computation of DFT using FFT algorithm – DIT &DIF using radix 2 FFT – Butterfly structure.

UNIT IV DESIGN OF DIGITAL FILTERS 6+6

FIR & IIR filter realization – Parallel & cascade forms. FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics. Analog filter design – Butterworth and Chebyshev approximations; IIR Filters, digital design using impulse invariant and bilinear transformation Warping, pre warping.

UNIT V DIGITAL SIGNAL PROCESSORS 6+6

Introduction – Architecture – Features – Addressing Formats – Functional modes - Introduction to Commercial DS Processors.

TOTAL : 60 PERIODS

OUTCOMES:

1. Ability to understand the importance of Fourier transform, digital filters and DS Processors.
2. Ability to acquire knowledge on Signals and systems & their mathematical representation.
3. Ability to understand and analyze the discrete time systems.
4. Ability to analyze the transformation techniques & their computation.
5. Ability to understand the types of filters and their design for digital implementation.
6. Ability to acquire knowledge on programmability digital signal processor & quantization effects.

TEXT BOOKS:

1. J.G. Proakis and D.G. Manolakis, ‘Digital Signal Processing Principles, Algorithms and Applications’, Pearson Education, New Delhi, PHI. 2003.

2. S.K. Mitra, ‘Digital Signal Processing – A Computer Based Approach’, McGraw Hill Edu, 2013.
3. Lonnie C.Ludeman ,”Fundamentals of Digital Signal Processing”,Wiley,2013

REFERENCES

1. Poorna Chandra S, Sasikala. B ,Digital Signal Processing, Vijay Nicole/TMH,2013.
2. Robert Schilling & Sandra L.Harris, Introduction to Digital Signal Processing using Matlab”, Cengage Learning,2014.
3. B.P.Lathi, ‘Principles of Signal Processing and Linear Systems’, Oxford University Press, 2010 3. Taan S. ElAli, ‘Discrete Systems and Digital Signal Processing with Mat Lab’, CRC Press, 2009.
4. SenM.kuo, woonseng…s.gan, “Digital Signal Processors, Architecture, Implementations & Applications, Pearson,2013
5. DimitrisG.Manolakis, Vinay K. Ingle, applied Digital Signal Processing,Cambridge,2012

20153C56	OBJECT ORIENTED PROGRAMMING	L T P C 3 0 0 3

OBJECTIVES:

- To understand Object Oriented Programming concepts and basic characteristics of Java
- To know the principles of packages, inheritance and interfaces
- To define exceptions and use I/O streams
- To develop a java application with threads and generics classes
- To design and build simple Graphical User Interfaces

UNIT I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 10

Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism- OOP in Java – Characteristics of Java – The Java Environment - Java Source File -Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers - static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays , Packages - JavaDoc comments.

UNIT II INHERITANCE AND INTERFACES 9

Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces - Object cloning -inner classes, Array Lists - Strings

UNIT III EXCEPTION HANDLING AND I/O 9

Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files

UNIT IV MULTITHREADING AND GENERIC PROGRAMMING 8

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations.

UNIT V EVENT DRIVEN PROGRAMMING 9

Graphics programming - Frame – Components - working with 2D shapes - Using color, fonts, and images - Basics of event handling - event handlers - adapter classes - actions - mouse events - AWT event hierarchy - Introduction to Swing – layout management - Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows –Menus – Dialog Boxes.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of the course, students will be able to:

- Develop Java programs using OOP principles
- Develop Java programs with the concepts inheritance and interfaces
- Build Java applications using exceptions and I/O streams
- Develop Java applications with threads and generics classes
- Develop interactive Java programs using swings

TEXT BOOKS

1. Herbert Schildt, "Java The complete reference", 8th Edition, McGraw Hill Education, 2011.
2. Cay S. Horstmann, Gary cornell, "Core Java Volume –I Fundamentals", 9th Edition, Prentice Hall, 2013.

REFERENCES

1. Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3rd Edition, Pearson, 2015.
2. Steven Holzner, "Java 2 Black book", Dreamtech press, 2011.
3. Timothy Budd, "Understanding Object-oriented programming with Java", Updated Edition, Pearson Education, 2000.

20153L57	**CONTROL AND INSTRUMENTATION LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**2**

OBJECTIVES:

- To provide knowledge on analysis and design of control system along with basics of instrumentation.

LIST OF EXPERIMENTS

CONTROLSYSTEMS:

1. P, PI and PID controllers
2. Stability Analysis
3. Modeling of Systems – Machines, Sensors and Transducers
4. Design of Lag, Lead and Lag-Lead Compensators
5. Position Control Systems
6. Synchro-Transmitter- Receiver and Characteristics
7. Simulation of Control Systems by Mathematical development tools.

INSTRUMENTATION:

8. Bridge Networks –AC and DC Bridges
9. Dynamics of Sensors/Transducers

(a) Temperature (b) pressure (c) Displacement (d) Optical (e) Strain (f) Flow

10 Power and Energy Measurement

11 Signal Conditioning

(a) Instrumentation Amplifier

(b) Analog – Digital and Digital –Analog converters (ADC and DACs)

12 Process Simulation

TOTAL: 60 PERIODS

OUTCOMES:

- Ability to understand control theory and apply them to electrical engineering problems.
- Ability to analyze the various types of converters.
- Ability to design compensators
- Ability to understand the basic concepts of bridge networks.
- Ability to the basics of signal conditioning circuits.
- Ability to study the simulation packages.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CONTROLSYSTEMS:

1. PID controller simulation and learner kit – 1 No.
2. Digital storage Oscilloscope for capturing transience- 1 No

2 Personal Computer with control system

simulation packages - 10 Nos

3. DC motor –Generator test set-up for evaluation of motor parameters
4. CRO 30MHz – 1 No.
5. 2MHz Function Generator – 1No.
6. Position Control Systems Kit (with manual) – 1 No., Tacho Generator Coupling set
7. AC Synchro transmitter& receiver – 1No.
8. Sufficient number of Digital multi meters, speed and torque sensors

INSTRUMENTATION:

9. R, L, C Bridge kit (with manual)
10. a) Electric heater – 1No.
    Thermometer – 1No.Thermistor (silicon type) RTD nickel type – 1No.

    b) 30 psi Pressure chamber (complete set) – 1No. Current generator (0 – 20mA) Air foot pump – 1 No. (with necessary connecting tubes)

    c) LVDT20mm core length movability type – 1No. CRO 30MHz – 1No. d)

    Optical sensor – 1 No. Light source

    e) Strain Gauge Kit with Handy lever beam – 1No.

100gm weights – 10 nos
f) Flow measurement Trainer kit – 1 No.
(1/2 HP Motor, Water tank, Digital Milliammeter, complete set)

11. Single phase Auto transformer – 1No. Watt-hour meter (energy meter) – 1No. Ammeter Voltmeter Rheostat Stop watch
Connecting wires (3/20)
12. IC Transistor kit – 1No.
13. Instrumentation Amplifier kit-1 No
14. Analog – Digital and Digital –Analog converters (ADC and DACs)- 1 No

20153L58 **OBJECT ORIENTED PROGRAMMING LABORATORY** **LT P C 0 0 3 2**

COURSE OBJECTIVES

- To build software development skills using java programming for real-world applications.
- To understand and apply the concepts of classes, packages, interfaces, arraylist, exception handling and file processing.
- To develop applications using generic programming and event handling.

List of experiments

1. Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection(i.e domestic or commercial). Compute the bill amount using the following tariff. If the type of the EB connection is domestic, calculate the amount to be paid as follows:
   - First 100 units - Rs. 1 per unit
   - 101-200 units - Rs. 2.50 per unit
   - 201 -500 units - Rs. 4 per unit
   - > 501 units - Rs. 6 per unit

   If the type of the EB connection is commercial, calculate the amount to be paid as follows:
   - First 100 units - Rs. 2 per unit
   - 101-200 units - Rs. 4.50 per unit
   - 201 -500 units - Rs. 6 per unit
   - > 501 units - Rs. 7 per unit
2. Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa) , time converter (hours to minutes, seconds and vice versa) using packages.
3. Develop a java application with Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
4. Design a Java interface for ADT Stack. Implement this interface using array. Provide necessary exception handling in both the implementations.
5. Write a program to perform string operations using ArrayList. Write functions for the following

   a. Append - add at end
   b. Insert – add at particular index c.
   Search
   d. List all string starts with given letter

6. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.
7. Write a Java program to implement user defined exception handling.
8. Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes.
9. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
10. Write a java program to find the maximum value from the given type of elements using a generic function.
11. Design a calculator using event-driven programming paradigm of Java with the following options.

    a) Decimal manipulations b) Scientific manipulations
12. Develop a mini project for any application using Java concepts.

COURSE OUTCOMES **TOTAL : 60 PERIODS**

Upon completion of the course, the students will be able to

- Develop and implement Java programs for simple applications that make use of classes, packages and interfaces.
- Develop and implement Java programs with arraylist, exception handling and multithreading .
- Design applications using file processing, generic programming and event handling.

20153L59 **PROFESSIONAL COMMUNICATION** **L T P C**
0 0 2 1

OBJECTIVES: The course aims to:

- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employability Graduates
- Develop their confidence and help them attend interviews successfully.

UNIT I

Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs

UNIT II

Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice–– presenting the visuals effectively – 5 minute presentations

UNIT III

Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic -— questioning and clarifying –GD strategies- activities to improve GD skills

UNIT IV

Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews

UNIT V

Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long- term career plan-making career changes.

TOTAL : 30 PERIODS

OUTCOMES: At the end of the course Learners will be ability to:

- Make effective presentations
- Participate confidently in Group Discussions.
- Attend job interviews and be successful in them.
- Develop adequate Soft Skills required for the workplace

Recommended Software

1. **Globearena**
2. **Win English**

REFERENCES:

1. Butterfield, Jeff **Soft Skills for Everyone.** Cengage Learning: New Delhi, 2015
2. **Interact** English Lab Manual for Undergraduate Students,. OrientBalckSwan: Hyderabad, 2016.
3. E. Suresh Kumar et al. **Communication for Professional Success.** Orient Blackswan: Hyderabad, 2015
4. Raman, Meenakshi and Sangeeta Sharma. **Professional Communication**. Oxford University Press: Oxford, 2014
5. S. Hariharanetal. **Soft Skills**. MJP Publishers: Chennai, 2010.

SOLID STATE DRIVES

20153C61

L	T	P	C
3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Steady state operation and transient dynamics of a motor load system.
- Analyze the operation of the converter/chopper fed dc drive, both qualitatively and quantitatively.
- Operation and performance of AC motor drives.
- Analyze and design the current and speed controllers for a closed loop solid state DC motor drive.

UNIT I DRIVE CHARACTERISTICS 9

Electric drive – Equations governing motor load dynamics – steady state stability – multi quadrant Dynamics: acceleration, deceleration, starting & stopping – typical load torque characteristics – Selection of motor.

UNIT II CONVERTER / CHOPPER FED DC MOTOR DRIVE 9

Steady state analysis of the single and three phase converter fed separately excited DC motor drive– continuous conduction – Time ratio and current limit control – 4 quadrant operation of converter / chopper fed drive- Applications.

UNIT III INDUCTION MOTOR DRIVES 9

Stator voltage control–V/f control– Rotor Resistance control-qualitative treatment of slip power recovery drives-closed loop control–– vector control- Applications.

UNIT IV SYNCHRONOUS MOTOR DRIVES 9

V/f control and self-control of synchronous motor: Margin angle control and power factor control- Three phase voltage/current source fed synchronous motor- Applications.

UNIT V DESIGN OF CONTROLLERS FOR DRIVES 9

Transfer function for DC motor / load and converter – closed loop control with Current and speed feedback–armature voltage control and field weakening mode – Design of controllers; current controller and speed controller- converter selection and characteristics.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and suggest a converter for solid state drive.
- Ability to select suitability drive for the given application.
- Ability to study about the steady state operation and transient dynamics of a motor load system.
- Ability to analyze the operation of the converter/chopper fed dc drive.
- Ability to analyze the operation and performance of AC motor drives.
- Ability to analyze and design the current and speed controllers for a closed loop solid state DC motor drive.

TEXT BOOKS:

1. Gopal K.Dubey, Fundamentals of Electrical Drives, Narosa Publishing House, 1992.
2. Bimal K.Bose. Modern Power Electronics and AC Drives, Pearson Education, 2002.
3. R.Krishnan, Electric Motor & Drives: Modeling, Analysis and Control, Pearson, 2001.

REFERENCES

1. Vedam Subramanyam, " Electric Drives Concepts and Applications ", 2e, McGraw Hill, 2016

2. Shaahin Felizadeh, “Electric Machines and Drives”, CRC Press (Taylor and Francis Group), 2013.
3. John Hindmarsh and Alasdain Renfrew, “Electrical Machines and Drives System,” Elsevier 2012.
4. Theodore Wildi, “ Electrical Machines ,Drives and power systems ,6th edition, Pearson Education ,2015
5. N.K. De., P.K. SEN” Electric drives” PHI, 2012.

20153C62	PROTECTION AND SWITCHGEAR	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Causes of abnormal operating conditions (faults, lightning and switching surges) of the apparatus and system.
- Characteristics and functions of relays and protection schemes.
- Apparatus protection, static and numerical relays
- Functioning of circuit breaker

UNIT I PROTECTION SCHEMES 9

Principles and need for protective schemes – nature and causes of faults – types of faults – Methods of Grounding - Zones of protection and essential qualities of protection – Protection scheme

UNIT II ELECTROMAGNETIC RELAYS 9

Operating principles of relays - the Universal relay – Torque equation – R-X diagram – Electromagnetic Relays – Over current, Directional, Distance, Differential, Negative sequence and Under frequency relays.

UNIT III APPARATUS PROTECTION 9

Current transformers and Potential transformers and their applications in protection schemes - Protection of transformer, generator, motor, bus bars and transmission line.

UNIT IV STATIC RELAYS AND NUMERICAL PROTECTION 9

Static relays – Phase, Amplitude Comparators – Synthesis of various relays using Static comparators – Block diagram of Numerical relays – Over current protection, transformer differential protection, distant protection of transmission lines.

UNIT V CIRCUIT BREAKERS 9

Physics of arcing phenomenon and arc interruption - DC and AC circuit breaking – re-striking voltage and recovery voltage - rate of rise of recovery voltage - resistance switching - current chopping - interruption of capacitive current - Types of circuit breakers – air blast, air break, oil, SF6, MCBs, MCCBs and vacuum circuit breakers – comparison of different circuit breakers – Rating and selection of Circuit breakers.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze Electromagnetic and Static Relays.
- Ability to suggest suitability circuit breaker.
- Ability to find the causes of abnormal operating conditions of the apparatus and system.

- Ability to analyze the characteristics and functions of relays and protection schemes.
- Ability to study about the apparatus protection, static and numerical relays.
- Ability to acquire knowledge on functioning of circuit breaker.

TEXT BOOKS:

1. Sunil S.Rao, 'Switchgear and Protection', Khanna Publishers, New Delhi, 2008.
2. B.Rabindranath and N.Chander, 'Power System Protection and Switchgear', New Age International (P) Ltd., First Edition 2011.
3. Arun Ingole, 'Switch Gear and Protection' Pearson Education, 2017.

REFERENCES

1. BadriRam ,B.H. Vishwakarma, 'Power System Protection and Switchgear', New Age InternationalPvt Ltd Publishers, Second Edition 2011.
2. Y.G.Paithankar and S.R.Bhide, 'Fundamentals of power system protection', Second Edition,Prentice Hall of India Pvt. Ltd., New Delhi, 2010.
3. C.L.Wadhwa, 'Electrical Power Systems', 6th Edition, New Age International (P) Ltd., 2010
4. RavindraP.Singh, 'Switchgear and Power System Protection', PHI Learning Private Ltd., NewDelhi, 2009.
5. VK Metha," Principles of Power Systems" S. Chand, 2005.
6. Bhavesh Bhalja, R.P. Maheshwari, Nilesh G. Chotani,'Protection and Switchgear' Oxford University Press, 2011.

20153C63	EMBEDDED SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES
:

To impart knowledge on the following Topics

- Building Blocks of Embedded System
- Various Embedded Development Strategies
- Bus Communication in processors, Input/output interfacing.
- Various processor scheduling algorithms.
- Basics of Real time operating system and example tutorials to discuss on one real time operating system tool.

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS 9

Introduction to Embedded Systems –Structural units in Embedded processor , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging.

UNIT II EMBEDDED NETWORKING 9

Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols RS232 standard – RS422 – RS 485 - CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I^2C) –need for device drivers.

UNIT III EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT 9

Embedded Product Development Life Cycle- objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model.

UNIT IV RTOS BASED EMBEDDED SYSTEM DESIGN 9

Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication shared memory, message passing-, Inter process Communication– synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance.

UNIT V EMBEDDED SYSTEM APPLICATION AND DEVELOPMENT 9

Case Study of Washing Machine- Automotive Application- Smart card System Application-ATM machine –Digital camera

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze Embedded systems.
- Ability to suggest an embedded system for a given application.
- Ability to operate various Embedded Development Strategies
- Ability to study about the bus Communication in processors.
- Ability to acquire knowledge on various processor scheduling algorithms.
- Ability to understand basics of Real time operating system.

TEXT BOOKS:

1. Peckol, “Embedded system Design”, John Wiley & Sons,2010
2. Lyla B Das,” Embedded Systems-An Integrated Approach”, Pearson, 2013
3. Shibu. K.V, “Introduction to Embedded Systems”, 2e, Mc graw Hill, 2017.

REFERENCES

1. Raj Kamal, ‘Embedded System-Architecture, Programming, Design’, Mc Graw Hill, 2013.
2. C.R.Sarma, “Embedded Systems Engineering”, University Press (India) Pvt. Ltd, 2013.
3. Tammy Noergaard, “Embedded Systems Architecture”, Elsevier, 2006.
4. Han-Way Huang, “Embedded system Design Using C8051”, Cengage Learning, 2009.
5. Rajib Mall “Real-Time systems Theory and Practice” Pearson Education, 2007.

20153L66	**POWER ELECTRONICS AND DRIVES LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**2**

OBJECTIVES:

- To provide hands on experience with power electronic converters and testing.

LIST OF EXPERIMENTS

1. Gate Pulse Generation using R, RC and UJT.
2. Characteristics of SCR and TRIAC
3. Characteristics of MOSFET and IGBT
4. AC to DC half controlled converter
5. AC to DC fully controlled Converter
6. Step down and step up MOSFET based choppers
7. IGBT based single phase PWM inverter

8 IGBT based three phase PWM inverter
9 AC Voltage controller
10 Switched mode power converter.
11 Simulation of PE circuits (1Φ & 3Φ semi converters, 1Φ & 3Φ full converters, DC-DC converters, AC voltage controllers).
12 Characteristics of GTO & IGCT.
13 Characteristics of PMBLDC motor

TOTAL: 60 PERIODS

OUTCOMES:

- Ability to practice and understand converter and inverter circuits and apply software for engineering problems.
- Ability to experiment about switching characteristics various switches.
- Ability to analyze about AC to DC converter circuits.
- Ability to analyze about DC to AC circuits.
- Ability to acquire knowledge on AC to AC converters
- Ability to acquire knowledge on simulation software.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Device characteristics(for SCR, MOSFET, TRIAC,GTO,IGCT and IGBT kit with built-in / discrete power supply and meters) - 2 each
2. SinglephaseSCRbasedhalfcontrolledconverterandfullycontrolledconverteralong with built-in/separate/firing circuit/module and meter – 2 each
3. MOSFET based step up and step down choppers (Built in/ Discrete) – 1 each
4. IGBT based single phase PWM inverter module/Discrete Component – 2
5. IGBT based three phase PWM inverter module/Discrete Component – 2
6. Switched mode power converter module/Discrete Component – 2
7. SCR &TRIAC based 1 phase AC controller along with lamp or rheostat load - 2
8. Cyclo converter kit with firing module – 1
9. Dual regulated DC power supply with common ground
10. Cathode ray Oscilloscope –10
11. Isolation Transformer – 5
12. Single phase Auto transformer –3
13. Components (Inductance, Capacitance) 3 set for each
14. Multimeter – 5
15. LCR meter – 3
16. Rheostats of various ranges – 2 sets of 10 value
17. Work tabilitys – 10
18. DC and AC meters of required ranges – 20
19. Component data sheets to be provided

20153L67 MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:

- To provide training on programming of microprocessors and microcontrollers and understand the interface requirements.
- To simulate various microprocessors and microcontrollers using KEIL or Equivalent simulator.

LIST OF EXPERIMENTS

1 Simple arithmetic operations: addition / subtraction / multiplication / division.

2 Programming with control instructions:

(i) Ascending / Descending order, Maximum / Minimum of numbers. (ii) Programs using Rotate instructions.

(iii) Hex / ASCII / BCD code conversions.

3 Interface Experiments: with 8085

(i) A/D Interfacing. & D/A Interfacing.

4 Traffic light controller.

5 I/O Port / Serial communication

6 Programming Practices with Simulators/Emulators/open source

7 Read a key ,interface display

8 Demonstration of basic instructions with 8051 Micro controller execution, including: (i) Conditional jumps & looping

(ii) Calling subroutines.

9 Programming I/O Port and timer of 8051 (i) study on interface with A/D & D/A

(ii) Study on interface with DC & AC motors

10 Application hardware development using embedded processors.

TOTAL: 60 PERIODS

OUTCOMES:

- Ability to understand and apply computing platform and software for engineering problems.
- Ability to programming logics for code conversion.
- Ability to acquire knowledge on A/D and D/A.
- Ability to understand basics of serial communication.
- Ability to understand and impart knowledge in DC and AC motor interfacing.
- Ability to understand basics of software simulators.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Sl.No.	Description of Equipment	Quantity required
1.	8085 Microprocessor Trainer with Power Supply	15
2.	8051 Micro Controller Trainer Kit with power supply	15
3.	8255 Interface boards	5
4.	8251 Interface boards	5

5.	8259 Interface boards	5
6.	8279 Keyboard / Display Interface boards	5
7.	8254 timer/ counters	5
8.	ADC and DAC cards	5
9.	AC & DC motor with Controller s	5
10.	Traffic Light Control Systems	5

20153MP68 **MINI PROJECT** **LT P C**
0 0 4 2

OBJECTIVES:

- To develop their own innovative prototype of ideas.
- To train the students in preparing mini project reports and examination.

The students in a group of 5 to 6 works on a topic approved by the head of the department and prepares a comprehensive mini project report after completing the work to the satisfaction. The progress of the project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department. A mini project report is required at the end of the semester. The mini project work is evaluated based on oral presentation and the mini project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 60 PERIODS

OUTCOMES:

- On Completion of the mini project work students will be in a position to take up their final year project work and find solution by formulating proper methodology.

20153C71	**HIGH VOLTAGE ENGINEERING**	**L T P C** **3 0 0 3**

OBJECTIVES:

To impart knowledge on the following Topics

- Various types of over voltages in power system and protection methods.
- Generation of over voltages in laboratories.
- Measurement of over voltages.
- Nature of Breakdown mechanism in solid, liquid and gaseous dielectrics.
- Testing of power apparatus and insulation coordination

UNIT I OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS 9

Causes of over voltages and its effects on power system – Lightning, switching surges and temporary over voltages, Corona and its effects – Bewley lattice diagram- Protection against over voltages.

UNIT II DIELECTRIC BREAKDOWN 9

Properties of Dielectric materials - Gaseous breakdown in uniform and non-uniform fields – Corona discharges – Vacuum breakdown – Conduction and breakdown in pure and commercial liquids, Maintenance of oil Quality – Breakdown mechanisms in solid and composite dielectrics- Applications of insulating materials in electrical equipments.

UNIT III GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS 9

Generation of High DC voltage: Rectifiers, voltage multipliers, vandigraff generator: generation of high impulse voltage: single and multistage Marx circuits – generation of high AC voltages: cascaded transformers, resonant transformer and tesla coil- generation of switching surges – generation of impulse currents - Triggering and control of impulse generators.

UNIT IV MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS 9

High Resistance with series ammeter – Dividers, Resistance, Capacitance and Mixed dividers - Peak Voltmeter, Generating Voltmeters - Capacitance Voltage Transformers, Electrostatic Voltmeters – Sphere Gaps - High current shunts- Digital techniques in high voltage measurement.

UNIT V HIGH VOLTAGE TESTING & INSULATION COORDINATION 9

High voltage testing of electrical power apparatus as per International and Indian standards – Power frequency, impulse voltage and DC testing of Insulators, circuit breakers, bushing, isolators and transformers- Insulation Coordination& testing of cabilitys.

OUTCOMES: **TOTAL : 45 PERIODS**

- Ability to understand Transients in power system.
- Ability to understand Generation and measurement of high voltage.
- Ability to understand High voltage testing.
- Ability to understand various types of over voltages in power system.
- Ability to measure over voltages.
- Ability to test power apparatus and insulation coordination

TEXT BOOKS:

1. S.Naidu and V. Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, Fifth Edition, 2013.

2. E. Kuffel and W.S. Zaengl, J.Kuffel, 'High voltage Engineering fundamentals', Newnes Second Edition Elsevier , New Delhi, 2005.

3. C.L. Wadhwa, 'High voltage Engineering', New Age International Publishers, Third Edition, 2010.

REFERENCES

1. L.L. Alston, 'High Voltage Technology', Oxford University Press, First Indian Edition, 2011.

2. Mazen Abdel – Salam, Hussein Anis, Ahdab A-Morshedy, Roshday Radwan, High Voltage Engineering – Theory &Practice, Second Edition Marcel Dekker, Inc., 2010.

3. Subir Ray,' An Introduction to High Voltage Engineering' PHI Learning Private Limited, New Delhi, Second Edition, 2013.

20153C72	**POWER SYSTEM OPERATION AND CONTROL**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

To impart knowledge on the following topics

- Significance of power system operation and control.
- Real power-frequency interaction and design of power-frequency controller.
- Reactive power-voltage interaction and the control actions to be implemented for maintaining the voltage profile against varying system load.
- Economic operation of power system.
- SCADA and its application for real time operation and control of power systems

UNIT I PRELIMINARIES ON POWER SYSTEM OPERATION AND CONTROL 9

Power scenario in Indian grid – National and Regional load dispatching centers – requirements of good power system - necessity of voltage and frequency regulation - real power vs frequency and reactive power vs voltage control loops - system load variation, load curves and basic concepts of load dispatching - load forecasting - Basics of speed governing mechanisms and modeling - speed load characteristics - regulation of two generators in parallel.

UNIT II REAL POWER - FREQUENCY CONTROL 9

Load Frequency Control (LFC) of single area system-static and dynamic analysis of uncontrolled and controlled cases - LFC of two area system - tie line modeling - block diagram representation of two area system - static and dynamic analysis - tie line with frequency bias control – state variability model - integration of economic dispatch control with LFC.

UNIT III REACTIVE POWER – VOLTAGE CONTROL 9

Generation and absorption of reactive power - basics of reactive power control – Automatic Voltage Regulator (AVR) – brushless AC excitation system – block diagram representation of AVR loop - static and dynamic analysis – stability compensation – voltage drop in transmission line - methods of reactive power injection - tap changing transformer, SVC (TCR + TSC) and STATCOM for voltage control.

UNIT IV ECONOMIC OPERATION OF POWER SYSTEM 9

Statement of economic dispatch problem - input and output characteristics of thermal plant - incremental cost curve - optimal operation of thermal units without and with transmission losses (no derivation of transmission loss coefficients) - base point and participation factors method - statement of unit commitment (UC) problem - constraints on UC problem - solution of UC problem using priority list – special aspects of short term and long term hydrothermal problems.

UNIT V COMPUTER CONTROL OF POWER SYSTEMS 9

Need of computer control of power systems-concept of energy control centers and functions – PMU - system monitoring, data acquisition and controls - System hardware configurations - SCADA and EMS functions - state estimation problem – measurements and errors - weighted least square estimation - various operating states - state transition diagram.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand the day-to-day operation of electric power system.
- Ability to analyze the control actions to be implemented on the system to meet the minute-to-minute variation of system demand.
- Ability to understand the significance of power system operation and control.
- Ability to acquire knowledge on real power-frequency interaction.
- Ability to understand the reactive power-voltage interaction.
- Ability to design SCADA and its application for real time operation

TEXT BOOKS:

1. Olle.I.Elgerd, 'Electric Energy Systems theory - An introduction', McGraw Hill Education Pvt. Ltd., New Delhi, 34th reprint, 2010.

2. Allen. J. Wood and Bruce F. Wollen berg, 'Power Generation, Operation and Control', John Wiley & Sons, Inc., 2016.

3. Abhijit Chakrabarti and Sunita Halder, 'Power System Analysis Operation and Control', PHI learning Pvt. Ltd., New Delhi, Third Edition, 2010.

REFERENCES

1. Kothari D.P. and Nagrath I.J., 'Power System Engineering', Tata McGraw-Hill Education, Second Edition, 2008.

2. Hadi Saadat, 'Power System Analysis', McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.

3. Kundur P., 'Power System Stability and Control, McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.

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20153C73 **RENEWABLE ENERGY SYSTEMS**

L	T	P	C
3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Awareness about renewable Energy Sources and technologies. Adequate
- inputs on a variety of issues in harnessing renewable Energy. Recognize
- current and possible future role of renewable energy sources.

UNIT I RENEWABLE ENERGY (RE) SOURCES 9

Environmental consequences of fossil fuel use, Importance of renewable sources of energy, Sustainable Design and development, Types of RE sources, Limitations of RE sources, Present Indian and international energy scenario of conventional and RE sources.

UNIT II WIND ENERGY 9

Power in the Wind – Types of Wind Power Plants(WPPs)–Components of WPPs-Working of WPPs-Siting of WPPs-Grid integration issues of WPPs.

UNIT III SOLAR PV AND THERMAL SYSTEMS 9

Solar Radiation, Radiation Measurement, Solar Thermal Power Plant, Central Receiver Power Plants, Solar Ponds.- Thermal Energy storage system with PCM- Solar Photovoltaic systems : Basic Principle of SPV conversion – Types of PV Systems- Types of Solar Cells, Photovoltaic cell concepts: Cell, module, array ,PV Module I-V Characteristics, Efficiency & Quality of the Cell, series and parallel connections, maximum power point tracking, Applications.

UNIT IV BIOMASS ENERGY 9

Introduction-Bio mass resources –Energy from Bio mass: conversion processes-Biomass Cogeneration-Environmental Benefits. Geothermal Energy: Basics, Direct Use, Geothermal Electricity. Mini/micro hydro power: Classification of hydropower schemes, Classification of water turbine, Turbine theory, Essential components of hydroelectric system.

UNIT V OTHER ENERGY SOURCES 9

Tidal Energy: Energy from the tides, Barrage and Non Barrage Tidal power systems. Wave Energy: Energy from waves, wave power devices. Ocean Thermal Energy Conversion (OTEC)- Hydrogen Production and Storage- Fuel cell : Principle of working- various types - construction and applications. Energy Storage System- Hybrid Energy Systems.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to create awareness about renewable Energy Sources and technologies.
- Ability to get adequate inputs on a variety of issues in harnessing renewable Energy.
- Ability to recognize current and possible future role of renewable energy sources.
- Ability to explain the various renewable energy resources and technologies and their applications.
- Ability to understand basics about biomass energy.
- Ability to acquire knowledge about solar energy.

TEXT BOOKS:

1. Joshua Earnest, Tore Wizeliu, 'Wind Power Plants and Project Development', PHI Learning Pvt.Ltd, New Delhi, 2011.

2. D.P.Kothari, K.C Singal, Rakesh Ranjan "Renewable Energy Sources and Emerging Technologies", PHI Learning Pvt.Ltd, New Delhi, 2013.

3. Scott Grinnell, "Renewable Energy & Sustainable Design", CENGAGE Learning, USA, 2016.

REFERENCES

1. A.K.Mukerjee and Nivedita Thakur," Photovoltaic Systems: Analysis and Design", PHI Learning Private Limited, New Delhi, 2011

2. Richard A. Dunlap," Sustainable Energy" Cengage Learning India Private Limited, Delhi, 2015.

3. Chetan Singh Solanki, " Solar Photovoltaics : Fundamentals, Technologies and Applications", PHI Learning Private Limited, New Delhi, 2011

4. Bradley A. Striebig,Adebayo A.Ogundipe and Maria Papadakis," Engineering Applications in Sustainable Design and Development", Cengage Learning India Private Limited, Delhi, 2016.

5. Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.

6. Shobh Nath Singh, 'Non-conventional Energy resources' Pearson Education ,2015.

20153L77	**POWER SYSTEM SIMULATION LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**2**

OBJECTIVES:

- To provide better understanding of power system analysis through digital simulation.

LIST OF EXPERIMENTS

1 Computation of Transmission Line Parameters
2 Formation of Bus Admittance and Impedance Matrices and Solution of Networks
3 Power Flow Analysis using Gauss-Seidel Method
4 Power Flow Analysis using Newton Raphson Method
5 Symmetric and unsymmetrical fault analysis
6 Transient stability analysis of SMIB System
7 Economic Dispatch in Power Systems
8 Load – Frequency Dynamics of Single- Area and Two-Area Power Systems
9 State estimation: Weighted least square estimation
10 Electromagnetic Transients in Power Systems : Transmission Line Energization

OUTCOMES: **TOTAL: 60 PERIODS**

- Ability to understand power system planning and operational studies.
- Ability to acquire knowledge on Formation of Bus Admittance and Impedance Matrices and Solution of Networks.
- Ability to analyze the power flow using GS and NR method
- Ability to find Symmetric and Unsymmetrical fault
- Ability to understand the economic dispatch.
- Ability to analyze the electromagnetic transients.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Personal computers (Intel i3, 80GB, 2GBRAM) – 30 nos
2. Printer laser- 1 No.
3. Dot matrix- 1 No.
4. Server (Intel i5, 80GB, 2GBRAM) (High Speed Processor) – 1 No.
5. Software: any power system simulation software with 5 user license
6. Compliers: C, C++, VB, VC++ - 30 users

RENEWABLE ENERGY SYSTEMS LABORATORY	L	T	P	C
	0	0	3	2

OBJECTIVES:

- To train the students in Renewable Energy Sources and technologies.
- To provide adequate inputs on a variety of issues in harnessing Renewable Energy.
- To recognize current and possible future role of Renewable energy sources.

LIST OF EXPERIMENTS

1 Simulation study on Solar PV Energy System.

2 Experiment on "VI-Characteristics and Efficiency of 1kWp Solar PV System".

3 Experiment on "Shadowing effect & diode based solution in 1kWp Solar PV System".

4 Experiment on Performance assessment of Grid connected and Standalone 1kWp Solar Power System.

5 Simulation study on Wind Energy Generator.

6 Experiment on Performance assessment of micro Wind Energy Generator.

7 Simulation study on Hybrid (Solar-Wind) Power System.

8 Experiment on Performance Assessment of Hybrid (Solar-Wind) Power System.

9 Simulation study on Hydel Power.

10 Experiment on Performance Assessment of 100W Fuel Cell.

11 Simulation study on Intelligent Controllers for Hybrid Systems.

OUTCOMES:

- Ability to understand and analyze Renewable energy systems.

TOTAL: 60 PERIODS

- Ability to train the students in Renewable Energy Sources and technologies.
- Ability to provide adequate inputs on a variety of issues in harnessing Renewable Energy.
- Ability to simulate the various Renewable energy sources.
- Ability to recognize current and possible future role of Renewable energy sources.
- Ability to understand basics of Intelligent Controllers.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S.No	Name of the equipments / Components	Quantity Required	Remarks
1.	Personal computers (Intel i3, 80GB, 2GBRAM)	15	-
2.	CRO	9	30MHz
3.	Digital Multimeter	10	Digital
4.	PV panels - 100W, 24V	1	
5.	Battery storage system with charge and discharge control 40Ah	1	
6.	PV Emulator	1	
7.	Micro Wind Energy Generator module	1	

Consumabilitys (Minimum of 5 Nos. each)			
8.	Potentiometer	5	-
9.	Step-down transformer	5	230V/12-0-12V
10	Component data sheets to be provided		

17153CEC -COMPS 0 0 2 2

Electric Circuits and Fields:

Network graph, KCL, KVL, node and mesh analysis, transient response of dc and ac networks; sinusoida steady-state analysis, resonance, basic filter concepts; ideal current and voltage sources, Thevenin’s Norton’s and Superposition and Maximum Power Transfer theorems, two-port networks, three phas circuits; Gauss Theorem, electric field and potential due to point, line, plane and spherical charg distributions; Ampere’s and Biot-Savart’s laws; inductance; dielectrics; capacitance.

Signals and Systems:

Representation of continuous and discrete-time signals; shifting and scaling operations; linear, time invariant and causal systems; Fourier series representation of continuous periodic signals; sampling theorem; Fourier, Laplace and Z transforms.

Electrical Machines:

Single phase transformer – equivalent circuit, phasor diagram, tests, regulation and efficiency; three phase transformers – connections, parallel operation; auto-transformer; energy conversion principles; DC machines – types, windings, generator characteristics, armature reaction and commutation, starting and speed control of motors; three phase induction motors – principles, types, performance characteristics, starting and speed control; single phase induction motors; synchronous machines – performance, regulation and parallel operation of generators, motor starting, characteristics and applications; servo and stepper motors.

Power Systems:

Basic power generation concepts; transmission line models and performance; cable performance, insulation; corona and radio interference; distribution systems; per-unit quantities; bus impedance and admittance matrices; load flow; voltage control; power factor correction; economic operation; symmetrical components; fault analysis; principles of over-current, differential and distance protection; solid state relays and digital protection; circuit breakers; system stability concepts, swing curves and equal area criterion; HVDC transmission and FACTS concepts.

Control Systems:

Principles of feedback; transfer function; block diagrams; steady-state errors; Routh and Niquist techniques; Bode plots; root loci; lag, lead and lead-lag compensation; state space model; state transition matrix, controllability and observability.

Electrical and Electronic Measurements:

Bridges and potentiometers; PMMC, moving iron, dynamometer and induction type instruments; measurement of voltage, current, power, energy and power factor; instrument transformers; digital voltmeters and multimeters; phase, time and frequency measurement; Q-meters; oscilloscopes; potentiometric recorders; error analysis.

Analog and Digital Electronics:
Characteristics of diodes, BJT, FET; amplifiers – biasing, equivalent circuit and frequency response; oscillators and feedback amplifiers; operational amplifiers – characteristics and applications; simple active filters; VCOs and timers; combinational and sequential logic circuits; multiplexer; Schmitt trigger; multi-vibrators; sample and hold circuits; A/D and D/A converters; 8-bit microprocessor basics, architecture, programming and interfacing.

Power Electronics and Drives:
Semiconductor power diodes, transistors, thyristors, triacs, GTOs, MOSFETs and IGBTs – static characteristics and principles of operation; triggering circuits; phase control rectifiers; bridge converters – fully controlled and half controlled; principles of choppers and inverters; basis concepts of adjustable speed dc and ac drives.

20153E64A **ADVANCED CONTROL SYSTEM** **LT P C**
2 2 0 3

OBJECTIVES

i. To provide knowledge on design state feedback control and state observer.
ii. To provide knowledge in phase plane analysis.
iii. To give basic knowledge in describing function analysis.
iv. To study the design of optimal controller.
v. To study the design of optimal estimator including Kalman Filter

UNIT I STATE VARIABLE ANALYSIS 6+6

Introduction- concepts of state variables and state model-State model for linear continuous time systems, Diagonalisation- solution of state equations- Concepts of controllability and observability.

UNIT II STATE VARIABLE DESIGN 6+6

Introduction to state model: Effect of state feedback - Pole placement design: Necessary and sufficient condition for arbitrary pole placement, State regulator design Design of state observers- Separation principle- Design of servo systems: State feedback with integral control.

UNIT III SAMPLED DATA ANALYSIS 6+6

Introduction spectrum analysis of sampling process signal reconstruction difference equations The Z transform function, the inverse Z transform function, response of Linear discrete system, the Z transform analysis of sampled data control systems, response between sampling instants, the Z and S domain relationship. Stability analysis and compensation techniques.

UNIT IV NON LINEAR SYSTEMS 6+6

Introduction, common physical nonlinearites, The phase plane method: concepts, singular points, stability of non linear systems, construction of phase trajectories system analysis by phase plane method. The describing function method, stability analysis by describing function method, Jump resonance.

UNIT V OPTIMAL CONTROL 6+6

Introduction: Classical control and optimization, formulation of optimal control problem, Typical optimal control performance measures - Optimal state regulator design: Lyapunov equation, Matrix Riccati equation - LQR steady state optimal control – Application examples.

OUTCOMES: **TOTAL: 60 PERIODS**

i. Able to design state feedback controller and state observer.
ii. Able to understand and analyse linear and nonlinear systems using phase plane method.
iii. Able to understand and analyse nonlinear systems using describing function method.
iv. Able to understand and design optimal controller.
v. Able to understand optimal estimator including Kalman Filter.
vi. Ability to apply advanced control strategies to practical engineering problems.

TEXT BOOKS:

1. M.Gopal, “Digital Control and State Variable Methods”, 4^{th} edition, Mc Graw Hill India, 2012
2. K. Ogata, ‘Modern Control Engineering’, 5th Edition, Pearson, 2012.
3. K. P. Mohandas, “Modern Control Engineering”, Sanguine Technical Publishers, 2006.

REFERENCES:

1. M.Gopal, Modern Control System Theory, 3^{rd} edition, New Age International Publishers, 2014.
2. William S Levine, “Control System Fundamentals,” The Control Handbook, CRC Press, Tayler and Francies Group, 2011.
3. Ashish Tewari, ‘Modern Control Design with Matlab and Simulink’, John Wiley, New Delhi, 2002.
4. T. Glad and L. Ljung,, “Control Theory –Multivariable and Non-Linear Methods”, Taylor & Francis, 2002.

20153E64B VISUAL LANGUAGES AND APPLICATIONS

L	T	P	C
3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- To study about the concepts of windows programming models, MFC applications, drawing with the GDI, getting inputs from Mouse and the Keyboard.
- To study the concepts of Menu basics, menu magic and classic controls of the windows programming using VC++.
- To study the concept of Document/View Architecture with single & multiple document interface, toolbars, status bars and File I/O Serialization.
- To study about the integrated development programming event driven programming, variabilitys, constants, procedures and basic ActiveX controls in visual basic.
- To understand the database and the database management system, visual data manager, data bound controls and ADO controls in VB.

UNIT I FUNDAMENTALS OF WINDOWS AND MFC 9

Messages - Windows programming - SDK style - Hungarian notation and windows data types - SDK programming in perspective. The benefits of C++ and MFC - MFC design philosophy – Document / View architecture - MFC class hierarchy - AFX functions. Application object - Frame window object - Message map. Drawing the lines – Curves – Ellipse – Polygons and other shapes. GDI pens – Brushes - GDI fonts - Deleting GDI objects and deselecting GDI objects. Getting input from the mouse: Client & Non-client - Area mouse messages - Mouse wheel - Cursor. Getting input from the keyboard: Input focus - Keystroke messages - Virtual key codes - Character & dead key messages.

UNIT II RESOURCES AND CONTROLS 9

Creating a menu – Loading and displaying a menu – Responding to menu commands – Command ranges - Updating the items in menu, update ranges – Keyboard accelerators. Creating menus programmatically - Modifying menus programmatically - The system menu - Owner draw menus – Cascading menus - Context menus. The C button class – C list box class – C static class - The font view application – C edit class – C combo box class – C scrollbar class. Model dialog boxes – Modeless dialog boxes.

UNIT III DOCUMENT / VIEW ARCHITECTURE 9

The in existence function revisited – Document object – View object – Frame window object – Dynamic object creation. SDI document template - Command routing. Synchronizing multiple views of a document – Mid squares application – Supporting multiple document types – Alternatives to MDI. Splitter Windows: Dynamic splitter window – Static splitter windows. Creating & initializing a toolbar - Controlling the toolbar's visibility – Creating & initializing a status bar - Creating custom status bar panes – Status bar support in appwizard. Opening, closing and creating the files - Reading & Writing – C file derivatives – Serialization basics - Writing serializability classes.

UNIT IV FUNDAMENTALS OF VISUAL BASIC 9

Menu bar – Tool bar – Project explorer – Toolbox – Properties window – Form designer – Form layout – Intermediate window. Designing the user interface: Aligning the controls – Running the application – Visual development and event driven programming.

Variabilitys: Declaration – Types – Converting variability types – User defined data types - Lifetime of a variability. Constants - Arrays – Types of arrays. Procedures: Subroutines – Functions – Calling procedures. Text box controls – List box & Combo box controls – Scroll bar and slider controls – File controls.

UNIT V DATABASE PROGRAMMING WITH VB 9

Record sets – Data control – Data control properties, methods. Visual data manager: Specifying indices with the visual data manager – Entering data with the visual data manager. Data bound list control – Data bound combo box – Data bound grid control. Mapping databases: Database object – Tability def object, Query def object. Programming the active database objects – ADO object model – Establishing a connection - Executing SQL statements – Cursor types and locking mechanism – Manipulating the record set object – Simple record editing and updating.

OUTCOMES:

- Ability to understand and apply computing platform and software for engineering problems
- Ability to study about the concepts of windows programming models.
- Ability to study the concepts of Menu basics, menu magic and classic controls.
- Ability to study the concept of Document/View Architecture with single & multiple document interface.
- Ability to study about the integrated development programming event driven programming.
- Ability to understand the database and the database management system.

TEXT BOOKS:

1. Jeff Prosise, 'Programming Windows With MFC', Second Edition, WP Publishers & Distributors (P) Ltd, Reprinted, 2002.
2. Evangelos Petroutsos, 'Mastering Visual Basic 6.0', BPB Publications, 2002.

REFERENCES

1. Herbert Schildt, 'MFC Programming From the Ground Up', Second Edition, McGraw Hill, reprinted, 2002.
2. John Paul Muller, 'Visual C++ 6 From the Ground Up Second Edition', McGraw Hill, Reprinted, 2002.
3. Curtis Smith & Micheal Amundsen, 'Teach Yourself Database Programming with Visual Basic 6 in 21 days', Techmedia Pub, 1999.

20153E64C	DESIGN OF ELECTRICAL APPARATUS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Magnetic circuit parameters and thermal rating of various types of electrical machines.
- Armature and field systems for D.C. machines.
- Core, yoke, windings and cooling systems of transformers.
- Design of stator and rotor of induction machines and synchronous machines.
- The importance of computer aided design method.

UNIT I DESIGN OF FIELD SYSTEM AND ARMATURE 9

Major considerations in Electrical Machine Design – Materials for Electrical apparatus – Design of Magnetic circuits – Magnetising current – Flux leakage – Leakage in Armature. Design of lap winding and wave winding.

UNIT II DESIGN OF TRANSFORMERS 9

Construction - KVA output for single and three phase transformers – Overall dimensions – design of yoke, core and winding for core and shell type transformers – Estimation of No load current – Temperature rise in Transformers – Design of Tank and cooling tubes of Transformers. Computer program: Complete Design of single phase core transformer

UNIT III DESIGN OF DC MACHINES 9

Construction - Output Equations – Main Dimensions – Choice of specific loadings – Selection of number of poles – Design of Armature – Design of commutator and brushes – design of field Computer program: Design of Armature main dimensions

UNIT IV DESIGN OF INDUCTION MOTORS 9

Construction - Output equation of Induction motor – Main dimensions – choice of specific loadings – Design of squirrel cage rotor and wound rotor –Magnetic leakage calculations – Operating characteristics : Magnetizing current - Short circuit current – Circle diagram - Computer program: Design of slip-ring rotor

UNIT V DESIGN OF SYNCHRONOUS MACHINES 9

Output equations – choice of specific loadings – Design of salient pole machines – Short circuit ratio – Armature design – Estimation of air gap length – Design of rotor –Design of damper winding – Determination of full load field MMF – Design of field winding – Design of turbo alternators -Computer program: Design of Stator main dimensions-Brushless DC Machines

OUTCOMES: **TOTAL : 45 PERIODS**

- Ability to understand basics of design considerations for rotating and static electrical machines
- Ability to design of field system for its application.
- Ability to design sing and three phase transformer.
- Ability to design armature and field of DC machines.
- Ability to design stator and rotor of induction motor.

TEXT BOOKS:

1. Sawhney, A.K., ‘A Course in Electrical Machine Design’, Dhanpat Rai& Sons, New Delhi, Fifth Edition, 1984.
2. M V Deshpande ‘Design and Testing of Electrical Machines’ PHI learning Pvt Lt, 2011.
3. Sen, S.K., ‘Principles of Electrical Machine Designs with Computer Programmes’, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, Second Edition, 2009.

REFERENCES

1. A.Shanmugasundaram, G.Gangadharan, R.Palani ‘Electrical Machine Design Data Book’, New Age International Pvt. Ltd., Reprint 2007.
2. ‘Electrical Machine Design’, Balbir Singh, Vikas Publishing House Private Limited, 1981.
3. V Rajini, V.S Nagarajan, ‘Electrical Machine Design’, Pearson, 2017.
4. K.M.Vishnumurthy ‘Computer aided design of electrical machines’ B S Publications,2008

20153E64D **POWER SYSTEM STABILITY**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the fundamental concepts of stability of power systems and its classification.
- To expose the students to dynamic behaviour of the power system for small and large disturbances.
- To understand and enhance the stability of power systems.

UNIT I INTRODUCTION TO STABILITY 9

Fundamental concepts - Stability and energy of a system - Power System Stability: Definition, Causes, Nature and Effects of disturbances, Classification of stability, Modelling of electrical components - Basic assumptions made in stability studies- Modelling of Synchronous machine for stability studies(classical model) - Rotor dynamics and the swing equation.

UNIT II SMALL-SIGNAL STABILITY 9

Basic concepts and definitions – State space representation, Physical Interpretation of small–signal stability, Eigen properties of the state matrix: Eigenvalues and eigenvectors, modal matrices, eigenvalue and stability, mode shape and participation factor. Small– signal stability analysis of a Single-Machine Infinite Bus (SMIB) Configuration with numerical example.

UNIT III TRANSIENT STABILITY 9

Review of numerical integration methods: modified Euler and Fourth Order Runge-Kutta methods, Numerical stability,. Interfacing of Synchronous machine (classical machine) model to the transient stability algorithm (TSA) with partitioned – explicit approaches- Application of TSA to SMIB system.

UNIT IV VOLTAGE STABILITY 9

Factors affecting voltage stability- Classification of Voltage stability-Transmission system characteristics- Generator characteristics- Load characteristics- Characteristics of reactive power compensating Devices- Voltage collapse.

UNIT V ENHANCEMENT OF SMALL-SIGNAL STABILITY AND TRANSIENT STABILITY 9

Power System Stabilizer –. Principle behind transient stability enhancement methods: high-speed fault clearing, regulated shunt compensation, dynamic braking, reactor switching, independent pole-operation of circuit-breakers, single-pole switching, fast- valving, high-speed excitation systems.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will attain knowledge about the stability of power system
- Learners will have knowledge on small-signal stability, transient stability and voltage stability.
- Learners will be able to understand the dynamic behaviour of synchronous generator for different disturbances.
- Learners will be able to understand the various methods to enhance the stability of a power system.

TEXT BOOKS:

1. Power system stability and control ,P. Kundur ; edited by Neal J. Balu, Mark G. Lauby, McGraw-Hill, 1994.
2. R.Ramnujam," Power System Dynamics Analysis and Simulation, PHI Learning Private Limited, New Delhi, 2009
3. T.V. Cutsem and C.Vournas, "Voltage Stability of Electric Power Systems", Kluwer publishers, 1998.

REFERENCES

1 Peter W., Saucer, Pai M.A., "Power System Dynamics and Stability, Pearson Education (Singapore), 9th Edition, 2007.

2 EW. Kimbark., "Power System Stability", John Wiley & Sons Limited, New Jersey, 2013.

3 SB. Crary., "Power System Stability", John Wiley & Sons Limited, New Jersey, 1955.

4 K.N. Shubhanga,"Power System Analysis" Pearson, 2017.

5 Power systems dynamics: Stability and control / K.R. Padiyar, BS Publications, 2008

6 Power system control and Stability P.M. Anderson, A.A. Foud, Iowa State University Press, 1977.

20153E64E	MODERN POWER CONVERTERS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Switched mode power supplies
- Matrix Converter
- Soft switched converters

UNIT I SWITCHED MODE POWER SUPPLIES (SMPS) 9

DC Power supplies and Classification; Switched mode dc power supplies - with and without isolation, single and multiple outputs; Closed loop control and regulation; Design examples on converter and closed loop performance.

UNIT II AC-DC CONVERTERS 9

Switched mode AC-DC converters. synchronous rectification - single and three phase topologies - switching techniques - high input power factor . reduced input current harmonic distortion. improved efficiency. with and without input-output isolation. performance indices design examples

UNIT III DC-AC CONVERTERS 9

Multi-level Inversion - concept, classification of multilevel inverters, Principle of operation, main features and analysis of Diode clamped, Flying capacitor and cascaded multilevel inverters; Modulation schemes.

UNIT IV AC-AC CONVERTERS WITH AND WITHOUT DC LINK 9

Matrix converters. Basic topology of matrix converter; Commutation – current path; Modulation techniques - scalar modulation, indirect modulation; Matrix converter as only AC-DC converter; AC-AC converter with DC link - topologies and operation - with and without resonance link - converter with dc link converter; Performance comparison with matrix converter with DC link converters.

UNIT V SOFT-SWITCHING POWER CONVERTERS 9

Soft switching techniques. ZVS, ZCS, quasi resonance operation; Performance comparison hard switched and soft switched converters.AC-DC converter, DC-DC converter, DC-AC converter.; Resonant DC power supplies .

OUTCOMES: **TOTAL : 45 PERIODS**

- Ability to suggest converters for AC-DC conversion and SMPS

TEXT BOOKS:

1. Power Electronics Handbook, M.H.Rashid, Academic press, New york, 2000.
2. Advanced DC/DC Converters, Fang Lin Luo and Fang Lin Luo, CRC Press, NewYork, 2004.
3. Control in Power Electronics- Selected Problem, Marian P.Kazmierkowski, R.Krishnan and Frede Blaabjerg, Academic Press (Elsevier Science), 2002.

REFERENCES

1. Power Electronic Circuits, Issa Batarseh, John Wiley and Sons, Inc.2004
2. Power Electronics for Modern Wind Turbines, Frede Blaabjerg and Zhe Chen, Morgan & Claypool Publishers series, United States of America, 2006.
3. Krein Philip T, Elements of Power Electronics,Oxford University press, 2008
4. Agarwal ,Power Electronics: Converters, Applications, and Design, 3rd edition, Jai P, Prentice Hall,2000
5. L. Umanand, Power Electronics: Essentials & Applications, John Wiley and Sons, 2009.

20153E64F	INTELLECTUAL PROPERTY RIGHTS	L T P C
		3 0 0 3

OBJECTIVE:

- To give an idea about IPR, registration and its enforcement.

UNIT I INTRODUCTION 9

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II REGISTRATION OF IPRs 10

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III AGREEMENTS AND LEGISLATIONS 10

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV DIGITAL PRODUCTS AND LAW 9

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT V ENFORCEMENT OF IPRs 7

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL:45 PERIODS

OUTCOME:

- Ability to manage Intellectual Property portfolio to enhance the value of the firm.

TEXT BOOKS

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. S. V. Satakar, "Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002

REFERENCES:

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli,"Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

20153E65A **PRINCIPLES OF ROBOTICS** **L T P C**
3 0 0 3

OBJECTIVES:

- To introduce the functional elements of Robotics
- To impart knowledge on the direct and inverse kinematics
- To introduce the manipulator differential motion and control
- To educate on various path planning techniques
- To introduce the dynamics and control of manipulators

UNIT I BASIC CONCEPTS **9**

Brief history-Types of Robot–Technology-Robot classifications and specifications-Design and controlissues- Various manipulators – Sensors - work cell - Programming languages.

UNIT II DIRECT AND INVERSE KINEMATICS **9**

Mathematical representation of Robots - Position and orientation – Homogeneous transformation-Various joints- Representation using the Denavit Hattenberg parameters -Degrees of freedom-Direct kinematics-Inverse kinematics- SCARA robots- Solvability – Solution methods-Closed form solution.

UNIT III MANIPULATOR DIFFERENTIAL MOTION AND STATICS **9**

Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints–Inverse -Wrist and arm singularity - Static analysis - Force and moment Balance.

UNIT IV PATH PLANNING **9**

Definition-Joint space technique-Use of p-degree polynomial-Cubic polynomial-Cartesian space technique - Parametric descriptions - Straight line and circular paths - Position and orientation planning.

UNIT V DYNAMICS AND CONTROL **9**

Lagrangian mechanics-2DOF Manipulator-Lagrange Euler formulation-Dynamic model – Manipulator control problem-Linear control schemes-PID control scheme-Force control of robotic manipulator.

TOTAL: 45 PERIOD

OUTCOMES:

- Ability to understand basic concept of robotics.
- To analyze Instrumentation systems and their applications to various
- To know about the differential motion add statics in robotics
- To know about the various path planning techniques.
- To know about the dynamics and control in robotics industrie.

TEXT BOOKS:

1. R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi,4th Reprint, 2005.
2. JohnJ.Craig ,Introduction to Robotics Mechanics and Control, Third edition, Pearson Education, 2009.
3. M.P.Groover, M.Weiss, R.N. Nageland N. G.Odrej, Industrial Robotics, McGraw-Hill Singapore, 1996.

REFERENCES:

1. Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis', Oxford University Press, Sixth impression, 2010.
2. K. K.Appu Kuttan, Robotics, I K International, 2007.
3. Edwin Wise, Applied Robotics, Cengage Learning, 2003.
4. R.D.Klafter,T.A.Chimielewski and M.Negin, Robotic Engineering–An Integrated Approach, Prentice Hall of India, New Delhi, 1994.
5. B.K.Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers,Chennai, 1998.
6. S.Ghoshal, " Embedded Systems & Robotics" – Projects using the 8051 Microcontroller", Cengage Learning, 2009.

20153E65B	SPECIAL ELECTRICAL MACHINES	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Construction, principle of operation, control and performance of stepping motors.
- Construction, principle of operation, control and performance of switched reluctance motors.
- Construction, principle of operation, control and performance of permanent magnet brushless D.C. motors.
- Construction, principle of operation and performance of permanent magnet synchronous motors.
- Construction, principle of operation and performance of other special Machines.

UNIT I STEPPER MOTORS 9

Constructional features –Principle of operation –Types – Torque predictions – Linear Analysis – Characteristics – Drive circuits – Closed loop control – Concept of lead angle - Applications.

UNIT II SWITCHED RELUCTANCE MOTORS (SRM) 9

Constructional features –Principle of operation- Torque prediction–Characteristics Steady state performance prediction – Analytical Method – Power controllers – Control of SRM drive- Sensor less operation of SRM – Applications.

UNIT III PERMANENT MAGNET BRUSHLESS D.C. MOTORS 9

Fundamentals of Permanent Magnets- Types- Principle of operation- Magnetic circuit analysis- EMF and Torque equations- Power Converter Circuits and their controllers - Characteristics and control- Applications.

UNIT IV PERMANENT MAGNET SYNCHRONOUS MOTORS (PMSM) 9

Constructional features -Principle of operation – EMF and Torque equations - Sine wave motor with practical windings - Phasor diagram - Power controllers – performance characteristics - Digital controllers – Applications.

UNIT V OTHER SPECIAL MACHINES 9

Constructional features – Principle of operation and Characteristics of Hysteresis motor- Synchronous Reluctance Motor–Linear Induction motor-Repulsion motor- Applications.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to analyze and design controllers for special Electrical Machines.
- Ability to acquire the knowledge on construction and operation of stepper motor.
- Ability to acquire the knowledge on construction and operation of stepper switched reluctance motors.
- Ability to construction, principle of operation, switched reluctance motors.
- Ability to acquire the knowledge on construction and operation of permanent magnet brushless D.C. motors.
- Ability to acquire the knowledge on construction and operation of permanent magnet synchronous motors.
- Ability to select a special Machine for a particular application.

TEXT BOOKS:

- K.Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.
- T. Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press London, 1984
- E.G. Janardanan, 'Special electrical machines', PHI learning Private Limited, Delhi, 2014.

REFERENCES

1. R.Krishnan, 'Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application', CRC Press, New York, 2001.
2. T. Kenjo and S. Nagamori, 'Permanent Magnet and Brushless DC Motors', Clarendon Press, London, 1988.
3. T.J.E.Miller,'Brushless Permanent-Magnet and Reluctance Motor Drives', Oxford University Press, 1989.
4. R.Srinivasan, 'Special Electrical Machines', Lakshmi Publications, 2013.

20153E65C	POWER QUALITY	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Causes & Mitigation techniques of various PQ events.
- Various Active & Passive power filters.

UNIT I INTRODUCTION TO POWER QUALITY 9

Terms and definitions & Sources – Overloading, under voltage, over voltage - Concepts of transients - Short duration variations such as interruption - Long duration variation such as sustained interruption - Sags and swells - Voltage sag - Voltage swell - Voltage imbalance – Voltage fluctuations - Power frequency variations - International standards of power quality – Computer Business Equipment Manufacturers Associations (CBEMA) curve

UNIT II VOLTAGE SAG AND SWELL 9

Estimating voltage sag performance - Thevenin's equivalent source - Analysis and calculation of various faulted condition - Estimation of the sag severity - Mitigation of voltage sag, Static transfer switches and fast transfer switches. - Capacitor switching – Lightning - Ferro resonance - Mitigation of voltage swell.

UNIT III HARMONICS 9

Harmonic sources from commercial and industrial loads - Locating harmonic sources – Power system response characteristics - Harmonics Vs transients. Effect of harmonics – Harmonic distortion - Voltage and current distortions - Harmonic indices - Inter harmonics – Resonance Harmonic distortion evaluation, IEEE and IEC standards.

UNIT IV PASSIVE POWER COMPENSATORS 9

Principle of Operation of Passive Shunt and Series Compensators, Analysis and Design of Passive Shunt Compensators Simulation and Performance of Passive Power Filters- Limitations of Passive Filters Parallel Resonance of Passive Filters with the Supply System and Its Mitigation. Fundamentals of load compensation – voltage regulation & power factor correction.

UNIT V POWER QUALITY MONITORING & CUSTOM POWER DEVICES 9

Monitoring considerations - Monitoring and diagnostic techniques for various power quality problems - Quality measurement equipment - Harmonic / spectrum analyzer - Flicker meters Disturbance analyzer - Applications of expert systems for power quality monitoring. Principle& Working of DSTATCOM – DSTATCOM in Voltage control mode, current control mode, DVR Structure – Rectifier supported DVR – DC Capacitor supported DVR -Unified power quality conditioner.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand various sources, causes and effects of power quality issues, electrical systems and their measures and mitigation.
- Ability to analyze the causes & Mitigation techniques of various PQ events.
- Ability to study about the various Active & Passive power filters.
- Ability to understand the concepts about Voltage and current distortions, harmonics.
- Ability to analyze and design the passive filters.
- Ability to acquire knowledge on compensation techniques.
- Ability to acquire knowledge on DVR.

TEXT BOOKS:

1. Roger. C. Dugan, Mark. F. Mc Granagham, Surya Santoso, H.WayneBeaty, "Electrical Power Systems Quality", McGraw Hill,2003

2. J. Arrillaga, N.R. Watson, S. Chen, "Power System Quality Assessment", (New York : Wiley),2000.

3. Bhim Singh, Ambrish Chandra, Kamal Al-Haddad," Power Quality Problems & Mitigation Techniques" Wiley, 2015.

REFERENCES

1. G.T. Heydt, "Electric Power Quality", 2nd Edition. (West Lafayette, IN, Stars in a Circle Publications, 1994.

2. M.H.J Bollen, "Understanding Power Quality Problems: Voltage Sags and Interruptions", (New York: IEEE Press), 2000.

20153E65D	**EHVAC TRANSMISSION**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES: To impart knowledge about the following topics:

- EHVAC Transmission lines
- Electrostatic field of AC lines
- Corona in E.H.V. lines

UNIT I INTRODUCTION 9

EHVAC Transmission line trends and preliminary aspect - standard transmission voltages – Estimation at line and ground parameters-Bundle conductors: Properties -Inductance and Capacitance of EHV lines – Positive, negative and zero sequence impedance – Line Parameters for Modes of Propagation.

UNIT II ELECTROSTATIC FIELDS 9

Electrostatic field and voltage gradients – Calculations of electrostatic field of AC lines – Effect of high electrostatic field on biological organisms and human beings - Surface voltage gradients and Maximum gradients of actual transmission lines – Voltage gradients on sub conductor.

UNIT III POWER CONTROL 9

Electrostatic induction in un energized lines – Measurement of field and voltage gradients for three phase single and double circuit lines – Un energized lines. Power Frequency Voltage control and overvoltage in EHV lines: No load voltage – Charging currents at power frequency-Voltage control – Shunt and Series compensation – Static VAR compensation.

UNIT IV CORONA EFFECTS AND RADIO INTERFERENCE 9

Corona in EHV lines – Corona loss formulae-Charge voltage diagram- Attenuation of traveling waves due to Corona – Audio noise due to Corona, its generation, characteristic and limits. Measurements of audio noise radio interference due to Corona - properties of radio noise – Frequency spectrum of RI fields – Measurements of RI and RIV.

UNIT V STEADY STATE AND TRANSIENT LIMITS 9

Design of EHV lines based on steady state and transient limits - EHV cabilitys and their characteristics-Introduction six phase transmission – UHV.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand the principles and types of EHVAC system.
- Ability to analyze the electrostatic field of AC lines
- Ability to study about the compensation.
- Ability to study about the corona in E.H.V. lines
- Ability to understand the EHV cabilitys.
- Ability to analyze the steady state and transient limits.

TEXT BOOKS:

1. Rokosh Das Begamudre, ”Extra High Voltage AC Transmission Engineering”– Wiley Eastern LTD., NEW DELHI 1990.

2. S. Rao, “HVAC and HVDC Transmission, Engineering and Practice” Khanna Publisher, Delhi, 1990.

REFERENCES

1. Subir Ray, “An Introduction to High Voltage Engineering”, Prentice Hall of India Private Limited, 2013.

2. RD Begamudre, “Extra High Voltage AC Transmission Engineering”– New Academic Science Ltd; 4 edition 2011.

3. Edison,” EHV Transmission line”- Electric Institution, GEC, 1968.

20153E65E **COMMUNICATION ENGINEERING** **L T P C**
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To study the various analog and digital modulation techniques
- To study the principles behind information theory and coding
- To study the various digital communication techniques

UNIT I ANALOG MODULATION **9**

Amplitude Modulation – AM, DSBSC, SSBSC, VSB – PSD, modulators and demodulators – Angle modulation – PM and FM – PSD, modulators and demodulators – Superheterodyne receivers

UNITII PULSE MODULATION **9**

Low pass sampling theorem – Quantization – PAM – Line coding – PCM, DPCM, DM, and ADPCM And ADM, Channel Vocoder - Time Division Multiplexing, Frequency Division Multiplexing

UNIT III DIGITAL MODULATION AND TRANSMISSION **9**

Phase shift keying – BPSK, DPSK, QPSK – Principles of M-ary signaling M-ary PSK & QAM – Comparison, ISI – Pulse shaping – Duo binary encoding – Cosine filters – Eye pattern, equalizers

UNIT IV INFORMATION THEORY AND CODING **9**

Measure of information – Entropy – Source coding theorem – Shannon–Fano coding, Huffman Coding, LZ Coding – Channel capacity – Shannon-Hartley law – Shannon's limit – Error control codes – Cyclic codes, Syndrome calculation – Convolution Coding, Sequential and Viterbi decoding

UNIT V SPREAD SPECTRUM AND MULTIPLE ACCESS **9**

PN sequences – properties – m-sequence – DSSS – Processing gain, Jamming – FHSS – Synchronisation and tracking – Multiple Access – FDMA, TDMA, CDMA,

OUTCOMES:

At the end of the course, the student should be able to:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- Apply analog and digital communication techniques.
- Use data and pulse communication techniques.
- Analyze Source and Error control coding.

TEXT BOOKS:

1. H Taub, D L Schilling, G Saha, "Principles of Communication Systems" TMH 2007
2. S. Haykin "Digital Communications" John Wiley 2005

REFERENCES:

1. B.P.Lathi, "Modern Digital and Analog Communication Systems", 3rd edition, Oxford University
2. H P Hsu, Schaum Outline Series – "Analog and Digital Communications" TMH 2006
3. B.Sklar, Digital Communications Fundamentals and Applications" 2/e Pearson Education 2007.

20153E75A **DISASTER MANAGEMENT** **LT P C**
3 0 0 3

OBJECTIVES:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA)
– Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:

The students will be ability to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.

- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.

TEXTBOOKS:

1. Singhal J.P. “Disaster Management”, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN**-13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerability India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

20153E75B **HUMAN RIGHTS** **LT P C**
3 0 0 3

OBJECTIVES :

- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I **9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II **9**

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III **9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV **9**

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V **9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabilityd persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO’s, Media, Educational Institutions, Social Movements.

TOTAL : 45 PERIODS

OUTCOME :

- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

20153E75C	**OPERATIONS RESEARCH**	**L T P C**
		3 0 0 3

OBJECTIVES:

- To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

UNIT I LINEAR MODELS 15

The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.

UNIT II TRANSPORTATION MODELS AND NETWORK MODELS 8

Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route – Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks – Critical path scheduling – Sequencing models.

UNIT III INVENTORY MODELS 6

Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

UNIT IV QUEUEING MODELS 6

Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

UNIT V DECISION MODELS 10

Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life – Economic life– Single / Multi variability search technique – Dynamic Programming – Simple Problem.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can ability to use the optimization techniques for use engineering and Business problems

TEXT BOOK:

1. Hillier and Libeberman, "Operations Research", Holden Day, 2005
2. Taha H.A., "Operations Research", Sixth Edition, Prentice Hall of India, 2003.

REFERENCES:

1. Bazara M.J., Jarvis and Sherali H., "Linear Programming and Network Flows", John Wiley, 2009.

2. Budnick F.S., "Principles of Operations Research for Management", Richard D Irwin, 1990.
3. Philip D.T. and Ravindran A., "Operations Research", John Wiley, 1992.
4. Shennoy G.V. and Srivastava U.K., "Operation Research for Management", Wiley Eastern, 1994.
5. Tulsian and Pasdey V., "Quantitative Techniques", Pearson Asia, 2002.

20153E75D	PROBABILITY AND STATISTICS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- This course aims at providing the required skill to apply the statistical tools in engineering problems.
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two dimensional random variables.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.

UNIT I PROBABILITY AND RANDOM VARIABLES 12

Probability – The axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT II TWO - DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTING OF HYPOTHESIS 12

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT IV DESIGN OF EXPERIMENTS 12

One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design - 2^2 factorial design.

UNIT V STATISTICAL QUALITY CONTROL `12

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL : 60 PERIODS

OUTCOMES :

Upon successful completion of the course, students will be able to:

- Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
- Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

TEXT BOOKS :

1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.

2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.

REFERENCES :

1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
2. Papoulis, A. and Unnikrishnapillai, S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2010.
3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
4. Spiegel. M.R., Schiller. J. and Srinivasan, R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.
5. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2007.

20153E75E **FIBRE OPTICS AND LASER INSTRUMENTS** **LT P C**
3 0 0 3

AIM :

To contribute to the knowledge of Fibre optics and Laser Instrumentation and its Industrial andMedical Application.

COURSE OBJECTIVES

- To expose the students to the basic concepts of optical fibres and their properties.
- To provide adequate knowledge about the Industrial applications of optical fibres.
- To expose the students to the Laser fundamentals.
- To provide adequate knowledge about Industrial application of lasers.
- To provide adequate knowledge about holography and Medical applications of Lasers.

UNIT I OPTICAL FIBRES AND THEIR PROPERTIES 9

Construction of optical fiber cable: Guiding mechanism in optical fiber and Basic component of optical fiber communication, –Principles of light propagation through a fibre: Total internal reflection, Acceptance angle (θa), Numerical aperture and Skew mode, –Different types of fibres and their properties: Single and multimode fibers and Step index and graded index fibers,– fibrecharacteristics: Mechanical characteristics and Transmission characteristics, – Absorption losses – Scattering losses – Dispersion – Connectors and splicers –Fibre termination – Optical sources: Light Emitting Diode (LED), – Optical detectors: PIN Diode.

UNIT II INDUSTRIAL APPLICATION OF OPTICAL FIBRES 9

Fibre optic sensors: Types of fiber optics sensor, Intrinsic sensor- Temperature/ Pressure sensor, Extrinsic sensors, Phase Modulated Fibre Optic Sensor and Displacementsensor (Extrinsic Sensor) – Fibre optic instrumentation system: Measurement of attenuation (by cut back method), Optical domain reflectometers, Fiber Scattering loss Measurement, Fiber Absorption Measurement, Fiber dispersion measurements, End reflection method and Near field scanning techniques – Different types of modulators: Electro-optic modulator (EOM) –Interferometric method of measurement of length – Moire fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain.

UNIT III LASER FUNDAMENTALS 9

Fundamental characteristics of lasers – Level Lasers: Two-Level Laser, Three Level Laser, Quasi Three and four level lasers – Properties of laser: Monochromaticity, Coherence, Divergence and Directionality and Brightness –Laser modes – Resonator configuration – Q-switching and mode locking – Cavity damping – Types of lasers; – Gas lasers, solid lasers, liquid lasers and semiconductor lasers.

UNIT IV INDUSTRIAL APPLICATION OF LASERS 9

Laser for measurement of distance, Laser for measurement of length, Laser for measurement of velocity, Laser for measurement of acceleration, Laser for measurement of current, voltage and Laser for measurement of Atmospheric Effect: Types of LIDAR, Construction And Working, and LIDAR Applications – Material processing: Laser instrumentation for material processing, Powder Feeder, Laser Heating, Laser Welding, Laser Melting, Conduction Limited Melting and Key Hole Melting – Laser trimming of material: Process Of Laser Trimming, Types Of Trim, Construction And Working Advantages – Material Removal and vaporization: Process Of Material Removal.

UNIT V HOLOGRAM AND MEDICAL APPLICATIONS 9

Holography: Basic Principle, Holography vs. photography, Principle Of Hologram Recording, Condition For Recording A Hologram, Reconstructing and viewing the holographic image– Holography for non-destructive testing – Holographic components – Medical applications of lasers, laser-Tissue Interactions Photochemical reactions, Thermalisation, collisional relaxation, Types of Interactions and Selecting an Interaction Mechanism – Laser instruments for surgery, removal of tumors of vocal cards, brain surgery, plastic surgery, gynaecology and oncology.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs):

1. Understand the principle, transmission, dispersion and attenuation characteristics of opticalfibers
2. Apply the gained knowledge on optical fibers for its use as communication medium and as sensor as well which have important applications in production, manufacturing industrial and biomedical applications.
3. Understand laser theory and laser generation system.
4. Students will gain ability to apply laser theory for the selection of lasers for a specific Industrial and medical application.

TEXT BOOKS:

1. J.M. Senior, 'Optical Fibre Communication – Principles and Practice', Prentice Hall of India,1985.
2. J. Wilson and J.F.B. Hawkes, 'Introduction to Opto Electronics', Prentice Hall of India, 2001.
3. Eric Udd, William B., and Spillman, Jr., "Fiber Optic Sensors: An Introduction for Engineers and Scientists ", John Wiley & Sons, 2011.

REFERENCES:

1. G. Keiser, 'Optical Fibre Communication', McGraw Hill, 1995.
2. M. Arumugam, 'Optical Fibre Communication and Sensors', Anuradha Agencies, 2002.
3. John F. Ready, "Industrial Applications of Lasers", Academic Press, Digitized in 2008.

4. Monte Ross, ‘Laser Applications’, McGraw Hill, 1968.
5. John and Harry, “Industrial lasers and their application”, McGraw-Hill, 2002.
6. Keiser, G., “Optical Fiber Communication”, McGraw-Hill, 3rd Edition, 2000. http://nptel.ac.in/courses/117101002/

20153E81A	FLEXIBLE AC TRANSMISSION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:
- The start-of-art of the power system
- Performance of power systems with FACTS controllers.
- FACTS controllers for load flow and dynamic analysis

UNIT I INTRODUCTION 9

Real and reactive power control in electrical power transmission lines–loads & system compensation-Uncompensated transmission line–shunt and series compensation.

UNIT II STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS 9

Voltage control by SVC–Advantages of slope in dynamic characteristics–Influence of SVC on system voltage–Design of SVC voltage regulator–TCR-FC-TCR-Modeling of SVC for power flow and fast transient stability– Applications: Enhancement of transient stability – Steady state power transfer –Enhancement of power system damping.

UNIT III THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) AND APPLICATIONS 9

Operation of the TCSC–Different modes of operation–Modelling of TCSC, Variability reactance model– Modelling for Power Flow and stability studies. Applications: Improvement of the system stability limit–Enhancement of system damping.

UNIT IV VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS 9

Static Synchronous Compensator (STATCOM)–Principle of operation–V-I Characteristics. Applications: Steady state power transfer-enhancement of transient stability-prevention of voltage instability. SSSC-operation of SSSC and the control of power flow–modelling of SSSC in load flow and transient stability studies- Dynamic voltage restorer(DVR).

UNIT V ADVANCED FACTS CONTROLLERS 9

Interline DVR(IDVR) - Unified Power flow controller (UPFC) - Interline power flow controller (IPFC) - Unified Power quality conditioner (UPQC).

TOTAL : 45 PERIODS

OUTCOMES:
- Ability to understand, analyze and develop analytical model of FACTS controller for power system application.
- Ability to understand the concepts about load compensation techniques.
- Ability to acquire knowledge on facts devices.
- Ability to understand the start-of-art of the power system
- Ability to analyze the performance of steady state and transients of facts controllers.
- Ability to study about advanced FACTS controllers.

TEXT BOOKS:

1. R.Mohan Mathur, Rajiv K.Varma,"Thyristor–Based Facts Controllers for Electrical Transmission Systems", IEEE press andJohnWiley&Sons,Inc,2002.
2. NarainG. Hingorani, "Understanding FACTS-Concepts and Technology of Flexible AC Transmission Systems", Standard Publishers Distributors,Delhi-110006,2011.
3. T.J.E Miller, Power Electronics in power systems, John Wiley and sons.

REFERENCES

1. K.R. Padiyar, "FACTS Controllers in Power Transmission and Distribution", New Age International (P) Limited, Publishers, New Delhi, 2008
2. A.T.John,"FlexibleA.C.TransmissionSystems",InstitutionofElectricalandElectronic Engineers(IEEE), 1999.
3. V.K.Sood, HVDC and FACTS controllers–Applications of Static Converters in Power System, APRIL2004,KluwerAcademic Publishers,2004.

SOFT COMPUTING TECHNIQUES

20153E81B	L	T	P	C
	3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Basics of artificial neural network.
- Concepts of modelling and control of neural and fuzzy control schemes.
- Features of hybrid control schemes.

UNIT I ARTIFICIAL NEURAL NETWORK 9

Review of fundamentals – Biological neuron, artificial neuron, activation function, single layer perceptron – Limitation – Multi layer perceptron – Back Propagation Algorithm (BPA) – Recurrent Neural Network (RNN) – Adaptive Resonance Theory (ART) based network – Radial basis function network – online learning algorithms, BP through time – RTRL algorithms – Reinforcement learning.

UNIT II NEURAL NETWORKS FOR MODELING AND CONTROL 9

Modelling of non-linear systems using ANN – Generation of training data – Optimal architecture– Model validation – Control of non-linear systems using ANN – Direct and indirect neuro control schemes – Adaptive neuro controller – Familiarization with neural network toolbox.

UNIT III FUZZY SET THEORY 9

Fuzzy set theory – Fuzzy sets – Operation on fuzzy sets – Scalar cardinality, fuzzy cardinality, union and intersection, complement (Yager and Sugeno), equilibrium points, aggregation, projection, composition, cylindrical extension, fuzzy relation – Fuzzy membership functions.

UNIT IV FUZZY LOGIC FOR MODELING AND CONTROL 9

Modelling of non-linear systems using fuzzy models – TSK model – Fuzzy logic controller – Fuzzification – Knowledge base – Decision making logic – Defuzzification – Adaptive fuzzy systems – Familiarization with fuzzy logic toolbox.

UNIT V HYBRID CONTROL SCHEMES 9

Fuzzification and rule base using ANN – Neuro fuzzy systems – ANFIS – Fuzzy neuron– GA – Optimization of membership function and rule base using Genetic Algorithm – Introduction to other evolutionary optimization techniques, support vector machine– Case study – Familiarization with ANFIS toolbox.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand the concepts of ANN, different features of fuzzy logic and their modelling, control aspects and different hybrid control schemes.
- Ability to understand the basics of artificial neural network.
- Ability to get knowledge on modelling and control of neural.
- Ability to get knowledge on modelling and control of fuzzy control schemes.
- Ability to acquire knowledge on hybrid control schemes.
- Ability to understand the concepts of Adaptive Resonance Theory

TEXT BOOKS:

1. Laurence Fausett, "Fundamentals of Neural Networks", Prentice Hall, Englewood Cliffs, N.J., 1992
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill Inc., 2000.

REFERENCES

1. Goldberg, "Genetic Algorithm in Search, Optimization and Machine learning", Addison Wesley Publishing Company Inc. 1989
2. Millon W.T., Sutton R.S. and Webrose P.J., "Neural Networks for Control", MIT press, 1992
3. Ethem Alpaydin, "Introduction to Machine learning (Adaptive Computation and Machine Learning series)', MIT Press, Second Edition, 2010.
4. Zhang Huaguang and Liu Derong, "Fuzzy Modeling and Fuzzy Control Series: Control Engineering", 2006

20153E81C	POWER SYSTEMS DYNAMICS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Basics of dynamics and stability problems
- Modeling of synchronous machines
- Excitation system and speed-governing controllers.
- Small signal stability of a single-machine infinite bus system with excitation system and power system stabilizer.
- Transient stability simulation of multi machine power system.

UNIT I INTRODUCTION 9

Basics of system dynamics – numerical techniques – introduction to software packages to study the responses. Concept and importance of power system stability in the operation and design - distinction between transient and dynamic stability - complexity of stability problem in large system – necessity for reduced models - stability of interconnected systems.

UNIT II SYNCHRONOUS MACHINE MODELLING 9

Synchronous machine - flux linkage equations - Park's transformation - per unit conversion - normalizing the equations - equivalent circuit - current space model - flux linkage state space model. Sub-transient and transient inductances - time constants. Simplified models (one axis and constant flux linkage) - steady state equations and phasor diagrams.

UNIT III MACHINE CONTROLLERS 9

Exciter and voltage regulators - function and types of excitation systems - typical excitation system configuration - block diagram and state space representation of IEEE type 1 excitation system - saturation function - stabilizing circuit. Function of speed governing systems - block diagram and state space representation of IEEE mechanical hydraulic governor and electrical hydraulic governors for hydro turbines and steam turbines.

UNIT IV TRANSIENT STABILITY 9

State equation for multi machine system with one axis model and simulation – modelling of multi machine power system with one axis machine model including excitation system and speed governing system and simulation using R-K method of fourth order (Gill's technique) for transient stability analysis - power system stabilizer. For all simulations, the algorithm and flow chart have to be discussed.

UNIT V DYNAMIC STABILITY 9

System response to small disturbances - linear model of the unregulated synchronous machine and its modes of oscillation - regulated synchronous machine - distribution of power impact - linearization of the load equation for the one machine problem – simplified linear model - effect of excitation on dynamic stability - approximate system representation - supplementary stabilizing signals - dynamic performance measure - small signal performance measures.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.
- Ability to get knowledge on the basics of dynamics and stability problems
- Ability to design and modelling of synchronous machines

- Ability to study about excitation system and speed-governing controllers.
- Ability to understand the concept of small signal stability of a single-machine infinite bus system with excitation system.
- Ability to analyze the transient stability simulation.

TEXT BOOKS:

1. P.M. Anderson and A.A.Fouad, ‘Power System Control and Stability’, Galgotia Publications, New Delhi, 2003.
2. P. Kundur, ‘Power System Stability and Control’, McGraw Hill Inc., USA, 1994.
3. R.Ramanujam, “Power System Dynamics – Analysis and Simulation”, PHI, 2009.

REFERENCES

1. M.A.Pai and W.Sauer, ‘Power System Dynamics and Stability’, Pearson Education Asia, India, 2002.
2. James A.Momoh, Mohamed. E. EI-Hawary. “ Electric Systems, Dynamics and Stability with Artificial Intelligence applications”, Marcel Dekker, USA First Edition, 2000.
3. C.A.Gross, “Power System Analysis,” Wiley India, 2011.
4. B.M.Weedy, B.J.Lory, N.Jenkins, J.B.Ekanayake and G.Strbac,” Electric Power Systems”, Wiley India, 2013.
5. K.Umarao, “Computer Techniques and Models in Power System,” I.K. International, 2007.

20153E81D	**SMPS AND UPS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES: To impart knowledge about the following topics:

- Modern power electronic converters and its applications in electric power utility.
- Resonant converters and UPS

UNIT I DC-DC CONVERTERS 9

Principles of step down and step up converters – Analysis and state space modeling of Buck, Boost, Buck- Boost and Cuk converters.

UNIT II SWITCHED MODE POWER CONVERTERS 9

Analysis and state space modeling of fly back, Forward, Push pull, Luo, Half bridge and full bridge converters- control circuits and PWM techniques.

UNIT III RESONANT CONVERTERS 9

Introduction- classification- basic concepts- Resonant switch- Load Resonant converters- ZVS , Clamped voltage topologies- DC link inverters with Zero Voltage Switching- Series and parallel Resonant inverters- Voltage control.

UNIT IV DC-AC CONVERTERS 9

Single phase and three phase inverters, control using various (sine PWM, SVPWM and PSPWM) techniques, various harmonic elimination techniques- Multilevel inverters- Concepts - Types: Diode clamped- Flying capacitor- Cascaded types- Applications.

UNIT V POWER CONDITIONERS, UPS & FILTERS 9

Introduction- Power line disturbances- Power conditioners –UPS: offline UPS, Online UPS, Applications – Filters: Voltage filters, Series-parallel resonant filters, filter without series capacitors, filter for PWM VSI, current filter, DC filters – Design of inductor and transformer for PE applications – Selection of capacitors.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to analyze the state space model for DC – DC converters
- Ability to acquire knowledge on switched mode power converters.
- Ability to understand the importance of Resonant Converters.
- Ability to analyze the PWM techniques for DC-AC converters
- Ability to acquire knowledge on modern power electronic converters and its applications in electric power utility.
- Ability to acquire knowledge on filters and UPS

TEXT BOOKS:

1. Simon Ang, Alejandro Oliva,” Power-Switching Converters”, Third Edition, CRC Press, 2010.

2. KjeldThorborg, “Power Electronics – In theory and Practice”, Overseas Press, First Indian Edition 2005.

3. M.H. Rashid – Power Electronics handbook, Elsevier Publication, 2001.

REFERENCES

1. Philip T Krein, “ Elements of Power Electronics”, Oxford University Press

2. Ned Mohan, Tore.M.Undeland, William.P.Robbins, Power Electronics converters,

Applications and design- Third Edition- John Wiley and Sons- 2006

3. M.H. Rashid – Power Electronics circuits, devices and applications- third edition Prentice Hall of India New Delhi, 2007.
4. Erickson, Robert W, "Fundamentals of Power Electronics", Springer, second edition, 2010.

20153E81E	ELECTRIC ENERGY GENERATION, UTILIZATION CONSERVATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- To study the generation, conservation of electrical power and energy efficient equipments.
- To understand the principle, design of illumination systems and energy efficiency lamps.
- To study the methods of industrial heating and welding.
- To understand the electric traction systems and their performance.

UNIT I ILLUMINATION 9

Importance of lighting – properties of good lighting scheme – laws of illumination – photometry - types of lamps – lighting calculations – basic design of illumination schemes for residential, commercial, street lighting, factory lighting and flood lighting – LED lighting and energy efficient lamps.

UNIT II REFRIGERATION AND AIR CONDITIONING 9

Refrigeration-Domestic refrigerator and water coolers - Air-Conditioning-Various types of air-conditioning system and their applications, smart air conditioning units - Energy Efficient motors: Standard motor efficiency, need for efficient motors, Motor life cycle, Direct Savings and payback analysis, efficiency evaluation factor.

UNIT III HEATING AND WELDING 9

Role of electric heating for industrial applications – resistance heating – induction heating – dielectric heating - electric arc furnaces. Brief introduction to electric welding – welding generator, welding transformer and the characteristics.

UNIT IV TRACTION 9

Merits of electric traction – requirements of electric traction system – supply systems – mechanics of train movement – traction motors and control – braking – recent trends in electric traction.

UNIT V DOMESTIC UTILIZATION OF ELECTRICAL ENERGY 9

Domestic utilization of electrical energy – House wiring. Induction based appliances, Online and OFF line UPS, Batteries - Power quality aspects – nonlinear and domestic loads – Earthing – Domestic, Industrial and Substation.

TOTAL : 45 PERIODS

OUTCOMES:

- To understand the main aspects of generation, utilization and conservation.
- To identify an appropriate method of heating for any particular industrial application.
- To evaluate domestic wiring connection and debug any faults occurred.
- To construct an electric connection for any domestic appliance like refrigerator as well as to design a battery charging circuit for a specific household application.

- To realize the appropriate type of electric supply system as well as to evaluate the performance of a traction unit.
- To understand the main aspects of Traction.

TEXT BOOKS:

1. Wadhwa, C.L. “Generation, Distribution and Utilization of Electrical Energy”, New Age International Pvt. Ltd, 2003.
2. Dr. Uppal S.L. and Prof. S. Rao, 'Electrical Power Systems', Khanna Publishers, New Delhi, 15th Edition, 2014.
3. Energy Efficiency in Electric Utilities, BEE Guide Book, 2010

REFERENCES

1. Partab.H, “Art and Science of Utilisation of Electrical Energy”, Dhanpat Rai and Co, New Delhi, 2004.
2. Openshaw Taylor.E, “Utilization of Electrical Energy in SI Units”, Orient Longman Pvt. Ltd, 2003.
3. Gupta.J.B, “Utilization of Electric Power and Electric Traction”, S.K.Kataria and Sons, 2002.
4. Cleaner Production – Energy Efficiency Manual for GERIAP, UNEP, Bangkok prepared by National Productivity Council.

20153E81F	**PROFESSIONAL ETHICS IN ENGINEERING**	**LT P C**
		3 0 0 3

OBJECTIVES:

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I HUMAN VALUES 10

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS 9

Senses of ‘Engineering Ethics’ – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg’s theory – Gilligan’s theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT V GLOBAL ISSUES 8

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of the course, the student should be ability to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

TEXT BOOKS:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd.,New Delhi, 2013.
6. World Community Service Centre, ' Value Education', Vethathiri publications, Erode, 2011.

Web sources:

1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

20153E81G	**PRINCIPLES OF MANAGEMENT**	**LT P C**
		3 0 0 3

OBJECTIVES:

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization.

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

UNIT II PLANNING **9**

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT III ORGANISING **9**

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

UNIT IV DIRECTING **9**

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

UNIT V CONTROLLING **9**

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

OUTCOMES: **TOTAL: 45 PERIODS**

- Upon completion of the course, students will be ability to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

TEXT BOOKS:

1. JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", 6th Edition, Pearson Education, 2004.
2. Stephen P. Robbins & Mary Coulter, "Management", Prentice Hall (India)Pvt. Ltd., 10th Edition, 2009.

REFERENCES:

1. Harold Koontz & Heinz Weihrich, "Essentials of Management", Tata McGraw Hill, 1998.
2. Robert Kreitner & Mamata Mohapatra, "Management", Biztantra, 2008.
3. Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management", 7th Edition, Pearson Education, 2011.
4. Tripathy PC & Reddy PN, "Principles of Management", Tata Mcgraw Hill, 1999

20153E82A	ENERGY MANAGEMENT AND AUDITING	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- To impact concepts behind economic analysis and Load management.
- Energy management on various electrical equipments and metering.
- Concept of lighting systems and cogeneration.

UNIT I INTRODUCTION 9

Basics of Energy – Need for energy management – Energy accounting - Energy monitoring, targeting and reporting - Energy audit process.

UNIT II ENERGY MANAGEMENT FOR MOTORS AND COGENERATION 9

Energy management for electric motors – Transformer and reactors - Capacitors and synchronous machines, energy management by cogeneration – Forms of cogeneration – Feasibility of cogeneration – Electrical interconnection.

UNIT III LIGHTING SYSTEMS 9

Energy management in lighting systems – Task and the working space - Light sources – Ballasts – Lighting controls – Optimizing lighting energy – Power factor and effect of harmonics, lighting and energy standards.

UNIT IV METERING FOR ENERGY MANAGEMENT 9

Metering for energy management – Units of measure - Utility meters – Demand meters – Paralleling of current transformers – Instrument transformer burdens – Multi tasking solid state meters, metering location vs requirements, metering techniques and practical examples.

UNIT V ECONOMIC ANALYSIS AND MODELS 9

Economic analysis – Economic models - Time value of money - Utility rate structures – Cost of electricity – Loss evaluation, load management – Demand control techniques – Utility monitoring and control system – HVAC and energy management – Economic justification.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand the basics of Energy audit process.
- Ability to understand the basics of energy management by cogeneration
- Ability to acquire knowledge on Energy management in lighting systems
- Ability to impact concepts behind economic analysis and Load management.
- Ability to understand the importance of Energy management on various electrical equipment and metering.
- Ability to acquire knowledge on HVAC.

TEXT BOOKS:

1. Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, Guide to Energy Management, Fifth Edition, The Fairmont Press, Inc., 2006
2. Eastop T.D & Croft D.R, Energy Efficiency for Engineers and Technologists,.Logman Scientific & Technical, ISBN-0-582-03184 , 1990.

REFERENCES

1. Reay D.A, Industrial Energy Conservation, 1st edition, Pergamon Press, 1977.
2. IEEE Recommended Practice for Energy Management in Industrial and Commercial Facilities, IEEE, 196.
3. Amit K. Tyagi, Handbook on Energy Audits and Management, TERI, 2003.
4. Electricity in buildings good practice guide, McGraw-Hill Education, 2016.
5. National Productivity Council Guide Books

20153E82B **DATA STRUCTURES** **LT P C**
3 0 0 3

OBJECTIVES:

- To understand the concepts of ADTs
- To Learn linear data structures – lists, stacks, and queues
- To understand sorting, searching and hashing algorithms
- To apply Tree and Graph structures

UNIT I LINEAR DATA STRUCTURES – LIST 9

Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation –– singly linked lists- circularly linked lists- doubly-linked lists – applications of lists –Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).

UNIT II LINEAR DATA STRUCTURES – STACKS, QUEUES 9

Stack ADT – Operations - Applications - Evaluating arithmetic expressions- Conversion of Infix to postfix expression - Queue ADT – Operations - Circular Queue – Priority Queue - deQueue – applications of queues.

UNIT III NON LINEAR DATA STRUCTURES – TREES 9

Tree ADT – tree traversals - Binary Tree ADT – expression trees – applications of trees – binary search tree ADT –Threaded Binary Trees- AVL Trees – B-Tree - B+ Tree **-** Heap – Applications of heap.

UNIT IV NON LINEAR DATA STRUCTURES - GRAPHS 9

Definition – Representation of Graph – Types of graph - Breadth-first traversal - Depth-first traversal – Topological Sort – Bi-connectivity – Cut vertex – Euler circuits – Applications of graphs.

UNIT V SEARCHING, SORTING AND HASHING TECHNIQUES 9

Searching- Linear Search - Binary Search. Sorting - Bubble sort - Selection sort - Insertion sort - Shell sort – Radix sort. Hashing- Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Implement abstract data types for linear data structures.
- Apply the different linear and non-linear data structures to problem solutions.
- Critically analyze the various sorting algorithms.

TEXT BOOKS:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education,1997.
2. Reema Thareja, "Data Structures Using C", Second Edition , Oxford University Press, 2011

REFERENCES:
1. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, “Introduction to Algorithms", Second Edition, Mcgraw Hill, 2002.
2. Aho, Hopcroft and Ullman, “Data Structures and Algorithms”, Pearson Education,1983.
3. Stephen G. Kochan, “Programming in C”, 3rd edition, Pearson Education.
4. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, “Fundamentals of Data Structures in C”, Second Edition, University Press, 2008

20153E82C	HIGH VOLTAGE DIRECT CURRENT TRANSMISSION	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:
- Planning of DC power transmission and comparison with AC power transmission.
- HVDC converters. HVDC
- system control. Harmonics and
- design of filters.
- Power flow in HVDC system under steady state.

UNIT I INTRODUCTION 9
DC Power transmission technology–Comparison of AC and DC transmission–Application of DC transmission–Description of DC transmission system–Planning for HVDC transmission–Modern trends in HVDC technology–DC breakers–Operating problems– HVDC transmission based on VSC –Types and applications of MTDC systems.

UNIT II ANALYSIS OF HVDC CONVERTERS 9
Line commutated converter -Analysis of Graetz circuit with and without overlap -Pulse number– Choice of converter configuration – Converter bridge characteristics– Analysis of a 12 pulse converters– Analysis of VSC topologies and firing schemes.

UNIT III CONVERTER AND HVDC SYSTEM CONTROL 9
Principles of DC link control–Converter control characteristics–System control hierarchy– Firing angle control– Current and extinction angle control–Starting and stopping of DC link –Power control –Higher level controllers –Control of VSC based HVDC link.

UNIT IV REACTIVE POWER AND HARMONICS CONTROL 9
Reactive power requirements in steady state–Sources of reactive power–SVC and STATCOM– Generation of harmonics –Design of AC and DC filters– Active filters.

UNIT V POWER FLOW ANALYSIS IN AC/DC SYSTEMS 9
Per unit system for DC quantities–DC system model –Inclusion of constraints –Power flow analysis –case study

TOTAL : 45 PERIODS

OUTCOMES:
- Ability to understand the principles and types of HVDC system.
- Ability to analyze and understand the concepts of HVDC converters.
- Ability to acquire knowledge on DC link control.
- Ability to understand the concepts of reactive power management, harmonics and

power flow analysis.

- Ability to get knowledge about Planning of DC power transmission and comparison with AC power transmission.
- Ability to understand the importance of power flow in HVDC system under steady state.

TEXT BOOKS:

1. Padiyar,K.R.,"HVDC power transmission system", New Age International(P)Ltd. NewDelhi, Second Edition,2010.
2. Arrillaga,J.,"High Voltage Direct Current Transmission", Peter Pregrinus, London,1983.

REFERENCES

1. Kundur P.," Power System Stability and Control", McGraw-Hill,1993.
2. Colin Adamson and Hingorani NG," High Voltage Direct Current Power Transmission", Garraway Limited, London, 1960.
3. Edward Wilson Kimbark," Direct Current Transmission", Vol.I, Wiley inter science, New York, London, Sydney,1971.

20153E82D	MICROCONTROLLER BASED SYSTEM DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Architecture of PIC microcontroller
- Interrupts and timers
- Peripheral devices for data communication and transfer
- Functional blocks of ARM processor
- Architecture of ARM processors

UNIT I INTRODUCTION TO PIC MICROCONTROLLER 9

Introduction to PIC Microcontroller–PIC 16C6x and PIC16C7x Architecture–IC16cxx–- Pipelining - Program Memory considerations – Register File Structure - Instruction Set - Addressing modes – Simple Operations.

UNIT II INTERRUPTS AND TIMER 9

PIC micro controller Interrupts- External Interrupts-Interrupt Programming–Loop time subroutine Timers-Timer Programming– Front panel I/O-Soft Keys– State machines and key switches– Display of Constant and Variability strings.

UNIT III PERIPHERALS AND INTERFACING 9

I^2C Bus for Peripherals Chip Access– Bus operation-Bus subroutines– Serial EEPROM— Analog to Digital Converter–UART-Baud rate selection–Data handling circuit–Initialization - LCD and keyboard Interfacing -ADC, DAC, and Sensor Interfacing.

UNIT IV INTRODUCTION TO ARM PROCESSOR 9

Architecture –ARM programmer's model –ARM Development tools- Memory Hierarchy – ARM Assembly Language Programming–Simple Examples–Architectural Support for

Operating systems.

UNIT V ARM ORGANIZATION 9

3-Stage Pipeline ARM Organization– 5-Stage Pipeline ARM Organization–ARM Instruction Execution- ARM Implementation– ARM Instruction Set– ARM coprocessor interface– Architectural support for High Level Languages – Embedded ARM Applications.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and apply computing platform and software for engineering problems.
- Ability to understand the concepts of Architecture of PIC microcontroller
- Ability to acquire knowledge on Interrupts and timers.
- Ability to understand the importance of Peripheral devices for data communication.
- Ability to understand the basics of sensor interfacing
- Ability to acquire knowledge in Architecture of ARM processors

TEXT BOOKS:

1. Peatman,J.B., "Design with PIC Micro Controllers"PearsonEducation,3rdEdition, 2004.

2. Furber,S., "ARM System on Chip Architecture" Addison Wesley trade Computer Publication, 2000.

REFERENCES

1. Mazidi, M.A.,"PIC Microcontroller" Rollin Mckinlay, Danny causey ,Prentice Hall of India, 2007.

20153E82E	SMART GRID	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Smart Grid technologies, different smart meters and advanced metering infrastructure.
- The power quality management issues in Smart Grid.
- The high performance computing for Smart Grid applications

UNIT I INTRODUCTION TO SMART GRID 9

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, National and International Initiatives in Smart Grid.

UNIT II SMART GRID TECHNOLOGIES 9

Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/VAR control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plugin Hybrid Electric Vehicles(PHEV).

UNIT III SMART METERS AND ADVANCED METERING INFRASTRUCTURE 9

IntroductiontoSmartMeters,AdvancedMeteringinfrastructure(AMI)driversandbenefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU), Intelligent Electronic Devices(IED)&their application for monitoring & protection.

UNIT IV POWER QUALITY MANAGEMENT IN SMART GRID 9

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, W eb based Power Quality monitoring, Power Quality Audit.

UNIT V HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS 9

Local Area Network(LAN),House Area Network(HAN), Wide Area Network(WAN), Broad band over Power line(BPL),IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will develop more understanding on the concepts of Smart Grid and its present developments.
- Learners will study about different Smart Grid technologies.
- Learners will acquire knowledge about different smart meters and advanced metering infrastructure.
- Learners will have knowledge on power quality management in Smart Grids
- Learners will develop more understanding on LAN, WAN and Cloud Computing for Smart Grid applications.

TEXT BOOKS:

1. Stuart Borlase “Smart Grid: Infrastructure, Technology and Solutions”,CRCPress2012.
2. JanakaEkanayake,NickJenkins,KithsiriLiyanage,JianzhongWu,AkihikoYokoyama, “Smart Grid: TechnologyandApplications”,Wiley2012.

REFERENCES

- VehbiC. Güngör ,Dilan Sahin, Taskin Kocak, Salih Ergüt, Concettina Buccella, Carlo Cecati, and Gerhard P. Hancke, “Smart Grid Technologies: Communication Technologies and Standards” IEEE Transactions On Industrial Informatics, Vol.7,No.4, November2011.
- Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang “SmartGrid –The New and Improved Power Grid: A Survey” ,IEEE Transaction on Smart Grids,vol.14,2012.
- James Momohe “Smart Grid: Fundamentals of Design and Analysis,”, Wiley-IEEE Press , 2012.

20153E82F	BIOMEDICAL INSTRUMENTATION	L T P C 3 0 0 3

OBJECTIVES:

- To Introduce Fundamentals of Biomedical Engineering
- To study the communication mechanics in a biomedical system with few examples
- To study measurement of certain important electrical and non-electrical parameters

- To understand the basic principles in imaging techniques
- To have a basic knowledge in life assisting and therapeutic devices

UNIT I FUNDAMENTALS OF BIOMEDICAL ENGINEERING 9

Cell and its structure – Resting and Action Potential – Nervous system and its fundamentals - Basic components of a biomedical system- Cardiovascular systems- Respiratory systems -Kidney and blood flow - Biomechanics of bone - Biomechanics of soft tissues -Physiological signals and transducers - Transducers – selection criteria – Piezo electric, ultrasonic transducers - Temperature measurements - Fibre optic temperature sensors

UNIT II NON ELECTRICAL PARAMETERS MEASUREMENT AND DIAGNOSTIC PROCEDURES 9

Measurement of blood pressure - Cardiac output - Heart rate - Heart sound - Pulmonary function measurements – spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analysers, pH of blood –measurement of blood pCO2, pO2, finger-tip oxymeter - ESR, GSR measurements.

UNIT III ELECTRICAL PARAMETERS ACQUISITION AND ANALYSIS 9

Electrodes – Limb electrodes –floating electrodes – pregelled disposability electrodes - Micro, needle and surface electrodes – Amplifiers, Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier - ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms - Electrical safety in medical environment, shock hazards – leakage current-Instruments for checking safety parameters of biomedical equipment.

UNIT IV IMAGING MODALITIES AND ANALYSIS 9

Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography –Different types of biotelemetry systems - Retinal Imaging - Imaging application in Biometric systems.

UNIT V LIFE ASSISTING, THERAPEUTIC AND ROBOTIC DEVICES 9

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialysers – Lithotripsy - ICCU patient monitoring system - Nano Robots - Robotic surgery –Orthopedic prostheses fixation.

TOTAL : 45 PERIODS

OUTCOMES: At the end of the course students will have the

- Ability to understand the philosophy of the heart, lung, blood circulation and respiration system.
- Ability to provide latest ideas on devices of non-electrical devices.
- Ability to gain knowledge on various sensing and measurement devices of electrical origin.
- Ability to understand the analysis systems of various organ types.
- Ability to bring out the important and modern methods of imaging techniques and their analysis.
- Ability to explain the medical assistance/techniques, robotic and therapeutic equipments.

TEXT BOOKS:

1. Leslie Cromwell, “Biomedical Instrumentation and Measurement”, Prentice Hall of India, New Delhi, 2007.
2. Khandpur R.S, Handbook of Biomedical Instrumentation, Tata McGraw-Hill, New Delhi,2nd edition, 2003
3. Joseph J Carr and John M.Brown, Introduction to Biomedical Equipment Technology, John

Wiley and sons, New York, 4th edition, 2012

REFERENCES

1. John G. Webster, Medical Instrumentation Application and Design, John Wiley and sons, New York, 1998.
2. Duane Knudson, Fundamentals of Biomechanics, Springer, 2nd Edition, 2007.
3. Suh, Sang, Gurupur, Varadraj P., Tanik, Murat M., Health Care Systems, Technology and Techniques, Springer, 1st Edition, 2011.
4. Ed. Joseph D. Bronzino, The Biomedical Engineering Hand Book, Third Edition, Boca Raton, CRC Press LLC, 2006.
5. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.

20153E82G FUNDAMENTALS OF NANOSCIENCE L T P C 3 0 0 3

OBJECTIVES:
To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION 8

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION 9

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS 12

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO2,MgO, ZrO2, NiO, nanoalumina, CaO, AgTiO2, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications.

UNIT IV CHARACTERIZATION TECHNIQUES 9

X- ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation.

UNIT V APPLICATIONS 7

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery.

TOTAL : 45 PERIODS

OUTCOMES:

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS :

1. A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, “Nanoscale Charecterisation of surfaces & Interfaces”, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

REFERENCES:

1. G Timp, “Nanotechnology”, AIP press/Springer, 1999.
2. Akhlesh Lakhtakia,“The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations”. Prentice-Hall of India (P) Ltd, New Delhi, 2007.

PONNAIYAH RAMAJAYAM INSTITUTE OF SCIENCE & TECHNOLOGY (PRIST)

Declared as DEEMED-TO-BE-UNIVERSITY
U/s 3 of UGC Act, 1956

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

PROGRAM HANDBOOK

B.Tech FULL TIME

[Regulation 2021]
[for candidates admitted to B.Tech EEE program from June 2021 onwards]

PROGRAMME EDUCATIONAL OBJECTIVES:

PEO1: To enable graduates to pursue research, or have a successful career in academia or industries associated with Electronics and Communication Engineering, or as entrepreneurs.

PEO2: To provide students with strong foundational concepts and also advanced techniques and tools in order to enable them to build solutions or systems of varying complexity.

PEO3: To prepare students to critically analyze existing literature in an area of specialization and ethically develop innovative and research oriented methodologies to solve the problems identified.

PROGRAMME OUTCOMES:

Engineering Graduates will be able to:

A. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

B. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

C. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

D. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

E. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

F. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

G. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

H. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

I. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

J. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

K. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

L. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMM OUTCOMES												
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**
1	3	3	2	3	2	1	1	2	1	1	3	1	3
2	3	3	3	3	3	1	1	1	1	1	1	2	2
3	3	3	3	3	3	2	2	3	1	2	2	2	2

1-Reasonable: 2- Significant: 3- Strong

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

COURSE STRUCTURE

B. TECH-EEE R 2021

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

SEMESTER I

S.No	Course Code	Course Title	L	T	P	C
1	**21147IP**	Induction Programme	-	-	-	0
2	**21147S11**	Professional English – I	3	0	0	3
3	**21148S12**	Matrices and Calculus	3	1	0	4
4	**21149S13**	Engineering Physics	3	0	0	3
5	**21149S14**	Engineering Chemistry	3	0	0	3
6	**21150S15**	Problem Solving and Python programming	3	0	0	3
7	**21150L16**	Problem Solving and Python Programming Laboratory	0	0	4	2
8	**21149L17**	Physics and Chemistry Laboratory	0	0	4	2
9	**21147L18**	Communication Laboratory - I	0	0	2	1
		TOTAL CREDITS				**21**

SEMESTER – II

S.No	Course Code	Course Name	L	T	P	C
1	**21147S21**	Professional English – II	2	0	0	2
2	**21148S22**	Statistics and Numerical Methods	3	1	0	4
3	**21149S23C**	Physics for Electrical Engineering	3	0	0	3
4	**21154S24**	Engineering Graphics	2	0	4	4
5	**21154S25**	Basic Civil and Mechanical Engineering	3	0	0	3
6	**21153S26B**	Electric Circuit Analysis	3	1	0	4
7	**21154L21**	Engineering Practices Laboratory	0	0	4	2
8	**21153L22B**	Electric Circuits Laboratory	0	0	4	2
9	**21147L23**	Communication Laboratory - II	0	0	4	2
		TOTAL CREDITS				**26**

SEMESTER III

S.No	Course Code	Course Name	L	T	P	C
1	**21148S31C**	Probability and Complex Functions	3	1	0	4
2	**21153C32**	Digital Logic Circuits	3	0	0	3
3	**21153C33**	Electromagnetic Fields	3	1	0	4
4	**21153C34**	Electrical Machines – I	3	0	0	3
5	**21153S35**	Electron Devices and Circuits	3	0	0	3
6	**21153S36**	C Programming and Data Structures	3	0	0	3
7	**21153L31**	Electronic Devices and Circuits Laboratory	0	0	4	2
8	**21153L32**	Electrical Machines Laboratory – I	0	0	4	2
9	**21153L33**	C Programming and Data Structures Laboratory	0	0	4	2
10	**21153L34**	Professional Development	0	0	2	1
					TOTAL CREDITS	**27**

SEMESTER IV

S.No	Course Code	Course Name	L	T	P	C
1	**21153C41**	Electrical Machines – II	3	0	0	3
2	**21153C42**	Transmission and Distribution	3	0	0	3
3	**21153C43**	Measurements and Instrumentation	3	0	0	3
4	**21153C44**	Linear Integrated Circuits	3	0	0	3
5	**21153C45**	Microprocessors and Microcontrollers	3	0	0	3
6	**21149S46**	Environmental Sciences and Sustainability	2	0	0	2
7	**21153L47**	Electrical Machines Laboratory - II	0	0	4	2
8	**21153L48**	Linear and Digital Circuits Laboratory	0	0	4	2
9	**21153L49**	Microprocessors and Microcontrollers Laboratory	0	0	4	2
					TOTAL CREDITS	**23**

SEMESTER – V

S.No	Course Code	Course Name	L	T	P	C
1	**21153C51**	Power System Analysis	3	0	0	3
2	**21153C52**	Control Systems	3	0	0	3
3	**21153C53**	Power Electronics	3	0	0	3
4	**21153E54_**	Elective I	3	0	0	3
5	**21153E55_**	Elective II	2	0	2	3
6	**21153E56_**	Elective III	2	0	2	3
7	**21147MC51_**	Mandatory Course I	3	0	0	0
8	**21153L57**	Control and Instrumentation Laboratory	0	0	4	2
9	**21153L58**	Power Electronics Laboratory	0	0	4	2
					TOTAL CREDITS	**22**

SEMESTER – VI

S.No	Course Code	Course Name	L	T	P	C
1	**21150OE61_**	Open Elective I	2	0	2	3
2	**21153C62**	Power System Operation and Control	3	0	0	3
3	**21153C63**	Protection and Switchgear	3	0	0	3
4	**21153E64_**	Elective IV	3	0	0	3
5	**21153E65_**	Elective V	2	0	2	3
6	**21153E66_**	Elective VI	2	0	2	3
7	**21147MC61_**	Mandatory Course II	3	0	0	0
8	**21153L67**	Power System Laboratory	0	0	4	2
					TOTAL CREDITS	**20**

SEMESTER – VII

S.No	Course Code	Course Name	L	T	P	C
1	**21147S71**	Human Values and Ethics	2	0	0	2
2	**211_ _OE72 _**	Open Elective II	2	0	2	3
3	**211_ _OE73 _**	Open Elective III	3	0	0	3
4	**211_ _OE74_**	Open Elective IV	3	0	0	3
5	**21160E75_**	Elective VII	3	0	0	3
6	**21153E76_**	Elective VIII	2	0	2	3
7	**21153C77**	High Voltage Engineering	3	0	0	3
					TOTAL CREDITS	**20**

SEMESTER – VIII

S.No	Course Code	Course Name	L	T	P	C
1.	**21153P81**	Project Work/ Internship	0	0	20	10
		TOTAL CREDITS				**10**

LIST OF ELECTIVES

MANDATORY COURSES I (V SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1.	21147MC51A	Introduction to Women and Gender Studies	3	0	0	0
2.	21147MC51B	Elements of Literature	3	0	0	0
3.	21147MC51C	Film Appreciation	3	0	0	0
4.	21147MC51D	Disaster Management	3	0	0	0

MANDATORY COURSES II (VI SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1.	21147MC61A	Well Being with Traditional Practices (Yoga, Ayurveda and Siddha)	3	3	0	0
2.	21147MC61B	History of Science and Technology in India	3	0	0	0
3.	21147MC61C	Political and Economic Thought for a Humane Society	3	0	0	0
4.	21147MC61D	State, Nation Building and Politics in India	3	0	0	0
5.	21147MC61E	Safety in Engineering Industries	3	0	0	0

ELECTIVE –I (V SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1.	21153E54A	Utilization and Conservation of Electrical Energy	3	0	0	3
2.	21153E54B	Embedded System Design	3	0	0	3
3.	21153E54C	Electric Vehicle Architecture	3	0	0	3
4.	21153E54D	Energy Management and Auditing	3	0	0	3
5.	21153E54E	SMPS and UPS	3	0	0	3
6.	21153E54F	Smart System Automation	3	0	0	3

ELECTIVE – II (VSEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1.	21153E55A	Special Electrical Machines	3	0	0	3
2.	21153E55B	Process Modeling and Simulation	3	0	0	3
3.	21153E55C	Energy Storage Systems	3	0	0	3
4.	21153E55D	Testing of Electric Vehicles	3	0	0	3
5.	21153E55E	Non Linear Control	3	0	0	3

ELECTIVE – III (V SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1	21153E56A	Embedded C- Programming	3	0	0	3
2	21153E56B	Smart Grids	3	0	0	3
3	21153E56C	Control of Power Electronics Circuits	3	0	0	3
4	21153E56D	VLSI Design	3	0	0	3
5	21153E56E	Intelligent control of Electric Vehicles	3	0	0	3
6	21153E56F	Adaptive Control	3	0	0	3
7	21153E56G	PLC Programming	3	0	0	3

ELECTIVE – IV (VI SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1	21153E64A	Power System Transients	3	0	0	3
2	21153E64B	Power Quality	3	0	0	3
3	21153E64C	Power Electronics for Renewable Energy Systems	3	0	0	3
4	21153E64D	Embedded System for Automotive Applications	3	0	0	3
5	21153E64E	Grid Integration of Electric Vehicles	3	0	0	3
6	21153E64F	Optimal Control	3	0	0	3

ELECTIVE – V (VI SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1	21153E65A	HVDC and FACTS	3	0	0	3
2	21153E65B	Electrical Drives	3	0	0	3
3	21153E65C	Embedded Control for Electrical Drives	3	0	0	3
4	21153E65D	Design of Electric Vehicle Charging System	3	0	0	3
5	21153E65E	Model Based Control	3	0	0	3
6	21153E65F	Grid integrating Techniques and Challenges	3	0	0	3

ELECTIVE – VI (VI SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1	21153E66A	Digital Signal Processing System	3	0	0	3
2	21153E66B	Under Ground Cable Engineering	3	0	0	3
3	21153E66C	Analysis of Electrical Machines	3	0	0	3
4	21153E66D	Design of Motor and Power Converters for Electric Vehicles	3	0	0	3
5	21153E66E	Hybrid Energy Technology	3	0	0	3
6	21153E66F	Computer Control of Processes	3	0	0	3

ELECTIVE – VII (VII SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1.	21160S75A	Total Quality Management	3	0	0	3
2.	21160S75B	Engineering Economics and Financial Accounting	3	0	0	3
3.	21160S75C	Human Resource Management	3	0	0	3
4.	21160S75D	Knowledge Management	3	0	0	3
5.	21160S75E	Industrial Management	3	0	0	3
6.	21160S75F	Principles of Management	3	0	0	3

ELECTIVE – VIII (VII SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1	21153E76A	Substation Engineering and Substation and Substation Automation	3	0	0	3
2	21153E76B	Multilevel Power Converters	3	0	0	3
3	21153E76C	Embedded Processors	3	0	0	3
4	21153E76D	Electric Vehicle Design, Mechanics and Control	3	0	0	3
5	21153E76E	System Identification	3	0	0	3
6	21153E76F	Design and Modelling of Renewable Energy Systems	3	0	0	3

OPEN ELECTIVE I (VI SEM)

S.No	Course Code	Course Name	L	T	P	C
1	21150OE61A	IoT Concepts and Applications	2	0	2	3
2	21150OE61B	Augmented and Virtual Reality	2	0	2	3

OPEN ELECTIVE II (VII SEM)

S.No	Course Code	Course Name	L	T	P	C
1	21150OE74A	Artificial Intelligence and Machine Learning Fundamentals	2	0	2	3
2	21150OE74B	Data Science Fundamentals	2	0	2	3

OPEN ELECTIVE III (VII SEM)

S.No	Course Code	Course Name	L	T	P	C
1	21147OE73A	English for Competitive Examinations	3	0	0	3
2	21154OE73A	Industrial Management	3	0	0	3
3	21154OE73B	Introduction to nondestructive testing	3	0	0	3
4	21155OE73A	Remote Sensing Concepts	3	0	0	3
5	21155OE73B	Drinking Water Supply and Treatment	3	0	0	3
6	21152OE73A	Nano Technology	3	0	0	3
7	21152OE73B	Signals and Systems	3	0	0	3

OPEN ELECTIVE IV (VII SEM)

S.No	Course Code	Course Name	L	T	P	C
1	21154OE74A	Additive Manufacturing	3	0	0	3
2	21154OE74B	Industrial safety	3	0	0	3
3	21155OE74A	Geographical Information System	3	0	0	3
4	21155OE74B	Basics of Integrated Water Resources Management	3	0	0	3
5	21152OE74A	Wearable devices	3	0	0	3
6	21152OE74B	Medical Informatics	3	0	0	3

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

CREDITS DISTRIBUTION

CGPA CREDITS

Semester	Core	Elective	Free Elective	Management Elective	RSD Course	Others	Total
I	21	-	-	-	-	-	21
II	26	-	-	-	-	-	26
III	27	-	-	-	-	-	27
IV	23	-	-	-	-	-	23
V	13	09	-	-	-	-	22
VI	08	09	03	-	-	-	20
VII	05	03	09	03	-	-	20
VIII	10	-	-	-	-	-	10
Over ALL Credits							**169**

NON CGPA CREDITS

Semester	Mandatory Course	Total
I	01	**01**
II	-	**-**
III	-	**-**
IV	-	**-**
V	01	**01**
VI	01	**01**
VII	-	**-**
VIII	-	**-**
Co curricular Activities	In-plant Training , Industrial Visit , Seminars & Conferences	-
TOTAL NON-CGPA CREDITS		**03**

TOTAL CREDITS	
CGPA CREDITS	**169**
NON-CGPA CREDITS	**03**
TOTAL	**172**

SYLLABI

2005

21147S11

COMMUNICATIVE ENGLISH

L	T	P	C
3	0	0	

OBJECTIVES:

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills

UNIT I SHARING INFORMATION RELATED TO ONESELF/FAMILY& FRIENDS 12

Reading- short comprehension passages, practice in skimming-scanning and predicting- **Writing-** completing sentences- - developing hints. **Listening-** short texts- short formal and informal conversations. **Speaking-** introducing oneself - exchanging personal information- **Language development-** Wh- Questions- asking and answering-yes or no questions- parts of speech. **Vocabulary development--** prefixes- suffixes- articles.- count/ uncount nouns.

UNIT II GENERAL READING AND FREE WRITING 12

Reading - comprehension-pre-reading-post reading- comprehension questions (multiple choice questions and /or short questions/ open-ended questions)-inductive reading- short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts)- register- **Writing –** paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions using some suggested vocabulary and structures –**Listening-** telephonic conversations. **Speaking –** sharing information of a personal kind—greeting – taking leave- **Language development** – prepositions, conjunctions **Vocabulary development-** guessing meanings of words in context.

UNIT III GRAMMAR AND LANGUAGE DEVELOPMENT 12

Reading- short texts and longer passages (close reading) **Writing-** understanding text structure- use of reference words and discourse markers-coherence-jumbled sentences **Listening** – listening to longer texts and filling up the table- product description- narratives from different sources. **Speaking-** asking about routine actions and expressing opinions. **Language development-** degrees of comparison- pronouns- direct vs indirect questions- **Vocabulary development –** single word substitutes- adverbs.

UNIT IV READING AND LANGUAGE DEVELOPMENT 12

Reading- comprehension-reading longer texts- reading different types of texts- magazines **Writing-** letter writing, informal or personal letters-e-mails-conventions of personal email- **Listening-** listening to dialogues or conversations and completing exercises based on them. **Speaking-** speaking about oneself- speaking about one's friend- **Language development-** Tenses- simple present-simple past- present continuous and past continuous- **Vocabulary development-** synonyms-antonyms- phrasal verbs

UNIT V EXTENDED WRITING 12

Reading- longer texts- close reading –**Writing-** brainstorming -writing short essays – developing an outline- identifying main and subordinate ideas- dialogue writing-**Listening** – listening to talks- conversations- **Speaking –** participating in conversations- short group conversations-**Language development**-modal verbs- present/ past perfect tense - **Vocabulary development**-collocations- fixed and semi-fixed expressions

REFERENCES

1. Bailey, Stephen. **Academic Writing: A practical guide for students**. New York: Rutledge,2011.
2. Comfort, Jeremy, et al. **Speaking Effectively : Developing Speaking Skillsfor BusinessEnglish.** Cambridge University Press, Cambridge: Reprint 2011
3. Dutt P. Kiranmai and RajeevanGeeta. **Basic Communication Skills,** Foundation Books: 2013
4. Means,L. Thomas and Elaine Langlois. **English & Communication For Colleges.** CengageLearning ,USA: 2007
5. Redston, Chris &Gillies Cunningham **Face2Face** (Pre-intermediate Student's Book& Workbook) Cambridge University Press, New Delhi: 2005 .

21148S12	ENGINEERING MATHEMATICS - I	L	T	P	C
		5	1	0	4

OBJECTIVES :

- The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

UNIT I DIFFERENTIAL CALCULUS 12

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

UNIT II FUNCTIONS OF SEVERAL VARIABLES 12

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT III INTEGRAL CALCULUS 12

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT IV MULTIPLE INTEGRALS 12

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

UNIT V DIFFERENTIAL EQUATIONS 12

Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients - Method of undetermined coefficients.

TOTAL : 60 PERIODS

OUTCOMES :

After completing this course, students should demonstrate competency in the following skills:

- Use both the limit definition and rules of differentiation to differentiate functions.
- Apply differentiation to solve maxima and minima problems.
- Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
- Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
- Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
- Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
- Apply various techniques in solving differential equations.

TEXT BOOKS :

1. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015. [For Units I & III - Sections 1.1, 2.2, 2.3, 2.5, 2.7(Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1(Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCES :

1. Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10th Edition, 2016.
2. Jain R.K. and Iyengar S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, New Delhi, 3rd Edition, 2007.
3. Narayanan, S. and Manicavachagom Pillai, T. K., “Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.
4. Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.
5. Weir, M.D and Joel Hass, "Thomas Calculus", 12tn Edition, Pearson India, 2016.

21149S13	ENGINEERING PHYSICS	L	T	P	C
		5	1	0	4

OBJECTIVES
:

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I PROPERTIES OF MATTER 9

Elasticity – Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment - I-shaped girders - stress due to bending in beams.

UNIT II WAVES AND FIBER OPTICS 9

Oscillatory motion – forced and damped oscillations: differential equation and its solution – plane progressive waves – wave equation. Lasers : population of energy levels, Einstein's A and B coefficients derivation – resonant cavity, optical amplification (qualitative) – Semiconductor lasers: homojunction and heterojunction – Fiber optics: principle, numerical aperture and acceptance angle -types of optical fibres (material, refractive index, mode) – losses associated with optical fibers - fibre optic sensors: pressure and displacement.

UNIT III THERMAL PHYSICS 9

Transfer of heat energy – thermal expansion of solids and liquids – expansion joints - bimetallic strips - thermal conduction, convection and radiation – heat conductions in solids – thermal conductivity - Forbe's and Lee's disc method: theory and experiment - conduction through compound media (series and parallel) – thermal insulation – applications: heat exchangers, refrigerators, ovens and solar water heaters.

UNIT IV QUANTUM PHYSICS 9

Black body radiation – Planck's theory (derivation) – Compton effect: theory and experimental verification – wave particle duality – electron diffraction – concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box – tunnelling (qualitative) - scanning tunnelling microscope.

UNIT V CRYSTAL PHYSICS 9

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - crystal imperfections: point defects, line defects – Burger vectors, stacking faults – role of imperfections in plastic deformation - growth of single crystals: solution and melt growth techniques.

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course,

- the students will gain knowledge on the basics of properties of matter and its applications,
- the students will acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics,
- the students will have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers,
- the students will get knowledge on advanced physics concepts of quantum theory and its applications in tunneling microscopes, and
- the students will understand the basics of crystals, their structures and different crystal growth techniques.

TEXT BOOKS:

1. Bhattacharya, D.K. & Poonam, T. “Engineering Physics”. Oxford University Press, 2015.
2. Gaur, R.K. & Gupta, S.L. “Engineering Physics”. Dhanpat Rai Publishers, 2012.
3. Pandey, B.K. & Chaturvedi, S. “Engineering Physics”. Cengage Learning India, 2012.

REFERENCES:

1. Halliday, D., Resnick, R. & Walker, J. “Principles of Physics”. Wiley, 2015.
2. Serway, R.A. & Jewett, J.W. “Physics for Scientists and Engineers”. Cengage Learning, 2010.
3. Tipler, P.A. & Mosca, G. “Physics for Scientists and Engineers with Modern Physics’. W.H.Freeman, 2007.

21149S14 **ENGINEERING CHEMISTRY** **L T P C**
5 1 0 4

OBJECTIVES:

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.

UNIT I WATER AND ITS TREATMENT 9

Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA – numerical problems – boiler troubles (scale and sludge) – treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) external treatment – Ion exchange process, zeolite process – desalination of brackish water - Reverse Osmosis.

UNIT II SURFACE CHEMISTRY AND CATALYSIS 9

Adsorption: Types of adsorption – adsorption of gases on solids – adsorption of solute from solutions – adsorption isotherms – Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – contact theory – kinetics of surface reactions, unimolecular reactions, Langmuir - applications of adsorption on pollution abatement.

Catalysis: Catalyst – types of catalysis – criteria – autocatalysis – catalytic poisoning and catalytic promoters - acid base catalysis – applications (catalytic convertor) – enzyme catalysis– Michaelis – Menten equation.

UNIT III ALLOYS AND PHASE RULE 9

Alloys: Introduction- Definition- properties of alloys- significance of alloying, functions and effect of alloying elements- Nichrome and stainless steel (18/8) – heat treatment of steel. Phase rule: Introduction, definition of terms with examples, one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system - Pattinson process.

UNIT IV FUELS AND COMBUSTION 9

Fuels: Introduction - classification of fuels - coal - analysis of coal (proximate and ultimate) - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum - manufacture of synthetic petrol (Bergius process) - knocking - octane number - diesel oil - cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) - power alcohol and biodiesel. Combustion of fuels: Introduction - calorific value - higher and lower calorific values- theoretical calculation of calorific value - ignition temperature - spontaneous ignition temperature - explosive range - flue gas analysis (ORSAT Method).

UNIT V ENERGY SOURCES AND STORAGE DEVICES 9

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H_2-O_2 fuel cell.

TOTAL: 45 PERIODS

OUTCOMES:

- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

TEXT BOOKS:

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015
2. P. C. Jain and Monika Jain, "Engineering Chemistry" Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.

REFERENCES:

1. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
2. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
3. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.

21154S15	ENGINEERING GRAPHICS	L T P C
		5 1 0 4

OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (Not for Examination) 1

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREEHAND SKETCHING 7+12

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and t r ue inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 5+12

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 5+12

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+12

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

TOTAL: 90 PERIODS

OUTCOMES:

On successful completion of this course, the student will be able to

- familiarize with the fundamentals and standards of Engineering graphics
- perform freehand sketching of basic geometrical constructions and multiple views of objects.
- project orthographic projections of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- visualize and to project isometric and perspective sections of simple solids.

TEXT BOOK:

1. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.

REFERENCES:

1. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
2. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.
3. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
4. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
5. N S Parthasarathy And Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
6. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

21150S16 **PROBLEM SOLVING AND PYTHON PROGRAMMING** **L T P C**
5 1 0 4

COURSE OBJECTIVES:

- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures –- lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT I ALGORITHMIC PROBLEM SOLVING 9

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS 9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

UNIT V FILES, MODULES, PACKAGES 9

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

- Develop algorithmic solutions to simple computational problems
- Read, write, execute by hand simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python Programs.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)

2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

REFERENCES:

1. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
2. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press , 2013
3. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
4. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013.
5. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
6. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd.,, 2015.

19150L17	**PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY**	**LT P C** **0 0 3 2**

COURSE OBJECTIVES:

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

LIST OF PROGRAMS

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

PLATFORM NEEDED
Python 3 interpreter for Windows/Linux

COURSE OUTCOMES:
Upon completion of the course, students will be able to

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

TOTAL :60 PERIODS

21149L18 **PHYSICS AND CHEMISTRY LABORATORY**
(Common to all branches of B.E. / B.Tech Programmes)

L	T	P	C
0	0	3	2

OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young's modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser
   (b) Determination of acceptance angle in an optical fiber.
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method

OUTCOMES:
Upon completion of the course, the students will be able to **TOTAL: 30 PERIODS**

- apply principles of elasticity, optics and thermal properties for engineering applications.

CHEMISTRY LABORATORY: (Any seven experiments to be conducted) OBJECTIVES:

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by viscometery.

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10- Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
11. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
12. Pseudo first order kinetics-ester hydrolysis.
13. Corrosion experiment-weight loss method.
14. Determination of CMC.
15. Phase change in a solid.
16. Conductometric titration of strong acid vs strong base.

OUTCOMES:

- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

TOTAL: 30

PERIODS TEXTBOOKS:

1. Vogel's Textbook of Quantitative Chemical Analysis (8^{TH} edition, 2014)

21147S21

TECHNICAL ENGLISH

L	T	P	C
3	1	0	4

OBJECTIVES: The Course prepares second semester engineering and Technology students to:

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations , participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialisation.

UNIT I INTRODUCTION TECHNICAL ENGLISH 12

Listening- Listening to talks mostly of a scientific/technical nature and completing information-gap exercises- **Speaking** –Asking for and giving directions- **Reading** – reading short technical texts from journals- newsapapers- **Writing-** purpose statements – extended definitions – issue- writing instructions – checklists-recommendations-**Vocabulary Development-** technical vocabulary **Language Development** –subject verb agreement **-** compound words.

UNIT II READING AND STUDY SKILLS 12

Listening- Listening to longer technical talks and completing exercises based on them-**Speaking** – describing a process-**Reading** – reading longer technical texts- identifying the various transitions in a text- paragraphing- **Writing**- interpreting cgarts, graphs- **Vocabulary Development-**vocabularyused in formal letters/emails and reports **Language Development-** impersonal passive voice, numerical adjectives.

UNIT III TECHNICAL WRITING AND GRAMMAR 12

Listening- Listening to classroom lectures/ talkls on engineering/technology **-Speaking** – introduction to technical presentations- **Reading** – longer texts both general and technical, practice in speed reading; **Writing**-Describing a process, use of sequence words- **Vocabulary Development-** sequence words- Misspelled words. **Language Development-** embedded sentences

UNIT IV REPORT WRITING 12

Listening- Listening to documentaries and making notes. **Speaking** – mechanics of presentations- **Reading** – reading for detailed comprehension- **Writing-** email etiquette- job application – cover letter – Résumé preparation(via email and hard copy)- analytical essays and issue based essays-- **Vocabulary Development-** finding suitable synonyms-paraphrasing-. **Language Development-** clauses- if conditionals.

UNIT V GROUP DISCUSSION AND JOB APPLICATIONS 12

Listening- TED/Ink talks; **Speaking** –participating in a group discussion **-Reading**– reading and understanding technical articles **Writing**– Writing reports- minutes of a meeting- accident and survey- **Vocabulary Development- verbal analogies Language Development-** reported speech

TOTAL : 60 PERIODS

OUTCOMES: At the end of the course learners will be able to:

- Read technical texts and write area- specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialisation successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write reports and winning job applications.

TEXT BOOKS:

1. Board of editors. **Fluency in English A Course book for Engineering and Technology.** Orient Blackswan, Hyderabad: 2016
2. Sudharshana.N.P and Saveetha. C. **English for Technical Communication**. Cambridge University Press: New Delhi, 2016.

REFERENCES

1. Booth-L. Diana**, Project Work,** Oxford University Press**,** Oxford: 2014.
2. Grussendorf, Marion, **English for Presentations,** Oxford University Press, Oxford: 2007
3. Kumar, Suresh. E. **Engineering English**. Orient Blackswan: Hyderabad,2015
4. Means, L. Thomas and Elaine Langlois, **English & Communication For Colleges.** Cengage Learning, USA: 2007
5. Raman, Meenakshi and Sharma, Sangeetha- **Technical Communication Principles and Practice.**Oxford University Press: New Delhi,2014.

Students can be asked to read Tagore, Chetan Bhagat and for suplementary reading.

21148S22A	ENGINEERING MATHEMATICS – II	L	T	P	C
		5	1	0	4

OBJECTIVES :

- This course is designed to cover topics such as Matrix Algebra, Vector Calculus, Complex Analysis and Laplace Transform. Matrix Algebra is one of the powerful tools to handle practical problems arising in the field of engineering. Vector calculus can be widely used for modelling the various laws of physics. The various methods of complex analysis and Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

UNIT I MATRICES 12

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II VECTOR CALCULUS 12

Gradient and directional derivative – Divergence and curl - Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III ANALYTIC FUNCTIONS 12

Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions w z 1 2 - Bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour.

UNIT V LAPLACE TRANSFORMS 12

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear second order ordinary differential equations with constant coefficients.

OUTCOMES : **TOTAL: 60 PERIODS**

After successfully completing the course, the student will have a good understanding of the following topics and their applications:

- Eigenvalues and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.
- Gradient, divergence and curl of a vector point function and related identities.
- Evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems and their verification.
- Analytic functions, conformal mapping and complex integration.
- Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.

TEXT BOOKS :

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.

REFERENCES :

1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
2. Jain R.K. and Iyengar S.R.K., " Advanced Engineering Mathematics ", Narosa Publications, New Delhi , 3rd Edition, 2007.
3. O'Neil, P.V. "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.
4. Sastry, S.S, "Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi, 2014.
5. Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

21149S23B **PHYSICS FOR ELECTRONICS ENGINEERING**

L	T	P	C
5	1	0	3

(Common to BME, ME, CC, ECE, EEE, E&I, ICE)

OBJECTIVES:

- To understand the essential principles of Physics of semiconductor device and Electron transport properties. Become proficient in magnetic, dielectric and optical properties of materials and nano devices.

UNIT I ELECTRICAL PROPERTIES OF MATERIALS 9

Classical free electron theory - Expression for electrical conductivity – Thermal conductivity, expression - Wiedemann-Franz law – Success and failures - electrons in metals – Particle in a three dimensional box – degenerate states – Fermi- Dirac statistics – Density of energy states – Electron in periodic potential: Bloch thorem – metals and insulators - Energy bands in solids– tight binding approximation - Electron effective mass – concept of hole.

UNIT II SEMICONDUCTOR PHYSICS 9

Intrinsic Semiconductors – Energy band diagram – direct and indirect semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Carrier transport: Velocity-electric field relations – drift and diffusion transport - Einstein's relation – Hall effect and devices – Zener and avalanche breakdown in p-n junctions - Ohmic contacts – tunnel diode - Schottky diode – MOS capacitor - power transistor.

UNIT III MAGNETIC AND DIELECTRIC PROPERTIES OF MATERIALS 9

Magnetism in materials – magnetic field and induction – magnetization - magnetic permeability and susceptibility–types of magnetic materials – microscopic classification of magnetic materials - Ferromagnetism: origin and exchange interaction- saturation magnetization and Curie temperature – Domain Theory. Dielectric materials: Polarization processes – dielectric loss – internal field – Clausius-Mosotti relation- dielectric breakdown – high-k dielectrics.

UNIT IV OPTICAL PROPERTIES OF MATERIALS 9

Classification of optical materials – carrier generation and recombination processes - Absorption emission and scattering of light in metals, insulators and Semiconductors (concepts only) - photo current in a P- N diode – solar cell –photo detectors - LED – Organic LED – Laser diodes – excitons - quantum confined Stark effect – quantum dot laser.

UNIT V NANOELECTRONIC DEVICES 9

Introduction - electron density in bulk material – Size dependence of Fermi energy– quantum confinement – quantum structures - Density of states in quantum well, quantum wire and quantum dot structures –Zener-Bloch oscillations – resonant tunneling – quantum interference effects – mesoscopic structures: conductance fluctuations and coherent transport – Coulomb blockade effects - Single electron phenomena and Single electron Transistor – magnetic semiconductors– spintronics - Carbon nanotubes: Properties and applications.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the students will able to

- gain knowledge on classical and quantum electron theories, and energy band structuues,
- acquire knowledge on basics of semiconductor physics and its applications in various devices,
- get knowledge on magnetic and dielectric properties of materials,
- have the necessary understanding on the functioning of optical materials for optoelectronics,
- understand the basics of quantum structures and their applications in spintronics and carbon electronics.

TEXT BOOKS:

1. Kasap, S.O. "Principles of Electronic Materials and Devices", McGraw-Hill Education, 2007.
2. Umesh K Mishra & Jasprit Singh, "Semiconductor Device Physics and Design", Springer, 2008.
3. Wahab, M.A. "Solid State Physics: Structure and Properties of Materials". Narosa Publishing House, 2009.

REFERENCES

1. Garcia, N. & Damask, A. "Physics for Computer Science Students". Springer-Verlag, 2012.
2. Hanson, G.W. "Fundamentals of Nanoelectronics". Pearson Education, 2009
3. Rogers, B., Adams, J. & Pennathur, S. "Nanotechnology: Understanding Small Systems". CRC Press, 2014

21149S24A **ENVIRONMENTAL SCIENCE AND ENGINEERING** **L T P C**
5 1 0 4

OBJECTIVES:

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth"s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In- situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL: 45 PERIODS

OUTCOMES:

- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXTBOOKS:

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.

REFERENCES :

1. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD,New Delhi, 2007.
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) PVT, LTD, Hydrabad, 2015.
3. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.

21153S25C **CIRCUIT THEORY**

L	T	P	C
5	1	0	4

OBJECTIVES:

- To introduce electric circuits and its analysis
- To impart knowledge on solving circuit equations using network theorems
- To introduce the phenomenon of resonance in coupled circuits.
- To educate on obtaining the transient response of circuits.
- To introduce Phasor diagrams and analysis of three phase circuits

UNIT I BASIC CIRCUITS ANALYSIS 6+6

Resistive elements - Ohm's Law Resistors in series and parallel circuits – Kirchoffs laws – Mesh current and node voltage - methods of analysis.

UNIT II NETWORK REDUCTION AND THEOREMS FOR DC AND AC IRCUITS 6+6

Network reduction: voltage and current division, source transformation – star delta conversion. Thevenins and Norton Theorems – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem – Millman's theorem.

UNIT III TRANSIENT RESPONSE ANALYSIS 6+6

L and C elements -Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. sinusoidal input.

UNIT IV THREE PHASE CIRCUITS 6+6

A.C. circuits – Average and RMS value - Phasor Diagram – Power, Power Factor and Energy.- Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents – power measurement in three phase circuits.

UNIT V RESONANCE AND COUPLED CIRCUITS 6+6

Series and parallel resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

OUTCOMES: **TOTAL : 60 PERIODS**

- Ability to analyse electrical circuits
- Ability to apply circuit theorems
- Ability to analyse transients

TEXT BOOKS:

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", McGraw Hill publishers, edition, New Delhi, 2013.
2. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, 2013.
3. Allan H. Robbins, Wilhelm C. Miller, "Circuit Analysis Theory and Practice", Cengage Learning India, 2013.

REFERENCES

1. Chakrabarti A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, 1999.
2. Jegatheesan, R., "Analysis of Electric Circuits," McGraw Hill, 2015.
3. Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, McGraw- Hill, New Delhi, 2010.
4. M E Van Valkenburg, "Network Analysis",Prentice-Hall of India Pvt Ltd, New Delhi,

2015.
5. Mahadevan, K., Chitra, C., "Electric Circuits Analysis," Prentice-Hall of India Pvt Ltd., New Delhi, 2015.
6. Richard C. Dorf and James A. Svoboda, "Introduction to Electric Circuits", 7th Edition, John Wiley & Sons, Inc. 2015.
7. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", McGraw Hill, 2015.

21154S26C **BASIC CIVIL AND MECHANICAL ENGINEERING** **L T P C**
5 1 0 4

OBJECTIVES:

- To impart basic knowledge on Civil and Mechanical Engineering.
- To familiarize the materials and measurements used in Civil Engineering.
- To provide the exposure on the fundamental elements of civil engineering structures.
- To enable the students to distinguish the components and working principle of power plant units, IC engines, and R & AC system.

A – OVER VIEW

UNIT I SCOPE OF CIVIL AND MECHANICAL ENGINEERING 10

Overview of Civil Engineering - Civil Engineering contributions to the welfare of Society – Specialized sub disciplines in Civil Engineering – Structural, Construction, Geotechnical, Environmental, Transportation and Water Resources Engineering

Overview of Mechanical Engineering - Mechanical Engineering contributions to the welfare of Society –Specialized sub disciplines in Mechanical Engineering - Production, Automobile, Energy Engineering - Interdisciplinary concepts in Civil and Mechanical Engineering.

B – CIVIL ENGINEERING

UNIT II SURVEYING AND CIVIL ENGINEERING MATERIALS 10

Surveying: Objects – classification – principles – measurements of distances – angles – leveling – determination of areas– contours - examples.

Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel - timber - modern materials

UNIT III BUILDING COMPONENTS AND STRUCTURES 15

Foundations: Types of foundations - Bearing capacity and settlement – Requirement of good foundations.

Civil Engineering Structures: Brickmasonry – stonemasonry – beams – columns – lintels – roofing – flooring – plastering – floor area, carpet area and floor space index - Types of Bridges and Dams – water supply - sources and quality of water - Rain water harvesting - introduction to high way and rail way.

C – MECHANICAL ENGINEERING

UNIT IV INTERNAL COMBUSTION ENGINES AND POWER PLANTS 15

Classification of Power Plants - Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Working principle of steam, Gas, Diesel, Hydro - electric and Nuclear Power plants –- working principle of Boilers, Turbines, Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps

UNIT V REFRIGERATION AND AIR CONDITIONING SYSTEM 10

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system– Layout of typical domestic refrigerator–Window and Split type room Air conditioner.

OUTCOMES: **TOTAL: 60 PERIODS**

On successful completion of this course, the student will be able to

- appreciate the Civil and Mechanical Engineering components of Projects.
- explain the usage of construction material and proper selection of construction materials.
- measure distances and area by surveying
- identify the components used in power plant cycle.
- demonstrate working principles of petrol and diesel engine.
- elaborate the components of refrigeration and Air conditioning cycle.

TEXTBOOKS:

1. Shanmugam Gand Palanichamy MS,“Basic Civil and Mechanical Engineering”,Tata McGraw Hill PublishingCo.,NewDelhi,1996.

REFERENCES:

1. Palanikumar, K. Basic Mechanical Engineering, ARS Publications, 2010.
2. Ramamrutham S.,“Basic Civil Engineering”, Dhanpat Rai Publishing Co.(P) Ltd.1999.
3. Seetharaman S.,“BasicCivil Engineering”,AnuradhaAgencies,2005.
4. ShanthaKumar SRJ.,“Basic Mechanical Engineering”, Hi-tech Publications, Mayiladuthurai, 2000.
5. Venugopal K. and Prahu Raja V., “Basic Mechanical Engineering”, Anuradha Publishers, Kumbakonam,2000.

21154L27 ENGINEERING PRACTICES LABORATORY L T P C
0 0 3 2

OBJECTIVES:

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE 13

Buildings:

(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works. (d) Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

(a) Study of the joints in roofs, doors, windows and furniture. (b) Hands-on-exercise:
Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE 18

Welding:

(a) Preparation of butt joints, lap joints and T-joints by Shielded metal arc welding. (b) Gas welding practice

Basic Machining:

(a) Simple Turning and Taper turning
(b) Drilling Practice

Sheet Metal Work:

(a) Forming & Bending:
(b) Model making – Trays and funnels. (c) Different type of joints.

Machine assembly practice:

(a) Study of centrifugal pump
(b) Study of air conditioner

Demonstration on:

(a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.
(c) Fitting – Exercises – Preparation of square fitting and V – fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE 13

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of an electrical equipment.

IV ELECTRONICS ENGINEERING PRACTICE **16**

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

OUTCOMES:

On successful completion of this course, the student will be able to

TOTAL: 60 PERIODS

- fabricate carpentry components and pipe connections including plumbing works.
- use welding equipments to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metal works
- Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundary and fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, soldering practices.

CIVIL

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.	15 Sets.	
2. Carpentry vice (fitted to work bench)	15 Nos.	
3. Standard woodworking tools	15 Sets.	
4. Models of industrial trusses, door joints, furniture joints	5 each	
5. Power Tools: (a) Rotary Hammer	2 Nos	
(b) Demolition Hammer	2 Nos	(c)
Circular Saw	2 Nos	(d)
Planer	2 Nos	(e)
Hand Drilling Machine	2 Nos	(f)
Jigsaw	2 Nos	

MECHANICAL

1. Arc welding transformer with cables and holders	5 Nos.
2. Welding booth with exhaust facility	5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 Nos.
5. Centre lathe	2 Nos.
6. Hearth furnace, anvil and smithy tools	2 Sets.
7. Moulding table, foundry tools	2 Sets.
8. Power Tool: Angle Grinder	2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner	One each.

ELECTRICAL

1. Assorted electrical components for house wiring	15 Sets
2. Electrical measuring instruments	10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp	1 each
4. Megger (250V/500V)	1 No.
5. Power Tools: (a) Range Finder	2 Nos
(b) Digital Live-wire detector	2 Nos

ELECTRONICS

1. Soldering guns	10 Nos.
2. Assorted electronic components for making circuits	50 Nos.
3. Small PCBs	10 Nos.
4. Multimeters	10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply	

21153L28C	ELECTRIC CIRCUITS LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES:

- To simulate various electric circuits using Pspice/ Matlab/e-Sim / Scilab
- To gain practical experience on electric circuits and verification of theorems.

LIST OF EXPERIMENTS

1. Simulation and experimental verification of electrical circuit problems using Kirchhoff's voltage and current laws.
2. Simulation and experimental verification of electrical circuit problems using Thevenin's theorem.
3. Simulation and experimental verification of electrical circuit problems using Norton's theorem.
4. Simulation and experimental verification of electrical circuit problems using Superposition theorem.
5. Simulation and experimental verification of Maximum Power transfer Theorem.
6. Study of Analog and digital oscilloscopes and measurement of sinusoidal voltage, frequency and power factor.
7. Simulation and Experimental validation of R-C electric circuit transients.
8. Simulation and Experimental validation of frequency response of RLC electric circuit.
9. Design and Simulation of series resonance circuit.
10. Design and Simulation of parallel resonant circuits.
11. Simulation of three phase balanced and unbalanced star, delta networks circuits.

OUTCOMES: **TOTAL: 60 PERIODS**

- Understand and apply circuit theorems and concepts in engineering applications.
- Simulate electric circuits.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Regulated Power Supply: 0 – 15 V D.C - 10 Nos / Distributed Power Source.
2. Function Generator (1 MHz) - 10 Nos.
3. Single Phase Energy Meter - 1 No.
4. Oscilloscope (20 MHz) - 10 Nos.
5. Digital Storage Oscilloscope (20 MHz) – 1 No.
6. 10 Nos. of PC with Circuit Simulation Software (min 10 Users) (e-Sim / Scilab/ Pspice / MATLAB /other Equivalent software Package) and Printer (1 No.)
7. AC/DC - Voltmeters (10 Nos.), Ammeters (10 Nos.) and Multi-meters (10 Nos.)
8. Single Phase Wattmeter – 3 Nos.
9. Decade Resistance Box, Decade Inductance Box, Decade Capacitance Box - 6 Nos each.
10. Circuit Connection Boards - 10 Nos.Necessary Quantities of Resistors,Inductors, Capacitors of various capacities (Quarter Watt to 10Watt

21149S31C TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

L	T	P	C
3	1	0	4

OBJECTIVES :

- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations – Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II FOURIER SERIES 12

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12

Classification of PDE – Method of separation of variables - Fourier Series Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

UNIT IV FOURIER TRANSFORMS 12

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS 12

Z-transforms - Elementary properties – Inverse Z-transform (using partial fraction and residues) – Initial and final value theorems - Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

TOTAL : 60 PERIODS

OUTCOMES :

Upon successful completion of the course, students should be able to:

- Understand how to solve the given standard partial differential equations.
- Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
- Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
- Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

TEXT BOOKS :

1. Grewal B.S., “Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, New Delhi, 2014.
2. Narayanan S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.

REFERENCES :

1. Andrews, L.C and Shivamoggi, B, "Integral Transforms for Engineers" SPIE Press, 1999.
2. Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 9th Edition, Laxmi Publications Pvt. Ltd, 2014.
3. Erwin Kreyszig, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, India, 2016.
4. James, G., "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.
5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
6. Wylie, R.C. and Barrett, L.C., “Advanced Engineering Mathematics “Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

21153C32	DIGITAL LOGIC CIRCUITS	L	T	P	C
		3	1	0	3

OBJECTIVES:

- To study various number systems and simplify the logical expressions using Boolean functions
- To study combinational circuits
- To design various synchronous and asynchronous circuits.
- To introduce asynchronous sequential circuits and PLDs
- To introduce digital simulation for development of application oriented logic circuits.

UNIT I NUMBER SYSTEMS AND DIGITAL LOGIC FAMILIES 6+6

Review of number systems, binary codes, error detection and correction codes (Parity and Hamming code) - Digital Logic Families -comparison of RTL, DTL, TTL, ECL and MOS families -operation, characteristics of digital logic family.

UNIT II COMBINATIONAL CIRCUITS 6+6

Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps - simplification and implementation of combinational logic – multiplexers and de multiplexers - code converters, adders, subtractors, Encoders and Decoders.

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS 6+6

Sequential logic- SR, JK, D and T flip flops - level triggering and edge triggering - counters - asynchronous and synchronous type - Modulo counters - Shift registers - design of synchronous sequential circuits – Moore and Melay models- Counters, state diagram; state reduction; state assignment.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS AND PROGRAMMABILITY LOGIC DEVICES 6+6

Asynchronous sequential logic circuits-Transition tability, flow tability-race conditions, hazards &errors in digital circuits; analysis of asynchronous sequential logic circuits- introduction to Programmability Logic Devices: PROM – PLA –PAL, CPLD-FPGA.

UNIT V VHDL 6+6

RTL Design – combinational logic – Sequential circuit – Operators – Introduction to Packages – Subprograms – Test bench. (Simulation /Tutorial Examples: adders, counters, flip flops, Multiplexers & De multiplexers).

OUTCOMES: **TOTAL : 60PERIODS**

- Ability to design combinational and sequential Circuits.
- Ability to simulate using software package.
- Ability to study various number systems and simplify the logical expressions using Boolean functions
- Ability to design various synchronous and asynchronous circuits.
- Ability to introduce asynchronous sequential circuits and PLDs
- Ability to introduce digital simulation for development of application oriented logic circuits.

TEXT BOOKS:

1. James W. Bignel, Digital Electronics, Cengage learning, 5th Edition, 2007.
2. M. Morris Mano, 'Digital Design with an introduction to the VHDL', Pearson Education, 2013.
3. Comer "Digital Logic & State Machine Design, Oxford, 2012.

REFERENCES

1. Mandal, "Digital Electronics Principles & Application, McGraw Hill Edu, 2013.
2. William Keitz, Digital Electronics-A Practical Approach with VHDL, Pearson, 2013.
3. Thomas L.Floyd, 'Digital Fundamentals', 11th edition, Pearson Education,2015.
4. Charles H.Roth, Jr, Lizy Lizy Kurian John, 'Digital System Design using VHDL, Cengage, 2013.
5. D.P.Kothari,J.S.Dhillon, 'Digital circuits and Design',Pearson Education,2016.

21153C33	ELECTROMAGNETIC THEORY	L	T	P	C
		2	2	0	3

OBJECTIVES:

- To introduce the basic mathematical concepts related to electromagnetic vector fields
- To impart knowledge on the concepts of
  - Electrostatic fields, electrical potential, energy density and their applications.
  - Magneto static fields, magnetic flux density, vector potential and its applications. Different methods of emf generation and Maxwell's equations
  - Electromagnetic waves and characterizing parameters

UNIT I ELECTROSTATICS – I 6+6

Sources and effects of electromagnetic fields – Coordinate Systems – Vector fields –Gradient, Divergence, Curl – theorems and applications - Coulomb's Law – Electric field intensity – Field due to discrete and continuous charges – Gauss's law and applications.

UNIT II ELECTROSTATICS – II 6+6

Electric potential – Electric field and equipotential plots, Uniform and Non-Uniform field, Utilization factor – Electric field in free space, conductors, dielectrics - Dielectric polarization – Dielectric strength - Electric field in multiple dielectrics – Boundary conditions, Poisson's and Laplace's equations, Capacitance, Energy density, Applications.

UNIT III MAGNETOSTATICS 6+6

Lorentz force, magnetic field intensity (H) – Biot–Savart's Law - Ampere's Circuit Law – H due to straight conductors, circular loop, infinite sheet of current, Magnetic flux density (B) – B in free space, conductor, magnetic materials – Magnetization, Magnetic field in multiple media – Boundary conditions, scalar and vector potential, Poisson's Equation, Magnetic force, Torque, Inductance, Energy density, Applications.

UNIT IV ELECTRODYNAMIC FIELDS 6+6

Magnetic Circuits - Faraday's law – Transformer and motional EMF – Displacement current - Maxwell's equations (differential and integral form) – Relation between field theory and circuit theory – Applications.

UNIT V ELECTROMAGNETIC WAVES 6+6

Electromagnetic wave generation and equations – Wave parameters; velocity, intrinsic impedance, propagation constant – Waves in free space, lossy and lossless dielectrics, conductors- skin depth - Poynting vector – Plane wave reflection and refraction.

TOTAL : 60 PERIODS

OUTCOMES:

- Ability to understand the basic mathematical concepts related to electromagnetic vector fields.
- Ability to understand the basic concepts about electrostatic fields, electrical potential, energy density and their applications.
- Ability to acquire the knowledge in magneto static fields, magnetic flux density, vector potential and its applications.
- Ability to understand the different methods of emf generation and Maxwell's equations
- Ability to understand the basic concepts electromagnetic waves and characterizing parameters
- Ability to understand and compute Electromagnetic fields and apply them for design and analysis of electrical equipment and systems

TEXT BOOKS:

1. Mathew N. O. Sadiku, 'Principles of Electromagnetics', 6th Edition, Oxford University Press Inc. Asian edition, 2015.
2. William H. Hayt and John A. Buck, 'Engineering Electromagnetics', McGraw Hill Special Indian edition, 2014.
3. Kraus and Fleish, 'Electromagnetics with Applications', McGraw Hill International Editions, Fifth Edition, 2010

REFERENCES

1. V.V.Sarwate, 'Electromagnetic fields and waves', First Edition, Newage Publishers, 1993.
2. J.P.Tewari, 'Engineering Electromagnetics - Theory, Problems and Applications', Second Edition, Khanna Publishers.
3. Joseph. A.Edminister, 'Schaum's Outline of Electromagnetics, Third Edition (Schaum's Outline Series), McGraw Hill, 2010.
4. S.P.Ghosh, Lipika Datta, 'Electromagnetic Field Theory', First Edition, McGraw Hill Education(India) Private Limited, 2012.
5. K A Gangadhar, 'Electromagnetic Field Theory', Khanna Publishers; Eighth Reprint : 2015
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21153C34	ELECTRICAL MACHINES – I	L	T	P	C
		2	2	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Magnetic-circuit analysis and introduce magnetic materials
- Constructional details, the principle of operation, prediction of performance, the methods of testing the transformers and three phase transformer connections.
- Working principles of electrical machines using the concepts of electromechanical energy conversion principles and derive expressions for generated voltage and torque developed in all Electrical Machines.
- Working principles of DC machines as Generator types, determination of their no-load/load characteristics, starting and methods of speed control of motors.
- Various losses taking place in D.C. Motor and to study the different testing methods to arrive at their performance.

UNIT I MAGNETIC CIRCUITS AND MAGNETIC MATERIALS 6+6

Magnetic circuits –Laws governing magnetic circuits - Flux linkage, Inductance and energy – Statically and Dynamically induced EMF - Torque – Properties of magnetic materials, Hysteresis and Eddy Current losses - AC excitation, introduction to permanent magnets-Transformer as a magnetically coupled circuit.

UNIT II TRANSFORMERS 6+6

Construction – principle of operation – equivalent circuit parameters – phasor diagrams, losses – testing – efficiency and voltage regulation-all day efficiency-Sumpner's test, per unit representation – inrush current - three phase transformers-connections – Scott Connection
– Phasing of transformer– parallel operation of three phase transformers-auto transformer –
tap changing transformers- tertiary winding.

UNIT III ELECTROMECHANICAL ENERGY CONVERSION AND CONCEPTS IN ROTATING MACHINES 6+6

Energy in magnetic system – Field energy and co energy-force and torque equations – singly and multiply excited magnetic field systems-mmf of distributed windings – Winding Inductances-, magnetic fields in rotating machines – rotating mmf waves – magnetic saturation and leakage fluxes.

UNIT IV DC GENERATORS 6+6

Construction and components of DC Machine – Principle of operation - Lap and wave windings-EMF equations– circuit model – armature reaction –methods of excitation- commutation - interpoles compensating winding –characteristics of DC generators.

UNIT V DC MOTORS 6+6

Principle and operations - types of DC Motors – Speed Torque Characteristics of DC Motors- starting and speed control of DC motors –Plugging, dynamic and regenerative braking- testing and efficiency – Retardation test- Swinburne's test and Hopkinson's test - Permanent Magnet DC (PMDC)motors-applications of DC
Motor

OUTCOMES: **TOTAL : 60 PERIODS**

- Ability to analyze the magnetic-circuits.

- Ability to acquire the knowledge in constructional details of transformers.
- Ability to understand the concepts of electromechanical energy conversion.
- Ability to acquire the knowledge in working principles of DC Generator.
- Ability to acquire the knowledge in working principles of DC Motor
- Ability to acquire the knowledge in various losses taking place in D.C. Machines

TEXT BOOKS:

1. Stephen J. Chapman, 'Electric Machinery Fundamentals'4th edition, McGraw Hill Education Pvt. Ltd, 2010.
2. P.C. Sen'Principles of Electric Machines and Power Electronics' John Wiley & Sons; 3rd Edition 2013.
3. Nagrath, I.J. and Kothari.D.P., Electric Machines', McGraw-Hill Education, 2004

REFERENCES

1. Theodore Wildi, "Electrical Machines, Drives, and Power Systems", Pearson Education., (5th Edition)**,** 2002**.**
2. B.R. Gupta ,'Fundamental of Electric Machines' New age International Publishers,3rd Edition ,Reprint 2015.
3. S.K. Bhattacharya, 'Electrical Machines' McGraw - Hill Education, New Delhi, 3rd Edition,2009.
4. Vincent Del Toro, 'Basic Electric Machines' Pearson India Education, 2016.
5. Surinder Pal Bali, 'Electrical Technology Machines & Measurements, Vol.II, Pearson, 2013.
6. Fitzgerald. A.E., Charles Kingsely Jr, Stephen D.Umans, 'Electric Machinery', Sixth edition, McGraw Hill Books Company, 2003.

21153C35	**ELECTRON DEVICES AND CIRCUITS**	**L T P C**
		3 0 0 3

OBJECTIVES:

The student should be made to:

- Understand the structure of basic electronic devices.
- Be exposed to active and passive circuit elements.
- Familiarize the operation and applications of transistor like BJT and FET.
- Explore the characteristics of amplifier gain and frequency response.
- Learn the required functionality of positive and negative feedback systems.

UNIT I PN JUNCTION DEVICES 9

PN junction diode –structure, operation and V-I characteristics, diffusion and transition capacitance - Rectifiers – Half Wave and Full Wave Rectifier,– Display devices- LED, Laser diodes, Zener diodecharacteristics- Zener Reverse characteristics – Zener as regulator

UNIT II TRANSISTORS AND THYRISTORS 9

BJT, JFET, MOSFET- structure, operation, characteristics and Biasing UJT, Thyristors and IGBT - Structure and characteristics.

UNIT III AMPLIFIERS 9

BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response –MOSFET small signal model– Analysis of CS and Source follower – Gain and frequency response- High frequency analysis.

UNIT IV MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER 9

BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis – FET input stages – Single tuned amplifiers – Gain and frequency response – Neutralization methods, power amplifiers –Types (Qualitative analysis).

UNIT V FEEDBACK AMPLIFIERS AND OSCILLATORS 9

Advantages of negative feedback – voltage / current, series , Shunt feedback –positive feedback – Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.

OUTCOMES: **TOTAL : 45 PERIODS**

Upon Completion of the course, the students will be ability to:

- Explain the structure and working operation of basic electronic devices.
- Able to identify and differentiate both active and passive elements
- Analyze the characteristics of different electronic devices such as diodes and transistors
- Choose and adapt the required components to construct an amplifier circuit.
- Employ the acquired knowledge in design and analysis of oscillators

TEXT BOOKS:

1. . David A. Bell ,"Electronic devices and circuits", Oxford University higher education, 5th edition 2008.
2. Sedra and smith, "Microelectronic circuits",7th Ed., Oxford University Press

REFERENCES:

1. Balbir Kumar, Shail.B.Jain, "Electronic devices and circuits" PHI learning private limited, 2nd edition 2014.
2. Thomas L.Floyd, "Electronic devices" Conventional current version, Pearson prentice hall, 10th Edition, 2017.
3. Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGraw Hill, 3rd Edition, 2003.
4. Robert L.Boylestad, "Electronic devices and circuit theory", 2002.
5. Robert B. Northrop, "Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation", CRC Press, 2004.

21153C36 **POWER PLANT ENGINEERING**

L	T	P	C
3	0	0	3

OBJECTIVE:

- Providing an overview of Power Plants and detailing the role of Mechanical Engineers in their operation and maintenance.

UNIT I COAL BASED THERMAL POWER PLANTS 9

Rankine cycle - improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.

UNIT II DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS 9

Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimisation. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.

UNIT III NUCLEAR POWER PLANTS 9

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : Boili*ng Water Reactor* (BWR), P*ressurized Water Reactor* (PW R), CANada Deuterium-Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

UNIT IV POWER FROM RENEWABLE ENERGY 9

Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, *Solar* Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.

UNIT V ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS 9

Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

OUTCOMES: **TOTAL : 45 PERIODS**

Upon the completion of this course the students will be able to

CO1 Explain the layout, construction and working of the components inside a thermal power plant.

CO2 Explain the layout, construction and working of the components inside a Diesel, Gas and Combined cycle power plants.

CO3 Explain the layout, construction and working of the components inside nuclear power plants.

CO4 Explain the layout, construction and working of the components inside Renewable energy power plants.

CO5 Explain the applications of power plants while extend their knowledge to power plant economics and environmental hazards and estimate the costs of electrical energy production.

TEXT BOOK:

1. Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008.

REFERENCES:

1. El-Wakil. M.M., "Power Plant Technology", Tata McGraw – Hill Publishing Company Ltd., 2010.

2. Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.
3. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, "Power Plant Engineering", Second Edition, Standard Handbook of McGraw – Hill, 1998.

21153L37	ELECTRONICS LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES:

- To enability the students to understand the behavior of semiconductor device based on experimentation.

LIST OF EXPERIMENTS

1. Characteristics of Semiconductor diode and Zener diode
2. Characteristics of a NPN Transistor under common emitter , common collector and common base configurations
3. Characteristics of JFET and draw the equivalent circuit
4. Characteristics of UJT and generation of saw tooth waveforms
5. Design and Frequency response characteristics of a Common Emitter amplifier
6. Characteristics of photo diode & photo transistor, Study of light activated relay circuit
7. Design and testing of RC phase shift and LC oscillators
8. Single Phase half-wave and full wave rectifiers with inductive and capacitive filters
9. Differential amplifiers using FET
10. Study of CRO for frequency and phase measurements
11. Realization of passive filters

OUTCOMES:

- Ability to understand and analyse electronic circuits.

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Semiconductor devices like Diode, Zener Diode, NPN Transistors, JFET, UJT, Photo diode, Photo Transistor
2. Resistors, Capacitors and inductors
3. Necessary digital IC 8
4. Function Generators 10
5. Regulated 3 output Power Supply 5, ± 15V 10
6. CRO 10
7. Storage Oscilloscope 1
8. Bread boards
9. Atleast one demo module each for the listed equipments.
10. Component data sheets to be provided

21153L38	ELECTRICAL MACHINES LABORATORY-I	L	T	P	C
		0	0	3	2

OBJECTIVES:

- To expose the students to the operation of D.C. machines and transformers and give them experimental skill.

LIST OF EXPERIMENTS

1. Open circuit and load characteristics of DC shunt generator- critical resistance and critical speed.
2. Load characteristics of DC compound generator with differential and cumulative connections.
3. Load test on DC shunt motor.
4. Load test on DC compound motor.
5. Load test on DC series motor.
6. Swinburne's test and speed control of DC shunt motor.
7. Hopkinson's test on DC motor – generator set.
8. Load test on single-phase transformer and three phase transformers.
9. Open circuit and short circuit tests on single phase transformer.
10. Sumpner's test on single phase transformers.
11. Separation of no-load losses in single phase transformer.
12. Study of starters and 3-phase transformers connections.

TOTAL: 60 PERIODS

OUTCOMES:

- Ability to understand and analyze DC Generator
- Ability to understand and analyze DC Motor
- Ability to understand and analyse Transformers.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. DC Shunt Motor with Loading Arrangement – 3 nos
2. DC Shunt Motor Coupled with Three phase Alternator – 1 No.
3. Single Phase Transformer – 4 nos
4. DC Series Motor with Loading Arrangement – 1 No.
5. DC compound Motor with Loading Arrangement – 1 No.
6. Three Phase Induction Motor with Loading Arrangement – 2 nos
7. Single Phase Induction Motor with Loading Arrangement – 1 No.
8. DC Shunt Motor Coupled With DC Compound Generator – 2 nos
9. DC Shunt Motor Coupled With DC Shunt Motor – 1 No.
10. Tachometer -Digital/Analog – 8 nos
11. Single Phase Auto Transformer – 2 nos
12. Three Phase Auto Transformer – 1 No.
13. Single Phase Resistive Loading Bank – 2 nos
14. Three Phase Resistive Loading Bank. – 2 nos

21149S41C **NUMERICAL METHODS**

L	T	P	C
4	0	0	4

OBJECTIVES :

- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals in real life situations.
- To acquaint the student with understanding of numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.
- To understand the knowledge of various techniques and methods of solving various types of partial differential equations.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 12

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

UNIT II INTERPOLATION AND APPROXIMATION 12

Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Difference operators and relations - Interpolation with equal intervals - Newton's forward and backward difference formulae.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 12

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's Method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 12

Single step methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge - Kutta method for solving first order equations - Multi step methods - Milne's and Adams - Bash forth predictor corrector methods for solving first order equations.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 12

Finite difference methods for solving second order two - point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

TOTAL : 60 PERIODS

OUTCOMES :

Upon successful completion of the course, students should be able to:

- Understand the basic concepts and techniques of solving algebraic and transcendental equations.
- Appreciate the numerical techniques of interpolation and error approximations in various intervals in real life situations.
- Apply the numerical techniques of differentiation and integration for engineering problems.
- Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
- Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

TEXTBOOKS :

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.

REFERENCES :

1. Brian Bradie, "A Friendly Introduction to Numerical Analysis", Pearson Education, Asia, New Delhi, 2007.
2. Gerald. C. F. and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6th Edition, New Delhi, 2006.
3. Mathews, J.H. "Numerical Methods for Mathematics, Science and Engineering", 2nd Edition, Prentice Hall, 1992.
4. Sankara Rao. K., "Numerical Methods for Scientists and Engineers", Prentice Hall of India Pvt. Ltd, 3rd Edition, New Delhi, 2007.
5. Sastry, S.S, "Introductory Methods of Numerical Analysis", PHI Learning Pvt. Ltd, 5th Edition, 2015.

21153C42 ELECTRICAL MACHINES – II

L	T	P	C
2	2	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Construction and performance of salient and non – salient type synchronous generators.
- Principle of operation and performance of synchronous motor.
- Construction, principle of operation and performance of induction machines.
- Starting and speed control of three-phase induction motors.
- Construction, principle of operation and performance of single phase induction motors and special machines.

UNIT I SYNCHRONOUS GENERATOR 6+6

Constructional details – Types of rotors –winding factors- emf equation – Synchronous reactance – Armature reaction – Phasor diagrams of non salient pole synchronous generator connected to infinite bus--Synchronizing and parallel operation – Synchronizing torque -Change of excitation and mechanical input- Voltage regulation – EMF, MMF, ZPF and A.S.A methods – steady state power- angle characteristics– Two reaction theory –slip test -short circuit transients - Capability Curves

UNIT II SYNCHRONOUS MOTOR 6+6

Principle of operation – Torque equation – Operation on infinite bus bars - V and Inverted V curves – Power input and power developed equations – Starting methods – Current loci for constant power input, constant excitation and constant power developed-Hunting – natural frequency of oscillations – damper windings- synchronous condenser.

UNIT III THREE PHASE INDUCTION MOTOR 6+6

Constructional details – Types of rotors –- Principle of operation – Slip –cogging and crawling- Equivalent circuit – Torque-Slip characteristics - Condition for maximum torque – Losses and efficiency – Load test - No load and blocked rotor tests - Circle diagram – Separation of losses – Double cage induction motors –Induction generators – Synchronous induction motor.

UNIT IV STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR 6+6

Need for starting – Types of starters – DOL, Rotor resistance, Autotransformer and Star- delta starters – Speed control – Voltage control, Frequency control and pole changing – Cascaded connection-V/f control – Slip power recovery scheme-Braking of three phase induction motor: Plugging, dynamic braking and regenerative braking.

UNIT V SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES 6+6

Constructional details of single phase induction motor – Double field revolving theory and operation – Equivalent circuit – No load and blocked rotor test – Performance analysis – Starting methods of single-phase induction motors – Capacitor-start capacitor run Induction motor- Shaded pole induction motor - Linear induction motor – Repulsion motor - Hysteresis motor - AC series motor- Servo motors- Stepper motors - introduction to magnetic levitation systems.

TOTAL : 60 PERIODS

OUTCOMES:

- Ability to understand the construction and working principle of Synchronous Generator
- Ability to understand MMF curves and armature windings.
- Ability to acquire knowledge on Synchronous motor.
- Ability to understand the construction and working principle of Three phase Induction Motor
- Ability to understand the construction and working principle of Special Machines
- Ability to predetermine the performance characteristics of Synchronous Machines.

TEXT BOOKS:

1. A.E. Fitzgerald, Charles Kingsley, Stephen. D. Umans, 'Electric Machinery', Mc Graw Hill publishing Company Ltd, 2003.
2. Vincent Del Toro, 'Basic Electric Machines' Pearson India Education, 2016.
3. Stephen J. Chapman, 'Electric Machinery Fundamentals' 4th edition, McGraw Hill Education Pvt. Ltd, 2010.

REFERENCES

1. D.P. Kothari and I.J. Nagrath, 'Electric Machines', McGraw Hill Publishing Company Ltd, 2002.
2. P.S. Bhimbhra, 'Electrical Machinery', Khanna Publishers, 2003.
3. M.N. Bandyopadhyay, Electrical Machines Theory and Practice, PHI Learning PVT LTD., New Delhi, 2009.
4. B.R.Gupta, 'Fundamental of Electric Machines' New age International Publishers, 3rd Edition ,Reprint 2015.
5. Murugesh Kumar, 'Electric Machines', Vikas Publishing House Pvt. Ltd, 2002.
6. Alexander S. Langsdorf, 'Theory of Alternating-Current Machinery', McGraw Hill Publications, 2001.

21153C43	TRANSMISSION AND DISTRIBUTION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the structure of electric power system and to develop expressions for the computation of transmission line parameters.
- To obtain the equivalent circuits for the transmission lines based on distance and to determine voltage regulation and efficiency.
- To understand the mechanical design of transmission lines and to analyze the voltage distribution in insulator strings to improve the efficiency.
- To study the types, construction of cabilitys and methods to improve the efficiency.
- To study about distribution systems, types of substations, methods of grounding, EHVAC, HVDC and FACTS.

UNIT I TRANSMISSION LINE PARAMETERS 9

Structure of Power System - Parameters of single and three phase transmission lines with single and double circuits -Resistance, inductance and capacitance of solid, stranded and bundled conductors, Symmetrical and unsymmetrical spacing and transposition - application of self and mutual GMD; skin and proximity effects -Typical configurations, conductor types and electrical parameters of EHV lines.

UNIT II MODELLING AND PERFORMANCE OF TRANSMISSION LINES 9

Performance of Transmission lines - short line, medium line and long line - equivalent circuits, phasor diagram, attenuation constant, phase constant, surge impedance - transmission efficiency and voltage regulation, real and reactive power flow in lines - Power Circle diagrams - Formation of Corona – Critical Voltages – Effect on Line Performance.

UNIT III MECHANICAL DESIGN OF LINES 9

Mechanical design of OH lines – Line Supports –Types of towers – Stress and Sag Calculation – Effects of Wind and Ice loading. Insulators: Types, voltage distribution in insulator string, improvement of string efficiency, testing of insulators.

UNIT IV UNDER GROUND CABILITYS 9

Underground cabilitys - Types of cabilitys – Construction of single core and 3 core Cabilitys - Insulation Resistance – Potential Gradient - Capacitance of Single-core and 3 core cabilitys - Grading of cabilitys - Power factor and heating of cabilitys– DC cabilitys.

UNIT V DISTRIBUTION SYSTEMS 9

Distribution Systems – General Aspects – Kelvin's Law – AC and DC distributions - Techniques of Voltage Control and Power factor improvement – Distribution Loss –Types of Substations -Methods of Grounding – Trends in Transmission and Distribution: EHVAC, HVDC and FACTS (Qualitative treatment only).

TOTAL : 45 PERIODS

OUTCOMES:

- To understand the importance and the functioning of transmission line parameters.
- To understand the concepts of Lines and Insulators.
- To acquire knowledge on the performance of Transmission lines.
- To acquire knowledge on Underground Cabilitys
- To become familiar with the function of different components used in Transmission and Distribution levels of power system and modelling of these components.

TEXT BOOKS:

1. D.P.Kothari, I.J. Nagarath, 'Power System Engineering', Mc Graw-Hill Publishing Company limited, New Delhi, Second Edition, 2008.
2. C.L.Wadhwa, 'Electrical Power Systems', New Academic Science Ltd, 2009.
3. S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall of India Pvt. Ltd, New Delhi, Second Edition, 2011.

REFERENCES

1. B.R.Gupta, 'Power System Analysis and Design' S. Chand, New Delhi, Fifth Edition, 2008.
2. Luces M.Fualken berry, Walter Coffer, 'Electrical Power Distribution and Transmission', Pearson Education, 2007.
3. Arun Ingole, "power transmission and distribution" Pearson Education, 2019
4. J.Brian, Hardy and Colin R.Bayliss 'Transmission and Distribution in Electrical Engineering', Newnes; Fourth Edition, 2012.
5. G.Ramamurthy, "Handbook of Electrical power Distribution," Universities Press, 2013.
6. V.K.Mehta, Rohit Mehta, 'Principles of power system', S. Chand & Company Ltd, New Delhi, 2013

21153C44 **MEASUREMENTS AND INSTRUMENTATION**

L	T	P	C
3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Basic functional elements of instrumentation.
- Fundamentals of electrical and electronic instruments.
- Comparison between various measurement techniques.
- Various storage and display devices.
- Various transducers and the data acquisition systems.

UNIT I INTRODUCTION 9

Functional elements of an instrument – Static and dynamic characteristics – Errors in measurement – Statistical evaluation of measurement data – Standards and calibration- Principle and types of analog and digital voltmeters, ammeters.

UNIT II ELECTRICAL AND ELECTRONIC INSTRUMENTS 9

Principle and types of multi meters – Single and three phase watt meters and energy meters – Magnetic measurements – Determination of B-H curve and measurements of iron loss – Instrument transformers – Instruments for measurement of frequency and phase.

UNIT III COMPARATIVE METHODS OF MEASUREMENTS 9

D.C potentiometers, D.C (Wheat stone, Kelvin and Kelvin Double bridge) & A.C bridges (Maxwell, Anderson and Schering bridges), transformer ratio bridges, self-balancing bridges. Interference & screening – Multiple earth and earth loops - Electrostatic and electromagnetic Interference – Grounding techniques.

UNIT IV STORAGE AND DISPLAY DEVICES 9

Magnetic disk and tape – Recorders, digital plotters and printers, CRT display, digital CRO, LED, LCD & Dot matrix display – Data Loggers.

UNIT V TRANSDUCERS AND DATA ACQUISITION SYSTEMS 9

Classification of transducers – Selection of transducers – Resistive, capacitive & inductive Transducers – Piezoelectric, Hall effect, optical and digital transducers – Elements of data acquisition system – Smart sensors-Thermal Imagers.

TOTAL : 45 PERIODS

OUTCOMES:

- To acquire knowledge on Basic functional elements of instrumentation
- To understand the concepts of Fundamentals of electrical and electronic instruments
- Ability to compare between various measurement techniques
- To acquire knowledge on Various storage and display devices
- To understand the concepts Various transducers and the data acquisition systems
- Ability to model and analyze electrical and electronic Instruments and understand the operational features of display Devices and Data Acquisition System.

TEXT BOOKS:

1. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2010.
2. J. B. Gupta, 'A Course in Electronic and Electrical Measurements', S. K. Kataria & Sons, Delhi, 2013.
3. Doebelin E.O. and Manik D.N., Measurement Systems – Applications and Design, Special Indian Edition, McGraw Hill Education Pvt. Ltd., 2007.

REFERENCES

1. H.S. Kalsi, 'Electronic Instrumentation', McGraw Hill, III Edition 2010.
2. D.V.S. Murthy, 'Transducers and Instrumentation', Prentice Hall of India Pvt Ltd, 2015.
3. David Bell, ' Electronic Instrumentation & Measurements', Oxford University Press, 2013.
4. Martin Reissland, 'Electrical Measurements', New Age International (P) Ltd., Delhi, 2001.
5. Alan. S. Morris, Principles of Measurements and Instrumentation, 2nd Edition, Prentice Hall of India, 2003.

		L	T	P	C
21153C45	**LINEAR INTEGRATED CIRCUITS AND APPLICATIONS**	**3**	**0**	**0**	**3**

OBJECTIVES:

To impart knowledge on the following topics

- Signal analysis using Op-amp based circuits.
- Applications of Op-amp.
- Functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits.
- IC fabrication procedure.

UNIT I IC FABRICATION 9

IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realisation of monolithic ICs and packaging. Fabrication of diodes, capacitance, resistance, FETs and PV Cell.

UNIT II CHARACTERISTICS OF OPAMP 9

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – Inverting and Non-inverting Amplifiers, summer, differentiator and integrator-V/I & I/V converters.

UNIT III APPLICATIONS OF OPAMP 9

Instrumentation amplifier and its applications for transducer Bridge, Log and Antilog Amplifiers- Analog multiplier & Divider, first and second order active filters, comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R- 2R ladder and weighted resistor types), A/D converters using opamps.

UNIT IV SPECIAL ICs 9

Functional block, characteristics of 555 Timer and its PWM application - IC-566 voltage controlled oscillator IC; 565-phase locked loop IC, AD633 Analog multiplier ICs.

UNIT V APPLICATION ICs 9

AD623 Instrumentation Amplifier and its application as load cell weight measurement - IC voltage regulators –LM78XX, LM79XX; Fixed voltage regulators its application as Linear power supply - LM317, 723 Variability voltage regulators, switching regulator- SMPS - ICL 8038 function generator IC.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to acquire knowledge in IC fabrication procedure
- Ability to analyze the characteristics of Op-Amp
- To understand the importance of Signal analysis using Op-amp based circuits.
- Functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits.
- To understand and acquire knowledge on the Applications of Op-amp
- Ability to understand and analyse, linear integrated circuits their Fabrication and Application.

TEXT BOOKS:

1. David A. Bell, ‘Op-amp & Linear ICs’, Oxford, 2013.
2. D. Roy Choudhary, Sheil B. Jani, ‘Linear Integrated Circuits’, II edition, New Age, 2003.
3. Ramakant A.Gayakward, ‘Op-amps and Linear Integrated Circuits’, IV edition, Pearson Education, 2003 / PHI. 2000.

REFERENCES

1. Fiore,”Opamps & Linear Integrated Circuits Concepts & applications”, Cengage, 2010.
2. Floyd ,Buchla,”Fundamentals of Analog Circuits, Pearson, 2013.
3. Jacob Millman, Christos C.Halkias, ‘Integrated Electronics - Analog and Digital circuits system’, McGraw Hill, 2003.
4. Robert F.Coughlin, Fredrick F. Driscoll, ‘Op-amp and Linear ICs’, Pearson, 6th edition,2012.
5. Sergio Franco, ‘Design with Operational Amplifiers and Analog Integrated Circuits’, Mc Graw Hill, 2016.
6. Muhammad H. Rashid,’ Microelectronic Circuits Analysis and Design’ Cengage Learning, 2011.

21153C46 CONTROL SYSTEMS **LT P C**
3 2 0 4

COURSE OBJECTIVES

- To understand the use of transfer function models for analysis physical systems and introduce the control system components.
- To provide adequate knowledge in the time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of systems.
- To introduce stability analysis and design of compensators

UNIT I SYSTEMS AND REPRESENTATION 9

Basic elements in control systems: – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs.

UNIT II TIME RESPONSE 9

Time response: – Time domain specifications – Types of test input – I and II order system response – Error coefficients – Generalized error series – Steady state error – Root locus construction- Effects of P, PI, PID modes of feedback control –Time response analysis.

UNIT III FREQUENCY RESPONSE 9

Frequency response: – Bode plot – Polar plot – Determination of closed loop response from open loop response - Correlation between frequency domain and time domain specifications

UNIT IV STABILITY AND COMPENSATOR DESIGN 9

Characteristics equation – Routh Hurwitz criterion – Nyquist stability criterion- Performance criteria – Effect of Lag, lead and lag-lead compensation on frequency response-Design of Lag, lead and lag- lead compensator using bode plots.

UNIT V STATE VARIABLE ANALYSIS 9

Concept of state variables – State models for linear and time invariant Systems – Solution of state and output equation in controllable canonical form – Concepts of controllability and observability.

TOTAL (L: 45+T:30): 75 PERIODS

COURSE OUTCOMES

At the end of the course, the student should have the :

- Ability to develop various representations of system based on the knowledge of
- Mathematics, Science and Engineering fundamentals.
- Ability to do time domain and frequency domain analysis of various models of linear system.
- Ability to interpret characteristics of the system to develop mathematical model.
- Ability to design appropriate compensator for the given specifications.
- Ability to come out with solution for complex control problem.
- Ability to understand use of PID controller in closed loop system.

TEXT BOOKS

1. Nagarath, I.J. and Gopal, M., "Control Systems Engineering", New Age International Publishers, 2017.
2. Benjamin C. Kuo, "Automatic Control Systems", Wiley, 2014.

REFERENCES

1. Katsuhiko Ogata, "Modern Control Engineering", Pearson, 2015.
2. Richard C.Dorf and Bishop, R.H., "Modern Control Systems", Pearson Education,2009.
3. John J.D., Azzo Constantine, H. and Houpis Sttuart, N Sheldon, "Linear Control System Analysis and Design with MATLAB", CRC Taylor& Francis Reprint 2009.
4. Rames C.Panda and T. Thyagarajan, "An Introduction to Process Modelling Identification and Control of Engineers", Narosa Publishing House, 2017.
5. M.Gopal, "Control System: Principle and design", McGraw Hill Education, 2012.
6. NPTEL Video Lecture Notes on "Control Engineering "by Prof. S. D. Agashe, IIT Bombay.

21153L47	ELECTRICAL MACHINES LABORATORY - II	L	T	P	C
		0	0	3	2

OBJECTIVES:

- To expose the students to the operation of synchronous machines and induction motors and give them experimental skill.

LIST OF EXPERIMENTS

1. Regulation of three phase alternator by EMF and MMF methods.
2. Regulation of three phase alternator by ZPF and ASA methods.
3. Regulation of three phase salient pole alternator by slip test.
4. Measurements of negative sequence and zero sequence impedance of alternators.
5. V and Inverted V curves of Three Phase Synchronous Motor.
6. Load test on three-phase induction motor.
7. No load and blocked rotor tests on three-phase induction motor (Determination of equivalent circuit parameters).
8. Separation of No-load losses of three-phase induction motor.
9. Load test on single-phase induction motor.
10. No load and blocked rotor test on single-phase induction motor.
11. Study of Induction motor Starters

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course, the student should have the :

- Ability to understand and analyze EMF and MMF methods
- Ability to analyze the characteristics of V and Inverted V curves
- Ability to understand the importance of Synchronous machines
- Ability to understand the importance of Induction Machines
- Ability to acquire knowledge on separation of losses

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Synchronous Induction motor 3HP – 1 No.
2. DC Shunt Motor Coupled With Three phase Alternator – 4 nos
3. DC Shunt Motor Coupled With Three phase Slip ring Induction motor – 1 No.
4. Three Phase Induction Motor with Loading Arrangement – 2 nos
5. Single Phase Induction Motor with Loading Arrangement – 2 nos
6. Tachometer -Digital/Analog – 8 nos
7. Single Phase Auto Transformer – 2 nos
8. Three Phase Auto Transformer – 3 nos
9. Single Phase Resistive Loading Bank – 2 nos
10. Three Phase Resistive Loading Bank – 2 nos
11. Capacitor Bank – 1 No.

21153L48 LINEAR AND DIGITAL INTEGRATED CIRCUITS LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:

- To learn design, testing and characterizing of circuit behavior with digital and analog ICs.

LIST OF EXPERIMENTS

1. Implementation of Boolean Functions, Adder and Subtractor circuits.
2. Code converters: Excess-3 to BCD and Binary to Gray code converter and vice-versa
3. Parity generator and parity checking
4. Encoders and Decoders
5. Counters: Design and implementation of 3-bit modulo counters as synchronous and Asynchronous types using FF IC's and specific counter IC.
6. Shift Registers: Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitability IC's.
7. Study of multiplexer and de multiplexer
8. Timer IC application: Study of NE/SE 555 timer in Astability, Monostability operation.
9. Application of Op-Amp: inverting and non-inverting amplifier, Adder, comparator, Integrator and Differentiator.
10. Voltage to frequency characteristics of NE/ SE 566 IC.
11. Variability Voltage Regulator using IC LM317.

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course, the student should have the :

- Ability to understand and implement Boolean Functions.
- Ability to understand the importance of code conversion
- Ability to Design and implement 4-bit shift registers
- Ability to acquire knowledge on Application of Op-Amp
- Ability to Design and implement counters using specific counter IC.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS: (3 per Batch)

S.No	Name of the equipments / Components	Quantity Required	Remarks
1	Dual ,(0-30V) variability Power Supply	10	-
2	CRO	9	30MHz
3	Digital Multimeter	10	Digital
4	Function Generator	8	1 MHz
5	IC Tester (Analog)	2	
6	Bread board	10	

7	Computer (PSPICE installed)	1	
Consumabilitys (sufficient quantity)			
1	IC 741/ IC NE555/566/565		
2	Digital IC types		
3	LED		
4	LM317		
5	LM723		
6	ICSG3524 / SG3525		
7	Transistor – 2N3391		
8	Diodes, IN4001,BY126		
9	Zener diodes		
10	Potentiometer		
11	Step-down transformer 230V/12-0-12V		
12	Capacitor		
13	Resistors 1/4 Watt Assorted		
14	Single Strand Wire		

21153C51 **POWER SYSTEM ANALYSIS**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To model the power system under steady state operating condition
- To understand and apply iterative techniques for power flow analysis
- To model and carry out short circuit studies on power system
- To model and analyze stability problems in power system

UNIT I POWER SYSTEM 9

Need for system planning and operational studies - Power scenario in India - Power system components – Representation - Single line diagram - per unit quantities - p.u. impedance diagram - p.u. reactance diagram - Network graph, Bus incidence matrix, Primitive parameters, Bus admittance matrix from primitive parameters - Representation of off- nominal transformer - Formation of bus admittance matrix of large power network.

UNIT II POWER FLOW ANALYSIS 9

Bus classification - Formulation of Power Flow problem in polar coordinates - Power flow solution using Gauss Seidel method - Handling of Voltage controlled buses - Power Flow Solution by Newton Raphson method.

UNIT III SYMMETRICAL FAULT ANALYSIS 9

Assumptions in short circuit analysis - Symmetrical short circuit analysis using Thevenin's theorem - Bus Impedance matrix building algorithm (without mutual coupling) - Symmetrical fault analysis through bus impedance matrix - Post fault bus voltages - Fault level - Current limiting reactors.

UNIT IV UNSYMMETRICAL FAULT ANALYSIS 9

Symmetrical components - Sequence impedances - Sequence networks - Analysis of unsymmetrical faults at generator terminals: LG, LL and LLG - unsymmetrical fault occurring at any point in a power system - computation of post fault currents in symmetrical component and phasor domains.

UNIT V STABILITY ANALYSIS 9

Classification of power system stability – Rotor angle stability - Swing equation - Swing curve - Power-Angle equation - Equal area criterion - Critical clearing angle and time - Classical step- by-step solution of the swing equation – modified Euler method.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to model the power system under steady state operating condition
- Ability to understand and apply iterative techniques for power flow analysis
- Ability to model and carry out short circuit studies on power system
- Ability to model and analyze stability problems in power system
- Ability to acquire knowledge on Fault analysis.
- Ability to model and understand various power system components and carry out power flow, short circuit and stability studies.

TEXT BOOKS:

1. John J. Grainger, William D. Stevenson, Jr, ‘Power System Analysis’, Mc Graw Hill Education (India) Private Limited, New Delhi, 2015.
2. Kothari D.P. and Nagrath I.J., ‘Power System Engineering’, Tata McGraw-Hill Education, Second Edition, 2008.
3. Hadi Saadat, ‘Power System Analysis’, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.

REFERENCES

1. Pai M A, ‘Computer Techniques in Power System Analysis’, Tata Mc Graw-Hill Publishing Company Ltd., New Delhi, Second Edition, 2007.
2. J. Duncan Glover, Mulukutla S.Sarma, Thomas J. Overbye, ‘Power System Analysis & Design’, Cengage Learning, Fifth Edition, 2012.
3. Gupta B.R., ‘Power System - Analysis and Design’, S. Chand Publishing, 2001.
4. Kundur P., ‘Power System Stability and Control’, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.

21153C52	MICROPROCESSORS AND MICROCONTROLLERS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Architecture of µP8085 & µC 8051
- Addressing modes & instruction set of 8085 & 8051.
- Need & use of Interrupt structure 8085 & 8051.
- Simple applications development with programming 8085 & 8051

UNIT I 8085 PROCESSOR 9

Hardware Architecture, pinouts – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts.

UNIT II PROGRAMMING OF 8085 PROCESSOR 9

Instruction -format and addressing modes – Assembly language format – Data transfer, data manipulation& control instructions – Programming: Loop structure with counting & Indexing – Look up tability - Subroutine instructions - stack.

UNIT III 8051 MICRO CONTROLLER 9

Hardware Architecture, pinouts – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts- Data Transfer, Manipulation, Control Algorithms& I/O instructions, Comparison to Programming concepts with 8085.

UNIT IV PERIPHERAL INTERFACING 9

Study on need, Architecture, configuration and interfacing, with ICs: 8255, 8259, 8254, 8279, - A/D and D/A converters &Interfacing with 8085& 8051.

UNIT V MICRO CONTROLLER PROGRAMMING & APPLICATIONS 9

Simple programming exercises- key board and display interface –Control of servo motor- stepper motor control- Application to automation systems.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to acquire knowledge in Addressing modes & instruction set of 8085 & 8051.
- Ability to need & use of Interrupt structure 8085 & 8051.
- Ability to understand the importance of Interfacing
- Ability to explain the architecture of Microprocessor and Microcontroller.
- Ability to write the assembly language programme.
- Ability to develop the Microprocessor and Microcontroller based applications.

TEXT BOOKS:

1. Sunil Mathur &Jeebananda Panda, "Microprocessor and Microcontrollers", PHI Learning Pvt. Ltd, 2016.
2. R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', with 8085, Wiley Eastern Ltd., New Delhi, 2013.
3. Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely 'The 8051 Micro Controller and Embedded Systems', PHI Pearson Education, 5th Indian reprint, 2003.

REFERENCES

1. Krishna Kant, "Microprocessor and Microcontrollers", Eastern Company Edition, Prentice Hall of India, New Delhi, 2007.
2. B.RAM," Computer Fundamentals Architecture and Organization" New age International Private Limited, Fifth edition, 2017.
3. Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051,McGraw Hill Edu,2013.
4. Ajay V.Deshmukh, 'Microcontroller Theory &Applications', McGraw Hill Edu,2016
5. Douglas V.Hall, 'Microprocessor and Interfacing', McGraw Hill Edu,2016.

21153C53	POWER ELECTRONICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Different types of power semiconductor devices and their switching
- Operation, characteristics and performance parameters of controlled rectifiers
- Operation, switching techniques and basics topologies of DC-DC switching regulators.
- Different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
- Operation of AC voltage controller and various configurations.

UNIT I POWER SEMI-CONDUCTOR DEVICES 9

Study of switching devices, SCR, TRIAC, GTO, BJT, MOSFET, IGBT and IGCT- Static characteristics: SCR, MOSFET and IGBT - Triggering and commutation circuit for SCR- Introduction to Driver and snubber circuits.

UNIT II PHASE-CONTROLLED CONVERTERS 9

2-pulse, 3-pulse and 6-pulseconverters– performance parameters –Effect of source inductance–– Firing Schemes for converter–Dual converters, Applications-light dimmer, Excitation system, Solar PV systems.

UNIT III DC TO DC CONVERTERS 9

Step-down and step-up chopper-control strategy– Introduction to types of choppers-A, B, C, D and E -Switched mode regulators- Buck, Boost, Buck- Boost regulator, Introduction to Resonant Converters, Applications-Battery operated vehicles.

UNIT IV INVERTERS 9

Single phase and three phase voltage source inverters (both120^0 mode and 180^0 mode)– Voltage& harmonic control--PWM techniques: Multiple PWM, Sinusoidal PWM, modified sinusoidal PWM – Introduction to space vector modulation –Current source inverter, Applications-Induction heating, UPS.

UNIT V AC TO AC CONVERTERS 9

Single phase and Three phase AC voltage controllers–Control strategy- Power Factor Control – Multistage sequence control -single phase and three phase cyclo converters – Introduction to Matrix converters, Applications –welding .

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to analyse AC-AC and DC-DC and DC-AC converters.
- Ability to choose the converters for real time applications.

TEXT BOOKS:

1. M.H. Rashid, 'Power Electronics: Circuits, Devices and Applications', Pearson Education, Third Edition, New Delhi, 2004.
2. P.S.Bimbra "Power Electronics" Khanna Publishers, third Edition, 2003.
3. Ashfaq Ahmed 'Power Electronics for Technology', Pearson Education, Indian reprint, 2003.

REFERENCES

1. Joseph Vithayathil,' Power Electronics, Principles and Applications', McGraw Hill Series, 6^{th} Reprint, 2013.
2. Philip T. Krein, "Elements of Power Electronics" Oxford University Press, 2004 Edition.
3. L. Umanand, "Power Electronics Essentials and Applications", Wiley, 2010.
4. Ned Mohan Tore. M. Undel and, William. P. Robbins, 'Power Electronics: Converters, Applications and Design', John Wiley and sons, third edition, 2003.
5. S.Rama Reddy, 'Fundamentals of Power Electronics', Narosa Publications, 2014.
6. M.D. Singh and K.B. Khanchandani, "Power Electronics," Mc Graw Hill India, 2013.
7. JP Agarwal," Power Electronic Systems: Theory and Design" 1e, Pearson Education, 2002.

21153C55 **DIGITAL SIGNAL PROCESSING**

L	T	P	C
2	2	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Signals and systems & their mathematical representation.
- Discrete time systems.
- Transformation techniques & their computation.
- Filters and their design for digital implementation.
- Programmability digital signal processor & quantization effects.

UNIT I INTRODUCTION 6+6

Classification of systems: Continuous, discrete, linear, causal, stability, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect.

UNIT II DISCRETE TIME SYSTEM ANALYSIS 6+6

Z-transform and its properties, inverse z-transforms; difference equation – Solution by z-transform, application to discrete systems - Stability analysis, frequency response – Convolution – Discrete Time Fourier transform , magnitude and phase representation.

UNIT III DISCRETE FOURIER TRANSFORM & COMPUTATION 6+6

Discrete Fourier Transform- properties, magnitude and phase representation - Computation of DFT using FFT algorithm – DIT &DIF using radix 2 FFT – Butterfly structure.

UNIT IV DESIGN OF DIGITAL FILTERS 6+6

FIR & IIR filter realization – Parallel & cascade forms. FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics. Analog filter design – Butterworth and Chebyshev approximations; IIR Filters, digital design using impulse invariant and bilinear transformation Warping, pre warping.

UNIT V DIGITAL SIGNAL PROCESSORS 6+6

Introduction – Architecture – Features – Addressing Formats – Functional modes - Introduction to Commercial DS Processors.

TOTAL : 60 PERIODS

OUTCOMES:

1. Ability to understand the importance of Fourier transform, digital filters and DS Processors.
2. Ability to acquire knowledge on Signals and systems & their mathematical representation.
3. Ability to understand and analyze the discrete time systems.
4. Ability to analyze the transformation techniques & their computation.
5. Ability to understand the types of filters and their design for digital implementation.
6. Ability to acquire knowledge on programmability digital signal processor & quantization effects.

TEXT BOOKS:

1. J.G. Proakis and D.G. Manolakis, ‘Digital Signal Processing Principles, Algorithms and Applications’, Pearson Education, New Delhi, PHI. 2003.

2. S.K. Mitra, 'Digital Signal Processing – A Computer Based Approach', McGraw Hill Edu, 2013.
3. Lonnie C.Ludeman ,"Fundamentals of Digital Signal Processing",Wiley,2013

REFERENCES

1. Poorna Chandra S, Sasikala. B ,Digital Signal Processing, Vijay Nicole/TMH,2013.
2. Robert Schilling & Sandra L.Harris, Introduction to Digital Signal Processing using Matlab", Cengage Learning,2014.
3. B.P.Lathi, 'Principles of Signal Processing and Linear Systems', Oxford University Press, 2010 3. Taan S. ElAli, 'Discrete Systems and Digital Signal Processing with Mat Lab', CRC Press, 2009.
4. SenM.kuo, woonseng…s.gan, "Digital Signal Processors, Architecture, Implementations & Applications, Pearson,2013
5. DimitrisG.Manolakis, Vinay K. Ingle, applied Digital Signal Processing,Cambridge,2012

21153C56	OBJECT ORIENTED PROGRAMMING	L T P C 3 0 0 3

OBJECTIVES:

- To understand Object Oriented Programming concepts and basic characteristics of Java
- To know the principles of packages, inheritance and interfaces
- To define exceptions and use I/O streams
- To develop a java application with threads and generics classes
- To design and build simple Graphical User Interfaces

UNIT I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 10

Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism- OOP in Java – Characteristics of Java – The Java Environment - Java Source File -Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers - static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays , Packages - JavaDoc comments.

UNIT II INHERITANCE AND INTERFACES 9

Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces - Object cloning -inner classes, Array Lists - Strings

UNIT III EXCEPTION HANDLING AND I/O 9

Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files

UNIT IV MULTITHREADING AND GENERIC PROGRAMMING 8

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations.

UNIT V EVENT DRIVEN PROGRAMMING 9

Graphics programming - Frame – Components - working with 2D shapes - Using color, fonts, and images - Basics of event handling - event handlers - adapter classes - actions - mouse events - AWT event hierarchy - Introduction to Swing – layout management - Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows –Menus – Dialog Boxes.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of the course, students will be able to:

- Develop Java programs using OOP principles
- Develop Java programs with the concepts inheritance and interfaces
- Build Java applications using exceptions and I/O streams
- Develop Java applications with threads and generics classes
- Develop interactive Java programs using swings

TEXT BOOKS

1. Herbert Schildt, "Java The complete reference", 8th Edition, McGraw Hill Education, 2011.
2. Cay S. Horstmann, Gary cornell, "Core Java Volume –I Fundamentals", 9th Edition, Prentice Hall, 2013.

REFERENCES

1. Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3rd Edition, Pearson, 2015.
2. Steven Holzner, "Java 2 Black book", Dreamtech press, 2011.
3. Timothy Budd, "Understanding Object-oriented programming with Java", Updated Edition, Pearson Education, 2000.

21153L57	CONTROL AND INSTRUMENTATION LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES:

- To provide knowledge on analysis and design of control system along with basics of instrumentation.

LIST OF EXPERIMENTS

CONTROLSYSTEMS:

1. P, PI and PID controllers
2. Stability Analysis
3. Modeling of Systems – Machines, Sensors and Transducers
4. Design of Lag, Lead and Lag-Lead Compensators
5. Position Control Systems
6. Synchro-Transmitter- Receiver and Characteristics
7. Simulation of Control Systems by Mathematical development tools.

INSTRUMENTATION:

8. Bridge Networks –AC and DC Bridges
9. Dynamics of Sensors/Transducers

   (a) Temperature (b) pressure (c) Displacement (d) Optical (e) Strain (f) Flow

10 Power and Energy Measurement

11 Signal Conditioning

   (a) Instrumentation Amplifier

   (b) Analog – Digital and Digital –Analog converters (ADC and DACs)

12 Process Simulation

TOTAL: 60 PERIODS

OUTCOMES:

- Ability to understand control theory and apply them to electrical engineering problems.
- Ability to analyze the various types of converters.
- Ability to design compensators
- Ability to understand the basic concepts of bridge networks.
- Ability to the basics of signal conditioning circuits.
- Ability to study the simulation packages.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CONTROLSYSTEMS:

1. PID controller simulation and learner kit – 1 No.
2. Digital storage Oscilloscope for capturing transience- 1 No

   2 Personal Computer with control system

   simulation packages - 10 Nos

3. DC motor –Generator test set-up for evaluation of motor parameters
4. CRO 30MHz – 1 No.
5. 2MHz Function Generator – 1No.
6. Position Control Systems Kit (with manual) – 1 No., Tacho Generator Coupling set
7. AC Synchro transmitter& receiver – 1No.
8. Sufficient number of Digital multi meters, speed and torque sensors

INSTRUMENTATION:

9. R, L, C Bridge kit (with manual)
10. a) Electric heater – 1No.
    Thermometer – 1No.Thermistor (silicon type) RTD nickel type – 1No.

    b) 30 psi Pressure chamber (complete set) – 1No. Current generator (0 – 20mA) Air foot pump – 1 No. (with necessary connecting tubes)

    c) LVDT20mm core length movability type – 1No. CRO 30MHz – 1No. d)

    Optical sensor – 1 No. Light source

    e) Strain Gauge Kit with Handy lever beam – 1No.

100gm weights – 10 nos
f) Flow measurement Trainer kit – 1 No.
(1/2 HP Motor, Water tank, Digital Milliammeter, complete set)

11. Single phase Auto transformer – 1No. Watt-hour meter (energy meter) – 1No. Ammeter Voltmeter Rheostat Stop watch
    Connecting wires (3/20)
12. IC Transistor kit – 1No.
13. Instrumentation Amplifier kit-1 No
14. Analog – Digital and Digital –Analog converters (ADC and DACs)- 1 No

21153L58	OBJECT ORIENTED PROGRAMMING LABORATORY	LT P C 0 0 3 2

COURSE OBJECTIVES

- To build software development skills using java programming for real-world applications.
- To understand and apply the concepts of classes, packages, interfaces, arraylist, exception handling and file processing.
- To develop applications using generic programming and event handling.

List of experiments

1. Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection(i.e domestic or commercial). Compute the bill amount using the following tariff. If the type of the EB connection is domestic, calculate the amount to be paid as follows:
   - First 100 units - Rs. 1 per unit
   - 101-200 units - Rs. 2.50 per unit
   - 201 -500 units - Rs. 4 per unit
   - > 501 units - Rs. 6 per unit

   If the type of the EB connection is commercial, calculate the amount to be paid as follows:
   - First 100 units - Rs. 2 per unit
   - 101-200 units - Rs. 4.50 per unit
   - 201 -500 units - Rs. 6 per unit
   - > 501 units - Rs. 7 per unit
2. Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa) , time converter (hours to minutes, seconds and vice versa) using packages.
3. Develop a java application with Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
4. Design a Java interface for ADT Stack. Implement this interface using array. Provide necessary exception handling in both the implementations.
5. Write a program to perform string operations using ArrayList. Write functions for the following

   a. Append - add at end
   b. Insert – add at particular index c. Search
   d. List all string starts with given letter

6. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.
7. Write a Java program to implement user defined exception handling.
8. Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes.
9. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
10. Write a java program to find the maximum value from the given type of elements using a generic function.
11. Design a calculator using event-driven programming paradigm of Java with the following options.

    a) Decimal manipulations b)
    Scientific manipulations
12. Develop a mini project for any application using Java concepts.

COURSE OUTCOMES **TOTAL : 60 PERIODS**

Upon completion of the course, the students will be able to

- Develop and implement Java programs for simple applications that make use of classes, packages and interfaces.
- Develop and implement Java programs with arraylist, exception handling and multithreading .
- Design applications using file processing, generic programming and event handling.

21153L59 PROFESSIONAL COMMUNICATION **L T P C**
0 0 2 1

OBJECTIVES: The course aims to:

- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employability Graduates
- Develop their confidence and help them attend interviews successfully.

UNIT I

Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs

UNIT II

Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively –
5 minute presentations

UNIT III

Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic -– questioning and clarifying –GD strategies- activities to improve GD skills

UNIT IV

Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews

UNIT V

Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long- term career plan-making career changes.

TOTAL : 30 PERIODS

OUTCOMES: At the end of the course Learners will be ability to:

- Make effective presentations
- Participate confidently in Group Discussions.
- Attend job interviews and be successful in them.
- Develop adequate Soft Skills required for the workplace

Recommended Software

1. **Globearena**
2. **Win English**

REFERENCES:

1. Butterfield, Jeff **Soft Skills for Everyone.** Cengage Learning: New Delhi, 2015
2. **Interact** English Lab Manual for Undergraduate Students,. OrientBalckSwan: Hyderabad, 2016.
3. E. Suresh Kumar et al. **Communication for Professional Success.** Orient Blackswan: Hyderabad, 2015
4. Raman, Meenakshi and Sangeeta Sharma. **Professional Communication**. Oxford University Press: Oxford, 2014
5. S. Hariharanetal. **Soft Skills**. MJP Publishers: Chennai, 2010.

SOLID STATE DRIVES

21153C61

L	T	P	C
3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Steady state operation and transient dynamics of a motor load system.
- Analyze the operation of the converter/chopper fed dc drive, both qualitatively and quantitatively.
- Operation and performance of AC motor drives.
- Analyze and design the current and speed controllers for a closed loop solid state DC motor drive.

UNIT I DRIVE CHARACTERISTICS 9

Electric drive – Equations governing motor load dynamics – steady state stability – multi quadrant Dynamics: acceleration, deceleration, starting & stopping – typical load torque characteristics – Selection of motor.

UNIT II CONVERTER / CHOPPER FED DC MOTOR DRIVE 9

Steady state analysis of the single and three phase converter fed separately excited DC motor drive– continuous conduction – Time ratio and current limit control – 4 quadrant operation of converter / chopper fed drive-Applications.

UNIT III INDUCTION MOTOR DRIVES 9

Stator voltage control–V/f control– Rotor Resistance control-qualitative treatment of slip power recovery drives-closed loop control–– vector control- Applications.

UNIT IV SYNCHRONOUS MOTOR DRIVES 9

V/f control and self-control of synchronous motor: Margin angle control and power factor control- Three phase voltage/current source fed synchronous motor- Applications.

UNIT V DESIGN OF CONTROLLERS FOR DRIVES 9

Transfer function for DC motor / load and converter – closed loop control with Current and speed feedback–armature voltage control and field weakening mode – Design of controllers; current controller and speed controller- converter selection and characteristics.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and suggest a converter for solid state drive.
- Ability to select suitability drive for the given application.
- Ability to study about the steady state operation and transient dynamics of a motor load system.
- Ability to analyze the operation of the converter/chopper fed dc drive.
- Ability to analyze the operation and performance of AC motor drives.
- Ability to analyze and design the current and speed controllers for a closed loop solid state DC motor drive.

TEXT BOOKS:

1. Gopal K.Dubey, Fundamentals of Electrical Drives, Narosa Publishing House, 1992.
2. Bimal K.Bose. Modern Power Electronics and AC Drives, Pearson Education, 2002.
3. R.Krishnan, Electric Motor & Drives: Modeling, Analysis and Control, Pearson, 2001.

REFERENCES

1. Vedam Subramanyam, " Electric Drives Concepts and Applications ", 2e, McGraw Hill, 2016

2. Shaahin Felizadeh, "Electric Machines and Drives", CRC Press (Taylor and Francis Group), 2013.
3. John Hindmarsh and Alasdain Renfrew, "Electrical Machines and Drives System," Elsevier 2012.
4. Theodore Wildi, " Electrical Machines ,Drives and power systems ,6th edition, Pearson Education ,2015
5. N.K. De., P.K. SEN" Electric drives" PHI, 2012.

21153C62	**PROTECTION AND SWITCHGEAR**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

To impart knowledge on the following Topics

- Causes of abnormal operating conditions (faults, lightning and switching surges) of the apparatus and system.
- Characteristics and functions of relays and protection schemes.
- Apparatus protection, static and numerical relays
- Functioning of circuit breaker

UNIT I PROTECTION SCHEMES 9

Principles and need for protective schemes – nature and causes of faults – types of faults – Methods of Grounding - Zones of protection and essential qualities of protection – Protection scheme

UNIT II ELECTROMAGNETIC RELAYS 9

Operating principles of relays - the Universal relay – Torque equation – R-X diagram – Electromagnetic Relays – Over current, Directional, Distance, Differential, Negative sequence and Under frequency relays.

UNIT III APPARATUS PROTECTION 9

Current transformers and Potential transformers and their applications in protection schemes - Protection of transformer, generator, motor, bus bars and transmission line.

UNIT IV STATIC RELAYS AND NUMERICAL PROTECTION 9

Static relays – Phase, Amplitude Comparators – Synthesis of various relays using Static comparators – Block diagram of Numerical relays – Over current protection, transformer differential protection, distant protection of transmission lines.

UNIT V CIRCUIT BREAKERS 9

Physics of arcing phenomenon and arc interruption - DC and AC circuit breaking – re-striking voltage and recovery voltage - rate of rise of recovery voltage - resistance switching - current chopping - interruption of capacitive current - Types of circuit breakers – air blast, air break, oil, SF6, MCBs, MCCBs and vacuum circuit breakers – comparison of different circuit breakers – Rating and selection of Circuit breakers.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze Electromagnetic and Static Relays.
- Ability to suggest suitability circuit breaker.
- Ability to find the causes of abnormal operating conditions of the apparatus and system.

- Ability to analyze the characteristics and functions of relays and protection schemes.
- Ability to study about the apparatus protection, static and numerical relays.
- Ability to acquire knowledge on functioning of circuit breaker.

TEXT BOOKS:

1. Sunil S.Rao, 'Switchgear and Protection', Khanna Publishers, New Delhi, 2008.
2. B.Rabindranath and N.Chander, 'Power System Protection and Switchgear', New Age International (P) Ltd., First Edition 2011.
3. Arun Ingole, 'Switch Gear and Protection' Pearson Education, 2017.

REFERENCES

1. BadriRam ,B.H. Vishwakarma, 'Power System Protection and Switchgear', New Age InternationalPvt Ltd Publishers, Second Edition 2011.
2. Y.G.Paithankar and S.R.Bhide, 'Fundamentals of power system protection', Second Edition,Prentice Hall of India Pvt. Ltd., New Delhi, 2010.
3. C.L.Wadhwa, 'Electrical Power Systems', 6th Edition, New Age International (P) Ltd., 2010
4. RavindraP.Singh, 'Switchgear and Power System Protection', PHI Learning Private Ltd., NewDelhi, 2009.
5. VK Metha," Principles of Power Systems" S. Chand, 2005.
6. Bhavesh Bhalja, R.P. Maheshwari, Nilesh G. Chotani,'Protection and Switchgear' Oxford University Press, 2011.

21153C63	**EMBEDDED SYSTEMS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES
:

To impart knowledge on the following Topics

- Building Blocks of Embedded System
- Various Embedded Development Strategies
- Bus Communication in processors, Input/output interfacing.
- Various processor scheduling algorithms.
- Basics of Real time operating system and example tutorials to discuss on one real time operating system tool.

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS 9

Introduction to Embedded Systems –Structural units in Embedded processor , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging.

UNIT II EMBEDDED NETWORKING 9

Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols RS232 standard – RS422 – RS 485 - CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I^2C) –need for device drivers.

UNIT III EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT 9

Embedded Product Development Life Cycle- objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model.

UNIT IV RTOS BASED EMBEDDED SYSTEM DESIGN 9

Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication shared memory, message passing-, Inter process Communication– synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance.

UNIT V EMBEDDED SYSTEM APPLICATION AND DEVELOPMENT 9

Case Study of Washing Machine- Automotive Application- Smart card System Application-ATM machine –Digital camera

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze Embedded systems.
- Ability to suggest an embedded system for a given application.
- Ability to operate various Embedded Development Strategies
- Ability to study about the bus Communication in processors.
- Ability to acquire knowledge on various processor scheduling algorithms.
- Ability to understand basics of Real time operating system.

TEXT BOOKS:

1. Peckol, “Embedded system Design”, John Wiley & Sons,2010
2. Lyla B Das,” Embedded Systems-An Integrated Approach”, Pearson, 2013
3. Shibu. K.V, “Introduction to Embedded Systems”, 2e, Mc graw Hill, 2017.

REFERENCES

1. Raj Kamal, ‘Embedded System-Architecture, Programming, Design’, Mc Graw Hill, 2013.
2. C.R.Sarma, “Embedded Systems Engineering”, University Press (India) Pvt. Ltd, 2013.
3. Tammy Noergaard, “Embedded Systems Architecture”, Elsevier, 2006.
4. Han-Way Huang, “Embedded system Design Using C8051”, Cengage Learning, 2009.
5. Rajib Mall “Real-Time systems Theory and Practice” Pearson Education, 2007.

		L	T	P	C
21153L66	**POWER ELECTRONICS AND DRIVES LABORATORY**	**0**	**0**	**3**	**2**

OBJECTIVES:

- To provide hands on experience with power electronic converters and testing.

LIST OF EXPERIMENTS

1 Gate Pulse Generation using R, RC and UJT.
2 Characteristics of SCR and TRIAC
3 Characteristics of MOSFET and IGBT
4 AC to DC half controlled converter
5 AC to DC fully controlled Converter
6 Step down and step up MOSFET based choppers
7 IGBT based single phase PWM inverter

8 IGBT based three phase PWM inverter
9 AC Voltage controller
10 Switched mode power converter.
11 Simulation of PE circuits (1Φ & 3Φ semi converters, 1Φ & 3Φ full converters, DC-DC converters, AC voltage controllers).
12 Characteristics of GTO & IGCT.
13 Characteristics of PMBLDC motor

TOTAL: 60 PERIODS

OUTCOMES:

- Ability to practice and understand converter and inverter circuits and apply software for engineering problems.
- Ability to experiment about switching characteristics various switches.
- Ability to analyze about AC to DC converter circuits.
- Ability to analyze about DC to AC circuits.
- Ability to acquire knowledge on AC to AC converters
- Ability to acquire knowledge on simulation software.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Device characteristics(for SCR, MOSFET, TRIAC,GTO,IGCT and IGBT kit with built-in / discrete power supply and meters) - 2 each
2. SinglephaseSCRbasedhalfcontrolledconverterandfullycontrolledconverteralong with built-in/separate/firing circuit/module and meter – 2 each
3. MOSFET based step up and step down choppers (Built in/ Discrete) – 1 each
4. IGBT based single phase PWM inverter module/Discrete Component – 2
5. IGBT based three phase PWM inverter module/Discrete Component – 2
6. Switched mode power converter module/Discrete Component – 2
7. SCR &TRIAC based 1 phase AC controller along with lamp or rheostat load - 2
8. Cyclo converter kit with firing module – 1
9. Dual regulated DC power supply with common ground
10. Cathode ray Oscilloscope –10
11. Isolation Transformer – 5
12. Single phase Auto transformer –3
13. Components (Inductance, Capacitance) 3 set for each
14. Multimeter – 5
15. LCR meter – 3
16. Rheostats of various ranges – 2 sets of 10 value
17. Work tabilitys – 10
18. DC and AC meters of required ranges – 20
19. Component data sheets to be provided

21153L67	**MICROPROCESSORS AND MICROCONTROLLERS LABORATORY**	L	T	P	C
		0	0	3	2

OBJECTIVES:

- To provide training on programming of microprocessors and microcontrollers and understand the interface requirements.
- To simulate various microprocessors and microcontrollers using KEIL or Equivalent simulator.

LIST OF EXPERIMENTS

1 Simple arithmetic operations: addition / subtraction / multiplication / division.

2 Programming with control instructions:

(i) Ascending / Descending order, Maximum / Minimum of numbers. (ii) Programs using Rotate instructions.

(iii) Hex / ASCII / BCD code conversions.

3 Interface Experiments: with 8085

(i) A/D Interfacing. & D/A Interfacing.

4 Traffic light controller.

5 I/O Port / Serial communication

6 Programming Practices with Simulators/Emulators/open source

7 Read a key ,interface display

8 Demonstration of basic instructions with 8051 Micro controller execution, including: (i) Conditional jumps & looping

(ii) Calling subroutines.

9 Programming I/O Port and timer of 8051 (i) study on interface with A/D & D/A

(ii) Study on interface with DC & AC motors

10 Application hardware development using embedded processors.

TOTAL: 60 PERIODS

OUTCOMES:

- Ability to understand and apply computing platform and software for engineering problems.
- Ability to programming logics for code conversion.
- Ability to acquire knowledge on A/D and D/A.
- Ability to understand basics of serial communication.
- Ability to understand and impart knowledge in DC and AC motor interfacing.
- Ability to understand basics of software simulators.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Sl.No.	Description of Equipment	Quantity required
1.	8085 Microprocessor Trainer with Power Supply	15
2.	8051 Micro Controller Trainer Kit with power supply	15
3.	8255 Interface boards	5
4.	8251 Interface boards	5

5.	8259 Interface boards	5
6.	8279 Keyboard / Display Interface boards	5
7.	8254 timer/ counters	5
8.	ADC and DAC cards	5
9.	AC & DC motor with Controller s	5
10.	Traffic Light Control Systems	5

21153MP68 **MINI PROJECT** **LT P C**
0 0 4 2

OBJECTIVES:

- To develop their own innovative prototype of ideas.
- To train the students in preparing mini project reports and examination.

The students in a group of 5 to 6 works on a topic approved by the head of the department and prepares a comprehensive mini project report after completing the work to the satisfaction. The progress of the project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department. A mini project report is required at the end of the semester. The mini project work is evaluated based on oral presentation and the mini project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 60 PERIODS

OUTCOMES:

- On Completion of the mini project work students will be in a position to take up their final year project work and find solution by formulating proper methodology.

21153C71 **HIGH VOLTAGE ENGINEERING**

L	T	P	C
3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Various types of over voltages in power system and protection methods.
- Generation of over voltages in laboratories.
- Measurement of over voltages.
- Nature of Breakdown mechanism in solid, liquid and gaseous dielectrics.
- Testing of power apparatus and insulation coordination

UNIT I OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS 9

Causes of over voltages and its effects on power system – Lightning, switching surges and temporary over voltages, Corona and its effects – Bewley lattice diagram- Protection against over voltages.

UNIT II DIELECTRIC BREAKDOWN 9

Properties of Dielectric materials - Gaseous breakdown in uniform and non-uniform fields – Corona discharges – Vacuum breakdown – Conduction and breakdown in pure and commercial liquids, Maintenance of oil Quality – Breakdown mechanisms in solid and composite dielectrics- Applications of insulating materials in electrical equipments.

UNIT III GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS 9

Generation of High DC voltage: Rectifiers, voltage multipliers, vandigraff generator: generation of high impulse voltage: single and multistage Marx circuits – generation of high AC voltages: cascaded transformers, resonant transformer and tesla coil- generation of switching surges – generation of impulse currents - Triggering and control of impulse generators.

UNIT IV MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS 9

High Resistance with series ammeter – Dividers, Resistance, Capacitance and Mixed dividers - Peak Voltmeter, Generating Voltmeters - Capacitance Voltage Transformers, Electrostatic Voltmeters – Sphere Gaps - High current shunts- Digital techniques in high voltage measurement.

UNIT V HIGH VOLTAGE TESTING & INSULATION COORDINATION 9

High voltage testing of electrical power apparatus as per International and Indian standards – Power frequency, impulse voltage and DC testing of Insulators, circuit breakers, bushing, isolators and transformers- Insulation Coordination& testing of cabilitys.

OUTCOMES: **TOTAL : 45 PERIODS**

- Ability to understand Transients in power system.
- Ability to understand Generation and measurement of high voltage.
- Ability to understand High voltage testing.
- Ability to understand various types of over voltages in power system.
- Ability to measure over voltages.
- Ability to test power apparatus and insulation coordination

TEXT BOOKS:

1. S.Naidu and V. Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, Fifth Edition, 2013.

2. E. Kuffel and W.S. Zaengl, J.Kuffel, 'High voltage Engineering fundamentals', Newnes Second Edition Elsevier , New Delhi, 2005.

3. C.L. Wadhwa, 'High voltage Engineering', New Age International Publishers, Third Edition, 2010.

REFERENCES

1. L.L. Alston, 'High Voltage Technology', Oxford University Press, First Indian Edition, 2011.

2. Mazen Abdel – Salam, Hussein Anis, Ahdab A-Morshedy, Roshday Radwan, High Voltage Engineering – Theory &Practice, Second Edition Marcel Dekker, Inc., 2010.

3. Subir Ray,' An Introduction to High Voltage Engineering' PHI Learning Private Limited, New Delhi, Second Edition, 2013.

21153C72	**POWER SYSTEM OPERATION AND CONTROL**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

To impart knowledge on the following topics

- Significance of power system operation and control.
- Real power-frequency interaction and design of power-frequency controller.
- Reactive power-voltage interaction and the control actions to be implemented for maintaining the voltage profile against varying system load.
- Economic operation of power system.
- SCADA and its application for real time operation and control of power systems

UNIT I PRELIMINARIES ON POWER SYSTEM OPERATION AND CONTROL 9

Power scenario in Indian grid – National and Regional load dispatching centers – requirements of good power system - necessity of voltage and frequency regulation - real power vs frequency and reactive power vs voltage control loops - system load variation, load curves and basic concepts of load dispatching - load forecasting - Basics of speed governing mechanisms and modeling - speed load characteristics - regulation of two generators in parallel.

UNIT II REAL POWER - FREQUENCY CONTROL 9

Load Frequency Control (LFC) of single area system-static and dynamic analysis of uncontrolled and controlled cases - LFC of two area system - tie line modeling - block diagram representation of two area system - static and dynamic analysis - tie line with frequency bias control – state variability model - integration of economic dispatch control with LFC.

UNIT III REACTIVE POWER – VOLTAGE CONTROL 9

Generation and absorption of reactive power - basics of reactive power control – Automatic Voltage Regulator (AVR) – brushless AC excitation system – block diagram representation of AVR loop - static and dynamic analysis – stability compensation – voltage drop in transmission line - methods of reactive power injection - tap changing transformer, SVC (TCR + TSC) and STATCOM for voltage control.

UNIT IV ECONOMIC OPERATION OF POWER SYSTEM 9

Statement of economic dispatch problem - input and output characteristics of thermal plant - incremental cost curve - optimal operation of thermal units without and with transmission losses (no derivation of transmission loss coefficients) - base point and participation factors method - statement of unit commitment (UC) problem - constraints on UC problem - solution of UC problem using priority list – special aspects of short term and long term hydrothermal problems.

UNIT V COMPUTER CONTROL OF POWER SYSTEMS 9

Need of computer control of power systems-concept of energy control centers and functions – PMU - system monitoring, data acquisition and controls - System hardware configurations - SCADA and EMS functions - state estimation problem – measurements and errors - weighted least square estimation - various operating states - state transition diagram.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand the day-to-day operation of electric power system.
- Ability to analyze the control actions to be implemented on the system to meet the minute- to-minute variation of system demand.
- Ability to understand the significance of power system operation and control.
- Ability to acquire knowledge on real power-frequency interaction.
- Ability to understand the reactive power-voltage interaction.
- Ability to design SCADA and its application for real time operation

TEXT BOOKS:

1. Olle.I.Elgerd, ‘Electric Energy Systems theory - An introduction’, McGraw Hill Education Pvt. Ltd., New Delhi, 34th reprint, 2010.

2. Allen. J. Wood and Bruce F. Wollen berg, ‘Power Generation, Operation and Control’, John Wiley & Sons, Inc., 2016.

3. Abhijit Chakrabarti and Sunita Halder, ‘Power System Analysis Operation and Control’, PHI learning Pvt. Ltd., New Delhi, Third Edition, 2010.

REFERENCES

1. Kothari D.P. and Nagrath I.J., ‘Power System Engineering’, Tata McGraw-Hill Education, Second Edition, 2008.

2. Hadi Saadat, ‘Power System Analysis’, McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.

3. Kundur P., ‘Power System Stability and Control, McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.

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21153C73 **RENEWABLE ENERGY SYSTEMS**

L	T	P	C
3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Awareness about renewable Energy Sources and technologies.
- Adequate inputs on a variety of issues in harnessing renewable Energy.
- Recognize current and possible future role of renewable energy sources.

UNIT I RENEWABLE ENERGY (RE) SOURCES 9

Environmental consequences of fossil fuel use, Importance of renewable sources of energy, Sustainable Design and development, Types of RE sources, Limitations of RE sources, Present Indian and international energy scenario of conventional and RE sources.

UNIT II WIND ENERGY 9

Power in the Wind – Types of Wind Power Plants(WPPs)–Components of WPPs-Working of WPPs-Siting of WPPs-Grid integration issues of WPPs.

UNIT III SOLAR PV AND THERMAL SYSTEMS 9

Solar Radiation, Radiation Measurement, Solar Thermal Power Plant, Central Receiver Power Plants, Solar Ponds.- Thermal Energy storage system with PCM- Solar Photovoltaic systems : Basic Principle of SPV conversion – Types of PV Systems- Types of Solar Cells, Photovoltaic cell concepts: Cell, module, array ,PV Module I-V Characteristics, Efficiency & Quality of the Cell, series and parallel connections, maximum power point tracking, Applications.

UNIT IV BIOMASS ENERGY 9

Introduction-Bio mass resources –Energy from Bio mass: conversion processes-Biomass Cogeneration-Environmental Benefits. Geothermal Energy: Basics, Direct Use, Geothermal Electricity. Mini/micro hydro power: Classification of hydropower schemes, Classification of water turbine, Turbine theory, Essential components of hydroelectric system.

UNIT V OTHER ENERGY SOURCES 9

Tidal Energy: Energy from the tides, Barrage and Non Barrage Tidal power systems. Wave Energy: Energy from waves, wave power devices. Ocean Thermal Energy Conversion (OTEC)- Hydrogen Production and Storage- Fuel cell : Principle of working- various types - construction and applications. Energy Storage System- Hybrid Energy Systems.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to create awareness about renewable Energy Sources and technologies.
- Ability to get adequate inputs on a variety of issues in harnessing renewable Energy.
- Ability to recognize current and possible future role of renewable energy sources.
- Ability to explain the various renewable energy resources and technologies and their applications.
- Ability to understand basics about biomass energy.
- Ability to acquire knowledge about solar energy.

TEXT BOOKS:

1. Joshua Earnest, Tore Wizeliu, 'Wind Power Plants and Project Development', PHI Learning Pvt.Ltd, New Delhi, 2011.

2. D.P.Kothari, K.C Singal, Rakesh Ranjan "Renewable Energy Sources and Emerging Technologies", PHI Learning Pvt.Ltd, New Delhi, 2013.

3. Scott Grinnell, "Renewable Energy & Sustainable Design", CENGAGE Learning, USA, 2016.

REFERENCES

1. A.K.Mukerjee and Nivedita Thakur," Photovoltaic Systems: Analysis and Design", PHI Learning Private Limited, New Delhi, 2011

2. Richard A. Dunlap," Sustainable Energy" Cengage Learning India Private Limited, Delhi, 2015.

3. Chetan Singh Solanki, " Solar Photovoltaics : Fundamentals, Technologies and Applications", PHI Learning Private Limited, New Delhi, 2011

4. Bradley A. Striebig,Adebayo A.Ogundipe and Maria Papadakis," Engineering Applications in Sustainable Design and Development", Cengage Learning India Private Limited, Delhi, 2016.

5. Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.

6. Shobh Nath Singh, 'Non-conventional Energy resources' Pearson Education ,2015.

21153L77	POWER SYSTEM SIMULATION LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES:

- To provide better understanding of power system analysis through digital simulation.

LIST OF EXPERIMENTS

1. Computation of Transmission Line Parameters
2. Formation of Bus Admittance and Impedance Matrices and Solution of Networks
3. Power Flow Analysis using Gauss-Seidel Method
4. Power Flow Analysis using Newton Raphson Method
5. Symmetric and unsymmetrical fault analysis
6. Transient stability analysis of SMIB System
7. Economic Dispatch in Power Systems
8. Load – Frequency Dynamics of Single- Area and Two-Area Power Systems
9. State estimation: Weighted least square estimation
10. Electromagnetic Transients in Power Systems : Transmission Line Energization

OUTCOMES: **TOTAL: 60 PERIODS**

- Ability to understand power system planning and operational studies.
- Ability to acquire knowledge on Formation of Bus Admittance and Impedance Matrices and Solution of Networks.
- Ability to analyze the power flow using GS and NR method
- Ability to find Symmetric and Unsymmetrical fault
- Ability to understand the economic dispatch.
- Ability to analyze the electromagnetic transients.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Personal computers (Intel i3, 80GB, 2GBRAM) – 30 nos
2. Printer laser- 1 No.
3. Dot matrix- 1 No.
4. Server (Intel i5, 80GB, 2GBRAM) (High Speed Processor) – 1 No.
5. Software: any power system simulation software with 5 user license
6. Compliers: C, C++, VB, VC++ - 30 users

RENEWABLE ENERGY SYSTEMS LABORATORY	**L**	**T**	**P**	**C**
	0	**0**	**3**	**2**

OBJECTIVES:

- To train the students in Renewable Energy Sources and technologies.
- To provide adequate inputs on a variety of issues in harnessing Renewable Energy.
- To recognize current and possible future role of Renewable energy sources.

LIST OF EXPERIMENTS

1 Simulation study on Solar PV Energy System.

2 Experiment on "VI-Characteristics and Efficiency of 1kWp Solar PV System".

3 Experiment on "Shadowing effect & diode based solution in 1kWp Solar PV System".

4 Experiment on Performance assessment of Grid connected and Standalone 1kWp Solar Power System.

5 Simulation study on Wind Energy Generator.

6 Experiment on Performance assessment of micro Wind Energy Generator.

7 Simulation study on Hybrid (Solar-Wind) Power System.

8 Experiment on Performance Assessment of Hybrid (Solar-Wind) Power System.

9 Simulation study on Hydel Power.

10 Experiment on Performance Assessment of 100W Fuel Cell.

11 Simulation study on Intelligent Controllers for Hybrid Systems.

OUTCOMES:

- Ability to understand and analyze Renewable energy systems.

TOTAL: 60 PERIODS

- Ability to train the students in Renewable Energy Sources and technologies.
- Ability to provide adequate inputs on a variety of issues in harnessing Renewable Energy.
- Ability to simulate the various Renewable energy sources.
- Ability to recognize current and possible future role of Renewable energy sources.
- Ability to understand basics of Intelligent Controllers.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S.No	**Name of the equipments / Components**	**Quantity Required**	**Remarks**
1.	Personal computers (Intel i3, 80GB, 2GBRAM)	15	-
2.	CRO	9	30MHz
3.	Digital Multimeter	10	Digital
4.	PV panels - 100W, 24V	1	
5.	Battery storage system with charge and discharge control 40Ah	1	
6.	PV Emulator	1	
7.	Micro Wind Energy Generator module	1	

Consumabilitys (Minimum of 5 Nos. each)			
8.	Potentiometer	5	-
9.	Step-down transformer	5	230V/12-0-12V
10	Component data sheets to be provided		

21153P83PW	**PROJECT WORK**	**L T P C** **0 0 20 10**

OBJECTIVES:

To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

OUTCOMES: **TOTAL: 300 PERIODS**

On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

21153CEC -COMPS **0 0 2 2**

Electric Circuits and Fields:

Network graph, KCL, KVL, node and mesh analysis, transient response of dc and ac networks; sinusoidal steady-state analysis, resonance, basic filter concepts; ideal current and voltage sources, Thevenin's, Norton's and Superposition and Maximum Power Transfer theorems, two-port networks, three phase circuits; Gauss Theorem, electric field and potential due to point, line, plane and spherical charge distributions; Ampere's and Biot-Savart's laws; inductance; dielectrics; capacitance.

Signals and Systems:

Representation of continuous and discrete-time signals; shifting and scaling operations; linear, time-invariant and causal systems; Fourier series representation of continuous periodic signals; sampling theorem; Fourier, Laplace and Z transforms.

Electrical Machines:

Single phase transformer – equivalent circuit, phasor diagram, tests, regulation and efficiency; three phase transformers – connections, parallel operation; auto-transformer; energy conversion principles; DC machines – types, windings, generator characteristics, armature reaction and commutation, starting and speed control of motors; three phase induction motors – principles, types, performance characteristics, starting and speed control; single phase induction motors; synchronous machines – performance, regulation and parallel operation of generators, motor starting, characteristics and applications; servo and stepper motors.

Power Systems:

Basic power generation concepts; transmission line models and performance; cable performance, insulation; corona and radio interference; distribution systems; per-unit quantities; bus impedance and admittance matrices; load flow; voltage control; power factor correction; economic operation; symmetrical components; fault analysis; principles of over-current, differential and distance protection; solid state relays and digital protection; circuit breakers; system stability concepts, swing curves and equal area criterion; HVDC transmission and FACTS concepts.

Control Systems:

Principles of feedback; transfer function; block diagrams; steady-state errors; Routh and Niquist techniques; Bode plots; root loci; lag, lead and lead-lag compensation; state space model; state transition matrix, controllability and observability.

Electrical and Electronic Measurements:

Bridges and potentiometers; PMMC, moving iron, dynamometer and induction type instruments; measurement of voltage, current, power, energy and power factor; instrument transformers; digital voltmeters and multimeters; phase, time and frequency measurement; Q-meters; oscilloscopes; potentiometric recorders; error analysis.

Analog and Digital Electronics:

Characteristics of diodes, BJT, FET; amplifiers – biasing, equivalent circuit and frequency response; oscillators and feedback amplifiers; operational amplifiers – characteristics and applications; simple active filters; VCOs and timers; combinational and sequential logic circuits; multiplexer; Schmitt trigger; multi-vibrators; sample and hold circuits; A/D and D/A converters; 8-bit microprocessor basics, architecture, programming and interfacing.

Power Electronics and Drives:

Semiconductor power diodes, transistors, thyristors, triacs, GTOs, MOSFETs and IGBTs – static characteristics and principles of operation; triggering circuits; phase control rectifiers; bridge converters – fully controlled and half controlled; principles of choppers and inverters; basis concepts of adjustable speed dc and ac drives.

21153E64A **ADVANCED CONTROL SYSTEM** **LT P C**
2 2 0 3

OBJECTIVES

i. To provide knowledge on design state feedback control and state observer.
ii. To provide knowledge in phase plane analysis.
iii. To give basic knowledge in describing function analysis.
iv. To study the design of optimal controller.
v. To study the design of optimal estimator including Kalman Filter

UNIT I STATE VARIABLE ANALYSIS 6+6

Introduction- concepts of state variables and state model-State model for linear continuous time systems, Diagonalisation- solution of state equations- Concepts of controllability and observability.

UNIT II STATE VARIABLE DESIGN 6+6

Introduction to state model: Effect of state feedback - Pole placement design: Necessary and sufficient condition for arbitrary pole placement, State regulator design Design of state observers- Separation principle- Design of servo systems: State feedback with integral control.

UNIT III SAMPLED DATA ANALYSIS 6+6

Introduction spectrum analysis of sampling process signal reconstruction difference equations The Z transform function, the inverse Z transform function, response of Linear discrete system, the Z transform analysis of sampled data control systems, response between sampling instants, the Z and S domain relationship. Stability analysis and compensation techniques.

UNIT IV NON LINEAR SYSTEMS 6+6

Introduction, common physical nonlinearites, The phase plane method: concepts, singular points, stability of non linear systems, construction of phase trajectories system analysis by phase plane method. The describing function method, stability analysis by describing function method, Jump resonance.

UNIT V OPTIMAL CONTROL 6+6

Introduction: Classical control and optimization, formulation of optimal control problem, Typical optimal control performance measures - Optimal state regulator design: Lyapunov equation, Matrix Riccati equation - LQR steady state optimal control – Application examples.

OUTCOMES: **TOTAL: 60 PERIODS**

i. Able to design state feedback controller and state observer.
ii. Able to understand and analyse linear and nonlinear systems using phase plane method.
iii. Able to understand and analyse nonlinear systems using describing function method.
iv. Able to understand and design optimal controller.
v. Able to understand optimal estimator including Kalman Filter.
vi. Ability to apply advanced control strategies to practical engineering problems.

TEXT BOOKS:

1. M.Gopal, “Digital Control and State Variable Methods”, 4th edition, Mc Graw Hill India, 2012
2. K. Ogata, ‘Modern Control Engineering’, 5th Edition, Pearson, 2012.
3. K. P. Mohandas, “Modern Control Engineering”, Sanguine Technical Publishers, 2006.

REFERENCES:

1. M.Gopal, Modern Control System Theory, 3rd edition, New Age International Publishers, 2014.
2. William S Levine, “Control System Fundamentals,” The Control Handbook, CRC Press, Tayler and Francies Group, 2011.
3. Ashish Tewari, ‘Modern Control Design with Matlab and Simulink’, John Wiley, New Delhi, 2002.
4. T. Glad and L. Ljung,, “Control Theory –Multivariable and Non-Linear Methods”, Taylor & Francis, 2002.

21153E64B	**VISUAL LANGUAGES AND APPLICATIONS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES: To impart knowledge about the following topics:

- To study about the concepts of windows programming models, MFC applications, drawing with the GDI, getting inputs from Mouse and the Keyboard.
- To study the concepts of Menu basics, menu magic and classic controls of the windows programming using VC++.
- To study the concept of Document/View Architecture with single & multiple document interface, toolbars, status bars and File I/O Serialization.
- To study about the integrated development programming event driven programming, variabilitys, constants, procedures and basic ActiveX controls in visual basic.
- To understand the database and the database management system, visual data manager, data bound controls and ADO controls in VB.

UNIT I FUNDAMENTALS OF WINDOWS AND MFC 9

Messages - Windows programming - SDK style - Hungarian notation and windows data types - SDK programming in perspective. The benefits of C++ and MFC - MFC design philosophy – Document / View architecture - MFC class hierarchy - AFX functions. Application object - Frame window object - Message map. Drawing the lines – Curves – Ellipse – Polygons and other shapes. GDI pens – Brushes - GDI fonts - Deleting GDI objects and deselecting GDI objects. Getting input from the mouse: Client & Non-client - Area mouse messages - Mouse wheel - Cursor. Getting input from the keyboard: Input focus - Keystroke messages - Virtual key codes - Character & dead key messages.

UNIT II RESOURCES AND CONTROLS 9

Creating a menu – Loading and displaying a menu – Responding to menu commands – Command ranges - Updating the items in menu, update ranges – Keyboard accelerators. Creating menus programmatically - Modifying menus programmatically - The system menu - Owner draw menus – Cascading menus - Context menus. The C button class – C list box class – C static class - The font view application – C edit class – C combo box class – C scrollbar class. Model dialog boxes – Modeless dialog boxes.

UNIT III DOCUMENT / VIEW ARCHITECTURE 9

The in existence function revisited – Document object – View object – Frame window object – Dynamic object creation. SDI document template - Command routing. Synchronizing multiple views of a document – Mid squares application – Supporting multiple document types – Alternatives to MDI. Splitter Windows: Dynamic splitter window – Static splitter windows. Creating & initializing a toolbar - Controlling the toolbar's visibility – Creating & initializing a status bar - Creating custom status bar panes – Status bar support in appwizard. Opening, closing and creating the files - Reading & Writing – C file derivatives – Serialization basics - Writing serializability classes.

UNIT IV FUNDAMENTALS OF VISUAL BASIC 9

Menu bar – Tool bar – Project explorer – Toolbox – Properties window – Form designer – Form layout – Intermediate window. Designing the user interface: Aligning the controls – Running the application – Visual development and event driven programming.

Variabilitys: Declaration – Types – Converting variability types – User defined data types - Lifetime of a variability. Constants - Arrays – Types of arrays. Procedures: Subroutines – Functions – Calling procedures. Text box controls – List box & Combo box controls – Scroll bar and slider controls – File controls.

UNIT V DATABASE PROGRAMMING WITH VB 9

Record sets – Data control – Data control properties, methods. Visual data manager: Specifying indices with the visual data manager – Entering data with the visual data manager. Data bound list control – Data bound combo box – Data bound grid control. Mapping databases: Database object – Tability def object, Query def object. Programming the active database objects – ADO object model – Establishing a connection - Executing SQL statements – Cursor types and locking mechanism – Manipulating the record set object – Simple record editing and updating.

OUTCOMES:

- Ability to understand and apply computing platform and software for engineering problems
- Ability to study about the concepts of windows programming models.
- Ability to study the concepts of Menu basics, menu magic and classic controls.
- Ability to study the concept of Document/View Architecture with single & multiple document interface.
- Ability to study about the integrated development programming event driven programming.
- Ability to understand the database and the database management system.

TEXT BOOKS:

1. Jeff Prosise, 'Programming Windows With MFC', Second Edition, WP Publishers & Distributors (P) Ltd, Reprinted, 2002.
2. Evangelos Petroutsos, 'Mastering Visual Basic 6.0', BPB Publications, 2002.

REFERENCES

1. Herbert Schildt, 'MFC Programming From the Ground Up', Second Edition, McGraw Hill, reprinted, 2002.
2. John Paul Muller, 'Visual C++ 6 From the Ground Up Second Edition', McGraw Hill, Reprinted, 2002.
3. Curtis Smith & Micheal Amundsen, 'Teach Yourself Database Programming with Visual Basic 6 in 21 days', Techmedia Pub, 1999.

21153E64C	DESIGN OF ELECTRICAL APPARATUS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Magnetic circuit parameters and thermal rating of various types of electrical machines.
- Armature and field systems for D.C. machines.
- Core, yoke, windings and cooling systems of transformers.
- Design of stator and rotor of induction machines and synchronous machines.
- The importance of computer aided design method.

UNIT I DESIGN OF FIELD SYSTEM AND ARMATURE 9

Major considerations in Electrical Machine Design – Materials for Electrical apparatus – Design of Magnetic circuits – Magnetising current – Flux leakage – Leakage in Armature. Design of lap winding and wave winding.

UNIT II DESIGN OF TRANSFORMERS 9

Construction - KVA output for single and three phase transformers – Overall dimensions – design of yoke, core and winding for core and shell type transformers – Estimation of No load current – Temperature rise in Transformers – Design of Tank and cooling tubes of Transformers. Computer program: Complete Design of single phase core transformer

UNIT III DESIGN OF DC MACHINES 9

Construction - Output Equations – Main Dimensions – Choice of specific loadings – Selection of number of poles – Design of Armature – Design of commutator and brushes – design of field Computer program: Design of Armature main dimensions

UNIT IV DESIGN OF INDUCTION MOTORS 9

Construction - Output equation of Induction motor – Main dimensions – choice of specific loadings – Design of squirrel cage rotor and wound rotor –Magnetic leakage calculations – Operating characteristics : Magnetizing current - Short circuit current – Circle diagram - Computer program: Design of slip-ring rotor

UNIT V DESIGN OF SYNCHRONOUS MACHINES 9

Output equations – choice of specific loadings – Design of salient pole machines – Short circuit ratio – Armature design – Estimation of air gap length – Design of rotor –Design of damper winding – Determination of full load field MMF – Design of field winding – Design of turbo alternators -Computer program: Design of Stator main dimensions-Brushless DC Machines

OUTCOMES: **TOTAL : 45 PERIODS**

- Ability to understand basics of design considerations for rotating and static electrical machines
- Ability to design of field system for its application.
- Ability to design sing and three phase transformer.
- Ability to design armature and field of DC machines.
- Ability to design stator and rotor of induction motor.

TEXT BOOKS:

1. Sawhney, A.K., ‘A Course in Electrical Machine Design’, Dhanpat Rai& Sons, New Delhi, Fifth Edition, 1984.

2. M V Deshpande ‘Design and Testing of Electrical Machines’ PHI learning Pvt Lt, 2011.

3. Sen, S.K., ‘Principles of Electrical Machine Designs with Computer Programmes’, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, Second Edition, 2009.

REFERENCES

1. A.Shanmugasundaram, G.Gangadharan, R.Palani ‘Electrical Machine Design Data Book’, New Age International Pvt. Ltd., Reprint 2007.

2. ‘Electrical Machine Design’, Balbir Singh, Vikas Publishing House Private Limited, 1981.

3. V Rajini, V.S Nagarajan, ‘Electrical Machine Design’, Pearson, 2017.

4. K.M.Vishnumurthy ‘Computer aided design of electrical machines’ B S Publications,2008

21153E64D	**POWER SYSTEM STABILITY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

- To understand the fundamental concepts of stability of power systems and its classification.
- To expose the students to dynamic behaviour of the power system for small and large disturbances.
- To understand and enhance the stability of power systems.

UNIT I INTRODUCTION TO STABILITY 9

Fundamental concepts - Stability and energy of a system - Power System Stability: Definition, Causes, Nature and Effects of disturbances, Classification of stability, Modelling of electrical components - Basic assumptions made in stability studies- Modelling of Synchronous machine for stability studies(classical model) - Rotor dynamics and the swing equation.

UNIT II SMALL-SIGNAL STABILITY 9

Basic concepts and definitions – State space representation, Physical Interpretation of small–signal stability, Eigen properties of the state matrix: Eigenvalues and eigenvectors, modal matrices, eigenvalue and stability, mode shape and participation factor. Small– signal stability analysis of a Single-Machine Infinite Bus (SMIB) Configuration with numerical example.

UNIT III TRANSIENT STABILITY 9

Review of numerical integration methods: modified Euler and Fourth Order Runge-Kutta methods, Numerical stability,. Interfacing of Synchronous machine (classical machine) model to the transient stability algorithm (TSA) with partitioned – explicit approaches- Application of TSA to SMIB system.

UNIT IV VOLTAGE STABILITY 9

Factors affecting voltage stability- Classification of Voltage stability-Transmission system characteristics- Generator characteristics- Load characteristics- Characteristics of reactive power compensating Devices- Voltage collapse.

UNIT V ENHANCEMENT OF SMALL-SIGNAL STABILITY AND TRANSIENT STABILITY 9

Power System Stabilizer –. Principle behind transient stability enhancement methods: high-speed fault clearing, regulated shunt compensation, dynamic braking, reactor switching, independent pole-operation of circuit-breakers, single-pole switching, fast- valving, high-speed excitation systems.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will attain knowledge about the stability of power system
- Learners will have knowledge on small-signal stability, transient stability and voltage stability.
- Learners will be able to understand the dynamic behaviour of synchronous generator for different disturbances.
- Learners will be able to understand the various methods to enhance the stability of a power system.

TEXT BOOKS:

1. Power system stability and control ,P. Kundur ; edited by Neal J. Balu, Mark G. Lauby, McGraw-Hill, 1994.
2. R.Ramnujam," Power System Dynamics Analysis and Simulation, PHI Learning Private Limited, New Delhi, 2009
3. T.V. Cutsem and C.Vournas, "Voltage Stability of Electric Power Systems", Kluwer publishers, 1998.

REFERENCES

1 Peter W., Saucer, Pai M.A., "Power System Dynamics and Stability, Pearson Education (Singapore), 9th Edition, 2007.
2 EW. Kimbark., "Power System Stability", John Wiley & Sons Limited, New Jersey, 2013.
3 SB. Crary., "Power System Stability", John Wiley & Sons Limited, New Jersey, 1955.
4 K.N. Shubhanga,"Power System Analysis" Pearson, 2017.
5 Power systems dynamics: Stability and control / K.R. Padiyar, BS Publications, 2008
6 Power system control and Stability P.M. Anderson, A.A. Foud, Iowa State University Press, 1977.

21153E64E	MODERN POWER CONVERTERS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Switched mode power supplies
- Matrix Converter
- Soft switched converters

UNIT I SWITCHED MODE POWER SUPPLIES (SMPS) 9

DC Power supplies and Classification; Switched mode dc power supplies - with and without isolation, single and multiple outputs; Closed loop control and regulation; Design examples on converter and closed loop performance.

UNIT II AC-DC CONVERTERS 9

Switched mode AC-DC converters. synchronous rectification - single and three phase topologies - switching techniques - high input power factor . reduced input current harmonic distortion. improved efficiency. with and without input-output isolation. performance indices design examples

UNIT III DC-AC CONVERTERS 9

Multi-level Inversion - concept, classification of multilevel inverters, Principle of operation, main features and analysis of Diode clamped, Flying capacitor and cascaded multilevel inverters; Modulation schemes.

UNIT IV AC-AC CONVERTERS WITH AND WITHOUT DC LINK 9

Matrix converters. Basic topology of matrix converter; Commutation – current path; Modulation techniques - scalar modulation, indirect modulation; Matrix converter as only AC-DC converter; AC-AC converter with DC link - topologies and operation - with and without resonance link - converter with dc link converter; Performance comparison with matrix converter with DC link converters.

UNIT V SOFT-SWITCHING POWER CONVERTERS 9

Soft switching techniques. ZVS, ZCS, quasi resonance operation; Performance comparison hard switched and soft switched converters.AC-DC converter, DC-DC converter, DC-AC converter.; Resonant DC power supplies .

OUTCOMES: **TOTAL : 45 PERIODS**

- Ability to suggest converters for AC-DC conversion and SMPS

TEXT BOOKS:

1. Power Electronics Handbook, M.H.Rashid, Academic press, New york, 2000.
2. Advanced DC/DC Converters, Fang Lin Luo and Fang Lin Luo, CRC Press, NewYork, 2004.
3. Control in Power Electronics- Selected Problem, Marian P.Kazmierkowski, R.Krishnan and Frede Blaabjerg, Academic Press (Elsevier Science), 2002.

REFERENCES

1. Power Electronic Circuits, Issa Batarseh, John Wiley and Sons, Inc.2004
2. Power Electronics for Modern Wind Turbines, Frede Blaabjerg and Zhe Chen, Morgan & Claypool Publishers series, United States of America, 2006.
3. Krein Philip T, Elements of Power Electronics,Oxford University press, 2008
4. Agarwal ,Power Electronics: Converters, Applications, and Design, 3rd edition, Jai P, Prentice Hall,2000
5. L. Umanand, Power Electronics: Essentials & Applications, John Wiley and Sons, 2009.

21153E64F	INTELLECTUAL PROPERTY RIGHTS	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To give an idea about IPR, registration and its enforcement.

UNIT I INTRODUCTION 9

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II REGISTRATION OF IPRs 10

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III AGREEMENTS AND LEGISLATIONS 10

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV DIGITAL PRODUCTS AND LAW 9

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT V ENFORCEMENT OF IPRs 7

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL:45 PERIODS

OUTCOME:

- Ability to manage Intellectual Property portfolio to enhance the value of the firm.

TEXT BOOKS

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. S. V. Satakar, “Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002

REFERENCES:

1. Deborah E. Bouchoux, “Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets”, Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli,”Intellectual Property Rights: Unleashing the Knowledge Economy”, McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

21153E65A **PRINCIPLES OF ROBOTICS** **L T P C**
3 0 0 3

OBJECTIVES:

- To introduce the functional elements of Robotics
- To impart knowledge on the direct and inverse kinematics
- To introduce the manipulator differential motion and control
- To educate on various path planning techniques
- To introduce the dynamics and control of manipulators

UNIT I BASIC CONCEPTS 9

Brief history-Types of Robot–Technology-Robot classifications and specifications-Design and controlissues- Various manipulators – Sensors - work cell - Programming languages.

UNIT II DIRECT AND INVERSE KINEMATICS 9

Mathematical representation of Robots - Position and orientation – Homogeneous transformation-Various joints- Representation using the Denavit Hattenberg parameters -Degrees of freedom-Direct kinematics-Inverse kinematics- SCARA robots- Solvability – Solution methods-Closed form solution.

UNIT III MANIPULATOR DIFFERENTIAL MOTION AND STATICS 9

Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints–Inverse -Wrist and arm singularity - Static analysis - Force and moment Balance.

UNIT IV PATH PLANNING 9

Definition-Joint space technique-Use of p-degree polynomial-Cubic polynomial-Cartesian space technique - Parametric descriptions - Straight line and circular paths - Position and orientation planning.

UNIT V DYNAMICS AND CONTROL 9

Lagrangian mechanics-2DOF Manipulator-Lagrange Euler formulation-Dynamic model – Manipulator control problem-Linear control schemes-PID control scheme-Force control of robotic manipulator.

TOTAL: 45 PERIOD

OUTCOMES:

- Ability to understand basic concept of robotics.
- To analyze Instrumentation systems and their applications to various
- To know about the differential motion add statics in robotics
- To know about the various path planning techniques.
- To know about the dynamics and control in robotics industrie.

TEXT BOOKS:

1. R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi,4th Reprint, 2005.
2. JohnJ.Craig ,Introduction to Robotics Mechanics and Control, Third edition, Pearson Education, 2009.
3. M.P.Groover, M.Weiss, R.N. Nageland N. G.Odrej, Industrial Robotics, McGraw-Hill Singapore, 1996.

REFERENCES:

1. Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis', Oxford University Press, Sixth impression, 2010.
2. K. K.Appu Kuttan, Robotics, I K International, 2007.
3. Edwin Wise, Applied Robotics, Cengage Learning, 2003.
4. R.D.Klafter,T.A.Chimielewski and M.Negin, Robotic Engineering–An Integrated Approach, Prentice Hall of India, New Delhi, 1994.
5. B.K.Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers,Chennai, 1998.
6. S.Ghoshal, " Embedded Systems & Robotics" – Projects using the 8051 Microcontroller", Cengage Learning, 2009.

21153E65B	**SPECIAL ELECTRICAL MACHINES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

To impart knowledge on the following Topics

- Construction, principle of operation, control and performance of stepping motors.
- Construction, principle of operation, control and performance of switched reluctance motors.
- Construction, principle of operation, control and performance of permanent magnet brushless D.C. motors.
- Construction, principle of operation and performance of permanent magnet synchronous motors.
- Construction, principle of operation and performance of other special Machines.

UNIT I STEPPER MOTORS 9

Constructional features –Principle of operation –Types – Torque predictions – Linear Analysis – Characteristics – Drive circuits – Closed loop control – Concept of lead angle - Applications.

UNIT II SWITCHED RELUCTANCE MOTORS (SRM) 9

Constructional features –Principle of operation- Torque prediction–Characteristics Steady state performance prediction – Analytical Method – Power controllers – Control of SRM drive- Sensor less operation of SRM – Applications.

UNIT III PERMANENT MAGNET BRUSHLESS D.C. MOTORS 9

Fundamentals of Permanent Magnets- Types- Principle of operation- Magnetic circuit analysis- EMF and Torque equations- Power Converter Circuits and their controllers - Characteristics and control- Applications.

UNIT IV PERMANENT MAGNET SYNCHRONOUS MOTORS (PMSM) 9

Constructional features -Principle of operation – EMF and Torque equations - Sine wave motor with practical windings - Phasor diagram - Power controllers – performance characteristics - Digital controllers – Applications.

UNIT V OTHER SPECIAL MACHINES 9

Constructional features – Principle of operation and Characteristics of Hysteresis motor- Synchronous Reluctance Motor–Linear Induction motor-Repulsion motor- Applications.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to analyze and design controllers for special Electrical Machines.
- Ability to acquire the knowledge on construction and operation of stepper motor.
- Ability to acquire the knowledge on construction and operation of stepper switched reluctance motors.
- Ability to construction, principle of operation, switched reluctance motors.
- Ability to acquire the knowledge on construction and operation of permanent magnet brushless D.C. motors.
- Ability to acquire the knowledge on construction and operation of permanent magnet synchronous motors.
- Ability to select a special Machine for a particular application.

TEXT BOOKS:

- K.Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.
- T. Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press London, 1984
- E.G. Janardanan, 'Special electrical machines', PHI learning Private Limited, Delhi, 2014.

REFERENCES

1. R.Krishnan, 'Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application', CRC Press, New York, 2001.
2. T. Kenjo and S. Nagamori, 'Permanent Magnet and Brushless DC Motors', Clarendon Press, London, 1988.
3. T.J.E.Miller,'Brushless Permanent-Magnet and Reluctance Motor Drives', Oxford University Press, 1989.
4. R.Srinivasan, 'Special Electrical Machines', Lakshmi Publications, 2013.

21153E65C	POWER QUALITY	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Causes & Mitigation techniques of various PQ events.
- Various Active & Passive power filters.

UNIT I INTRODUCTION TO POWER QUALITY 9

Terms and definitions & Sources – Overloading, under voltage, over voltage - Concepts of transients - Short duration variations such as interruption - Long duration variation such as sustained interruption - Sags and swells - Voltage sag - Voltage swell - Voltage imbalance – Voltage fluctuations - Power frequency variations - International standards of power quality – Computer Business Equipment Manufacturers Associations (CBEMA) curve

UNIT II VOLTAGE SAG AND SWELL 9

Estimating voltage sag performance - Thevenin's equivalent source - Analysis and calculation of various faulted condition - Estimation of the sag severity - Mitigation of voltage sag, Static transfer switches and fast transfer switches. - Capacitor switching – Lightning - Ferro resonance - Mitigation of voltage swell.

UNIT III HARMONICS 9

Harmonic sources from commercial and industrial loads - Locating harmonic sources – Power system response characteristics - Harmonics Vs transients. Effect of harmonics – Harmonic distortion - Voltage and current distortions - Harmonic indices - Inter harmonics – Resonance Harmonic distortion evaluation, IEEE and IEC standards.

UNIT IV PASSIVE POWER COMPENSATORS 9

Principle of Operation of Passive Shunt and Series Compensators, Analysis and Design of Passive Shunt Compensators Simulation and Performance of Passive Power Filters- Limitations of Passive Filters Parallel Resonance of Passive Filters with the Supply System and Its Mitigation. Fundamentals of load compensation – voltage regulation & power factor correction.

UNIT V POWER QUALITY MONITORING & CUSTOM POWER DEVICES 9

Monitoring considerations - Monitoring and diagnostic techniques for various power quality problems - Quality measurement equipment - Harmonic / spectrum analyzer - Flicker meters Disturbance analyzer - Applications of expert systems for power quality monitoring. Principle& Working of DSTATCOM – DSTATCOM in Voltage control mode, current control mode, DVR Structure – Rectifier supported DVR – DC Capacitor supported DVR -Unified power quality conditioner.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand various sources, causes and effects of power quality issues, electrical systems and their measures and mitigation.
- Ability to analyze the causes & Mitigation techniques of various PQ events.
- Ability to study about the various Active & Passive power filters.
- Ability to understand the concepts about Voltage and current distortions, harmonics.
- Ability to analyze and design the passive filters.
- Ability to acquire knowledge on compensation techniques.
- Ability to acquire knowledge on DVR.

TEXT BOOKS:

1. Roger. C. Dugan, Mark. F. Mc Granagham, Surya Santoso, H.WayneBeaty, “Electrical Power Systems Quality”, McGraw Hill,2003

2. J. Arrillaga, N.R. Watson, S. Chen, “Power System Quality Assessment”, (New York : Wiley),2000.

3. Bhim Singh, Ambrish Chandra, Kamal Al-Haddad,” Power Quality Problems & Mitigation Techniques” Wiley, 2015.

REFERENCES

1. G.T. Heydt, “Electric Power Quality”, 2nd Edition. (West Lafayette, IN, Stars in a Circle Publications, 1994.

2. M.H.J Bollen, “Understanding Power Quality Problems: Voltage Sags and Interruptions”, (New York: IEEE Press), 2000.

21153E65D **EHVAC TRANSMISSION**

L	T	P	C
3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- EHVAC Transmission lines
- Electrostatic field of AC lines
- Corona in E.H.V. lines

UNIT I INTRODUCTION 9

EHVAC Transmission line trends and preliminary aspect - standard transmission voltages – Estimation at line and ground parameters-Bundle conductors: Properties -Inductance and Capacitance of EHV lines – Positive, negative and zero sequence impedance – Line Parameters for Modes of Propagation.

UNIT II ELECTROSTATIC FIELDS 9

Electrostatic field and voltage gradients – Calculations of electrostatic field of AC lines – Effect of high electrostatic field on biological organisms and human beings - Surface voltage gradients and Maximum gradients of actual transmission lines – Voltage gradients on sub conductor.

UNIT III POWER CONTROL 9

Electrostatic induction in un energized lines – Measurement of field and voltage gradients for three phase single and double circuit lines – Un energized lines. Power Frequency Voltage control and overvoltage in EHV lines: No load voltage – Charging currents at power frequency- Voltage control – Shunt and Series compensation – Static VAR compensation.

UNIT IV CORONA EFFECTS AND RADIO INTERFERENCE 9

Corona in EHV lines – Corona loss formulae-Charge voltage diagram- Attenuation of traveling waves due to Corona – Audio noise due to Corona, its generation, characteristic and limits. Measurements of audio noise radio interference due to Corona - properties of radio noise – Frequency spectrum of RI fields – Measurements of RI and RIV.

UNIT V STEADY STATE AND TRANSIENT LIMITS 9

Design of EHV lines based on steady state and transient limits - EHV cabilitys and their characteristics-Introduction six phase transmission – UHV.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand the principles and types of EHVAC system.
- Ability to analyze the electrostatic field of AC lines
- Ability to study about the compensation.
- Ability to study about the corona in E.H.V. lines
- Ability to understand the EHV cabilitys.
- Ability to analyze the steady state and transient limits.

TEXT BOOKS:

1. Rokosh Das Begamudre, "Extra High Voltage AC Transmission Engineering"– Wiley Eastern LTD., NEW DELHI 1990.

2. S. Rao, "HVAC and HVDC Transmission, Engineering and Practice" Khanna Publisher, Delhi, 1990.

REFERENCES

1. Subir Ray, "An Introduction to High Voltage Engineering", Prentice Hall of India Private Limited, 2013.

2. RD Begamudre, "Extra High Voltage AC Transmission Engineering"– New Academic Science Ltd; 4 edition 2011.

3. Edison," EHV Transmission line"- Electric Institution, GEC, 1968.

21153E65E **COMMUNICATION ENGINEERING** **L T P C**
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To study the various analog and digital modulation techniques
- To study the principles behind information theory and coding
- To study the various digital communication techniques

UNIT I ANALOG MODULATION 9

Amplitude Modulation – AM, DSBSC, SSBSC, VSB – PSD, modulators and demodulators – Angle modulation – PM and FM – PSD, modulators and demodulators – Superheterodyne receivers

UNITII PULSE MODULATION 9

Low pass sampling theorem – Quantization – PAM – Line coding – PCM, DPCM, DM, and ADPCM And ADM, Channel Vocoder - Time Division Multiplexing, Frequency Division Multiplexing

UNIT III DIGITAL MODULATION AND TRANSMISSION 9

Phase shift keying – BPSK, DPSK, QPSK – Principles of M-ary signaling M-ary PSK & QAM – Comparison, ISI – Pulse shaping – Duo binary encoding – Cosine filters – Eye pattern, equalizers

UNIT IV INFORMATION THEORY AND CODING 9

Measure of information – Entropy – Source coding theorem – Shannon–Fano coding, Huffman Coding, LZ Coding – Channel capacity – Shannon-Hartley law – Shannon's limit – Error control codes – Cyclic codes, Syndrome calculation – Convolution Coding, Sequential and Viterbi decoding

UNIT V SPREAD SPECTRUM AND MULTIPLE ACCESS 9

PN sequences – properties – m-sequence – DSSS – Processing gain, Jamming – FHSS – Synchronisation and tracking – Multiple Access – FDMA, TDMA, CDMA,

OUTCOMES:
At the end of the course, the student should be able to:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- Apply analog and digital communication techniques.
- Use data and pulse communication techniques.
- Analyze Source and Error control coding.
-

TEXT BOOKS:

1. H Taub, D L Schilling, G Saha, "Principles of Communication Systems" TMH 2007
2. S. Haykin "Digital Communications" John Wiley 2005

REFERENCES:

1
. B.P.Lathi, "Modern Digital and Analog Communication Systems", 3rd edition, Oxford University
2. H P Hsu, Schaum Outline Series – "Analog and Digital Communications" TMH 2006
3. B.Sklar, Digital Communications Fundamentals and Applications" 2/e Pearson Education 2007.

21153E75A **DISASTER MANAGEMENT** **LT P C**
3 0 0 3

OBJECTIVES:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA)
– Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:

The students will be ability to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.

- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.

TEXTBOOKS:

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-**13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerability India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

21153E75B	**HUMAN RIGHTS**	**LT P C**
		3 0 0 3

OBJECTIVES :

- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I **9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II **9**

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III **9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV **9**

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V **9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabilityd persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

TOTAL : 45 PERIODS

OUTCOME :

- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

21153E75C	**OPERATIONS RESEARCH**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

- To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

UNIT I LINEAR MODELS 15

The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.

UNIT II TRANSPORTATION MODELS AND NETWORK MODELS 8

Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route – Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks – Critical path scheduling – Sequencing models.

UNIT III INVENTORY MODELS 6

Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

UNIT IV QUEUEING MODELS 6

Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

UNIT V DECISION MODELS 10

Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life – Economic life– Single / Multi variability search technique – Dynamic Programming – Simple Problem.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can ability to use the optimization techniques for use engineering and Business problems

TEXT BOOK:

1. Hillier and Libeberman, "Operations Research", Holden Day, 2005
2. Taha H.A., "Operations Research", Sixth Edition, Prentice Hall of India, 2003.

REFERENCES:

1. Bazara M.J., Jarvis and Sherali H., "Linear Programming and Network Flows", John Wiley, 2009.

2. Budnick F.S., “Principles of Operations Research for Management”, Richard D Irwin, 1990.
3. Philip D.T. and Ravindran A., “Operations Research”, John Wiley, 1992.
4. Shennoy G.V. and Srivastava U.K., “Operation Research for Management”, Wiley Eastern, 1994.
5. Tulsian and Pasdey V., “Quantitative Techniques”, Pearson Asia, 2002.

21153E75D **PROBABILITY AND STATISTICS**

L	T	P	C
3	0	0	3

OBJECTIVES :

- This course aims at providing the required skill to apply the statistical tools in engineering problems.
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two dimensional random variables.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.

UNIT I PROBABILITY AND RANDOM VARIABLES 12

Probability – The axioms of probability – Conditional probability – Baye’s theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT II TWO - DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTING OF HYPOTHESIS 12

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT IV DESIGN OF EXPERIMENTS 12

One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design - 2^2 factorial design.

UNIT V STATISTICAL QUALITY CONTROL `12

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL : 60 PERIODS

OUTCOMES :

Upon successful completion of the course, students will be able to:

- Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
- Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

TEXT BOOKS :

1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.

2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.

REFERENCES :

1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
2. Papoulis, A. and Unnikrishnapillai, S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2010.
3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
4. Spiegel. M.R., Schiller. J. and Srinivasan, R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.
5. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2007.

21153E75E	**FIBRE OPTICS AND LASER INSTRUMENTS**	**LT P C** **3 0 0 3**

AIM :

To contribute to the knowledge of Fibre optics and Laser Instrumentation and its Industrial andMedical Application.

COURSE OBJECTIVES

- To expose the students to the basic concepts of optical fibres and their properties.
- To provide adequate knowledge about the Industrial applications of optical fibres.
- To expose the students to the Laser fundamentals.
- To provide adequate knowledge about Industrial application of lasers.
- To provide adequate knowledge about holography and Medical applications of Lasers.

UNIT I OPTICAL FIBRES AND THEIR PROPERTIES 9

Construction of optical fiber cable: Guiding mechanism in optical fiber and Basic component of optical fiber communication, –Principles of light propagation through a fibre: Total internal reflection, Acceptance angle (θa), Numerical aperture and Skew mode, –Different types of fibres and their properties: Single and multimode fibers and Step index and graded index fibers,– fibrecharacteristics: Mechanical characteristics and Transmission characteristics, – Absorption losses – Scattering losses – Dispersion – Connectors and splicers –Fibre termination – Optical sources: Light Emitting Diode (LED), – Optical detectors: PIN Diode.

UNIT II INDUSTRIAL APPLICATION OF OPTICAL FIBRES 9

Fibre optic sensors: Types of fiber optics sensor, Intrinsic sensor- Temperature/ Pressure sensor, Extrinsic sensors, Phase Modulated Fibre Optic Sensor and Displacementsensor (Extrinsic Sensor) – Fibre optic instrumentation system: Measurement of attenuation (by cut back method), Optical domain reflectometers, Fiber Scattering loss Measurement, Fiber Absorption Measurement, Fiber dispersion measurements, End reflection method and Near field scanning techniques – Different types of modulators: Electro-optic modulator (EOM) –Interferometric method of measurement of length – Moire fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain.

UNIT III LASER FUNDAMENTALS 9

Fundamental characteristics of lasers – Level Lasers: Two-Level Laser, Three Level Laser, Quasi Three and four level lasers – Properties of laser: Monochromaticity, Coherence, Divergence and Directionality and Brightness –Laser modes – Resonator configuration – Q-switching and mode locking – Cavity damping – Types of lasers; – Gas lasers, solid lasers, liquid lasers and semiconductor lasers.

UNIT IV INDUSTRIAL APPLICATION OF LASERS 9

Laser for measurement of distance, Laser for measurement of length, Laser for measurement of velocity, Laser for measurement of acceleration, Laser for measurement of current, voltage and Laser for measurement of Atmospheric Effect: Types of LIDAR, Construction And Working, and LIDAR Applications – Material processing: Laser instrumentation for material processing, Powder Feeder, Laser Heating, Laser Welding, Laser Melting, Conduction Limited Melting and Key Hole Melting – Laser trimming of material: Process Of Laser Trimming, Types Of Trim, Construction And Working Advantages – Material Removal and vaporization: Process Of Material Removal.

UNIT V HOLOGRAM AND MEDICAL APPLICATIONS 9

Holography: Basic Principle, Holography vs. photography, Principle Of Hologram Recording, Condition For Recording A Hologram, Reconstructing and viewing the holographic image– Holography for non-destructive testing – Holographic components – Medical applications of lasers, laser-Tissue Interactions Photochemical reactions, Thermalisation, collisional relaxation, Types of Interactions and Selecting an Interaction Mechanism – Laser instruments for surgery, removal of tumors of vocal cards, brain surgery, plastic surgery, gynaecology and oncology.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs):

1. Understand the principle, transmission, dispersion and attenuation characteristics of opticalfibers
2. Apply the gained knowledge on optical fibers for its use as communication medium and as sensor as well which have important applications in production, manufacturing industrial and biomedical applications.
3. Understand laser theory and laser generation system.
4. Students will gain ability to apply laser theory for the selection of lasers for a specific Industrial and medical application.

TEXT BOOKS:

1. J.M. Senior, 'Optical Fibre Communication – Principles and Practice', Prentice Hall of India,1985.
2. J. Wilson and J.F.B. Hawkes, 'Introduction to Opto Electronics', Prentice Hall of India, 2001.
3. Eric Udd, William B., and Spillman, Jr., "Fiber Optic Sensors: An Introduction for Engineers and Scientists ", John Wiley & Sons, 2011.

REFERENCES:

1. G. Keiser, 'Optical Fibre Communication', McGraw Hill, 1995.
2. M. Arumugam, 'Optical Fibre Communication and Sensors', Anuradha Agencies, 2002.
3. John F. Ready, "Industrial Applications of Lasers", Academic Press, Digitized in 2008.

4. Monte Ross, ‘Laser Applications’, McGraw Hill, 1968.
5. John and Harry, “Industrial lasers and their application”, McGraw-Hill, 2002.
6. Keiser, G., “Optical Fiber Communication”, McGraw-Hill, 3rd Edition, 2000. http://nptel.ac.in/courses/117101002/

		L	T	P	C
21153E81A	**FLEXIBLE AC TRANSMISSION SYSTEMS**	**3**	**0**	**0**	**3**

OBJECTIVES: To impart knowledge about the following topics:

- The start-of-art of the power system
- Performance of power systems with FACTS controllers.
- FACTS controllers for load flow and dynamic analysis

UNIT I INTRODUCTION 9

Real and reactive power control in electrical power transmission lines–loads & system compensation-Uncompensated transmission line–shunt and series compensation.

UNIT II STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS 9

Voltage control by SVC–Advantages of slope in dynamic characteristics–Influence of SVC on system voltage–Design of SVC voltage regulator–TCR-FC-TCR-Modeling of SVC for power flow and fast transient stability– Applications: Enhancement of transient stability – Steady state power transfer –Enhancement of power system damping.

UNIT III THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) AND APPLICATIONS 9

Operation of the TCSC–Different modes of operation–Modelling of TCSC, Variability reactance model– Modelling for Power Flow and stability studies. Applications: Improvement of the system stability limit–Enhancement of system damping.

UNIT IV VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS 9

Static Synchronous Compensator (STATCOM)–Principle of operation–V-I Characteristics. Applications: Steady state power transfer-enhancement of transient stability-prevention of voltage instability. SSSC-operation of SSSC and the control of power flow–modelling of SSSC in load flow and transient stability studies- Dynamic voltage restorer(DVR).

UNIT V ADVANCED FACTS CONTROLLERS 9

Interline DVR(IDVR) - Unified Power flow controller (UPFC) - Interline power flow controller (IPFC) - Unified Power quality conditioner (UPQC).

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand, analyze and develop analytical model of FACTS controller for power system application.
- Ability to understand the concepts about load compensation techniques.
- Ability to acquire knowledge on facts devices.
- Ability to understand the start-of-art of the power system
- Ability to analyze the performance of steady state and transients of facts controllers.
- Ability to study about advanced FACTS controllers.

TEXT BOOKS:

1. R.Mohan Mathur, Rajiv K.Varma,"Thyristor–Based Facts Controllers for Electrical Transmission Systems", IEEE press andJohnWiley&Sons,Inc,2002.
2. NarainG. Hingorani, "Understanding FACTS-Concepts and Technology of Flexible AC Transmission Systems", Standard Publishers Distributors,Delhi-110006,2011.
3. T.J.E Miller, Power Electronics in power systems, John Wiley and sons.

REFERENCES

1. K.R. Padiyar, "FACTS Controllers in Power Transmission and Distribution", New Age International (P) Limited, Publishers, New Delhi, 2008
2. A.T.John,"FlexibleA.C.TransmissionSystems",InstitutionofElectricalandElectronic Engineers(IEEE), 1999.
3. V.K.Sood, HVDC and FACTS controllers–Applications of Static Converters in Power System, APRIL2004,KluwerAcademic Publishers,2004.

SOFT COMPUTING TECHNIQUES

	L	T	P	C
21153E81B	3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Basics of artificial neural network.
- Concepts of modelling and control of neural and fuzzy control schemes.
- Features of hybrid control schemes.

UNIT I ARTIFICIAL NEURAL NETWORK 9

Review of fundamentals – Biological neuron, artificial neuron, activation function, single layer perceptron – Limitation – Multi layer perceptron – Back Propagation Algorithm (BPA) – Recurrent Neural Network (RNN) – Adaptive Resonance Theory (ART) based network – Radial basis function network – online learning algorithms, BP through time – RTRL algorithms – Reinforcement learning.

UNIT II NEURAL NETWORKS FOR MODELING AND CONTROL 9

Modelling of non-linear systems using ANN – Generation of training data – Optimal architecture– Model validation – Control of non-linear systems using ANN – Direct and indirect neuro control schemes – Adaptive neuro controller – Familiarization with neural network toolbox.

UNIT III FUZZY SET THEORY 9

Fuzzy set theory – Fuzzy sets – Operation on fuzzy sets – Scalar cardinality, fuzzy cardinality, union and intersection, complement (Yager and Sugeno), equilibrium points, aggregation, projection, composition, cylindrical extension, fuzzy relation – Fuzzy membership functions.

UNIT IV FUZZY LOGIC FOR MODELING AND CONTROL 9

Modelling of non-linear systems using fuzzy models – TSK model – Fuzzy logic controller – Fuzzification – Knowledge base – Decision making logic – Defuzzification – Adaptive fuzzy systems – Familiarization with fuzzy logic toolbox.

UNIT V HYBRID CONTROL SCHEMES 9

Fuzzification and rule base using ANN – Neuro fuzzy systems – ANFIS – Fuzzy neuron– GA – Optimization of membership function and rule base using Genetic Algorithm – Introduction to other evolutionary optimization techniques, support vector machine– Case study – Familiarization with ANFIS toolbox.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand the concepts of ANN, different features of fuzzy logic and their modelling, control aspects and different hybrid control schemes.
- Ability to understand the basics of artificial neural network.
- Ability to get knowledge on modelling and control of neural.

- Ability to get knowledge on modelling and control of fuzzy control schemes.
- Ability to acquire knowledge on hybrid control schemes.
- Ability to understand the concepts of Adaptive Resonance Theory

TEXT BOOKS:

1. Laurence Fausett, "Fundamentals of Neural Networks", Prentice Hall, Englewood Cliffs, N.J., 1992
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill Inc., 2000.

REFERENCES

1. Goldberg, "Genetic Algorithm in Search, Optimization and Machine learning", Addison Wesley Publishing Company Inc. 1989
2. Millon W.T., Sutton R.S. and Webrose P.J., "Neural Networks for Control", MIT press, 1992
3. Ethem Alpaydin, "Introduction to Machine learning (Adaptive Computation and Machine Learning series)', MIT Press, Second Edition, 2010.
4. Zhang Huaguang and Liu Derong, "Fuzzy Modeling and Fuzzy Control Series: Control Engineering", 2006

21153E81C	**POWER SYSTEMS DYNAMICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES: To impart knowledge about the following topics:

- Basics of dynamics and stability problems
- Modeling of synchronous machines
- Excitation system and speed-governing controllers.
- Small signal stability of a single-machine infinite bus system with excitation system and power system stabilizer.
- Transient stability simulation of multi machine power system.

UNIT I INTRODUCTION 9

Basics of system dynamics – numerical techniques – introduction to software packages to study the responses. Concept and importance of power system stability in the operation and design - distinction between transient and dynamic stability - complexity of stability problem in large system – necessity for reduced models - stability of interconnected systems.

UNIT II SYNCHRONOUS MACHINE MODELLING 9

Synchronous machine - flux linkage equations - Park's transformation - per unit conversion - normalizing the equations - equivalent circuit - current space model - flux linkage state space model. Sub-transient and transient inductances - time constants. Simplified models (one axis and constant flux linkage) - steady state equations and phasor diagrams.

UNIT III MACHINE CONTROLLERS 9

Exciter and voltage regulators - function and types of excitation systems - typical excitation system configuration - block diagram and state space representation of IEEE type 1 excitation system - saturation function - stabilizing circuit. Function of speed governing systems - block diagram and state space representation of IEEE mechanical hydraulic governor and electrical hydraulic governors for hydro turbines and steam turbines.

UNIT IV TRANSIENT STABILITY 9

State equation for multi machine system with one axis model and simulation – modelling of multi machine power system with one axis machine model including excitation system and speed governing system and simulation using R-K method of fourth order (Gill's technique) for transient stability analysis - power system stabilizer. For all simulations, the algorithm and flow chart have to be discussed.

UNIT V DYNAMIC STABILITY 9

System response to small disturbances - linear model of the unregulated synchronous machine and its modes of oscillation - regulated synchronous machine - distribution of power impact - linearization of the load equation for the one machine problem – simplified linear model - effect of excitation on dynamic stability - approximate system representation - supplementary stabilizing signals - dynamic performance measure - small signal performance measures.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.
- Ability to get knowledge on the basics of dynamics and stability problems
- Ability to design and modelling of synchronous machines

- Ability to study about excitation system and speed-governing controllers.
- Ability to understand the concept of small signal stability of a single-machine infinite bus system with excitation system.
- Ability to analyze the transient stability simulation.

TEXT BOOKS:

1. P.M. Anderson and A.A.Fouad, ‘Power System Control and Stability’, Galgotia Publications, New Delhi, 2003.
2. P. Kundur, ‘Power System Stability and Control’, McGraw Hill Inc., USA, 1994.
3. R.Ramanujam, “Power System Dynamics – Analysis and Simulation”, PHI, 2009.

REFERENCES

1. M.A.Pai and W.Sauer, ‘Power System Dynamics and Stability’, Pearson Education Asia, India, 2002.
2. James A.Momoh, Mohamed. E. EI-Hawary. “ Electric Systems, Dynamics and Stability with Artificial Intelligence applications”, Marcel Dekker, USA First Edition, 2000.
3. C.A.Gross, “Power System Analysis,” Wiley India, 2011.
4. B.M.Weedy, B.J.Lory, N.Jenkins, J.B.Ekanayake and G.Strbac,” Electric Power Systems”, Wiley India, 2013.
5. K.Umarao, “Computer Techniques and Models in Power System,” I.K. International, 2007.

21153E81D	SMPS AND UPS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Modern power electronic converters and its applications in electric power utility.
- Resonant converters and UPS

UNIT I DC-DC CONVERTERS 9

Principles of step down and step up converters – Analysis and state space modeling of Buck, Boost, Buck- Boost and Cuk converters.

UNIT II SWITCHED MODE POWER CONVERTERS 9

Analysis and state space modeling of fly back, Forward, Push pull, Luo, Half bridge and full bridge converters- control circuits and PWM techniques.

UNIT III RESONANT CONVERTERS 9

Introduction- classification- basic concepts- Resonant switch- Load Resonant converters- ZVS , Clamped voltage topologies- DC link inverters with Zero Voltage Switching- Series and parallel Resonant inverters- Voltage control.

UNIT IV DC-AC CONVERTERS 9

Single phase and three phase inverters, control using various (sine PWM, SVPWM and PSPWM) techniques, various harmonic elimination techniques- Multilevel inverters- Concepts - Types: Diode clamped- Flying capacitor- Cascaded types- Applications.

UNIT V POWER CONDITIONERS, UPS & FILTERS 9

Introduction- Power line disturbances- Power conditioners –UPS: offline UPS, Online UPS, Applications – Filters: Voltage filters, Series-parallel resonant filters, filter without series capacitors, filter for PWM VSI, current filter, DC filters – Design of inductor and transformer for PE applications – Selection of capacitors.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to analyze the state space model for DC – DC converters
- Ability to acquire knowledge on switched mode power converters.
- Ability to understand the importance of Resonant Converters.
- Ability to analyze the PWM techniques for DC-AC converters
- Ability to acquire knowledge on modern power electronic converters and its applications in electric power utility.
- Ability to acquire knowledge on filters and UPS

TEXT BOOKS:

1. Simon Ang, Alejandro Oliva," Power-Switching Converters", Third Edition, CRC Press, 2010.
2. KjeldThorborg, "Power Electronics – In theory and Practice", Overseas Press, First Indian Edition 2005.
3. M.H. Rashid – Power Electronics handbook, Elsevier Publication, 2001.

REFERENCES

1. Philip T Krein, " Elements of Power Electronics", Oxford University Press
2. Ned Mohan, Tore.M.Undeland, William.P.Robbins, Power Electronics converters,

Applications and design- Third Edition- John Wiley and Sons- 2006
3. M.H. Rashid – Power Electronics circuits, devices and applications- third edition Prentice Hall of India New Delhi, 2007.
4. Erickson, Robert W, "Fundamentals of Power Electronics", Springer, second edition, 2010.

21153E81E	ELECTRIC ENERGY GENERATION, UTILIZATION CONSERVATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- To study the generation, conservation of electrical power and energy efficient equipments.
- To understand the principle, design of illumination systems and energy efficiency lamps.
- To study the methods of industrial heating and welding.
- To understand the electric traction systems and their performance.

UNIT I ILLUMINATION 9

Importance of lighting – properties of good lighting scheme – laws of illumination – photometry - types of lamps – lighting calculations – basic design of illumination schemes for residential, commercial, street lighting, factory lighting and flood lighting – LED lighting and energy efficient lamps.

UNIT II REFRIGERATION AND AIR CONDITIONING 9

Refrigeration-Domestic refrigerator and water coolers - Air-Conditioning-Various types of air-conditioning system and their applications, smart air conditioning units - Energy Efficient motors: Standard motor efficiency, need for efficient motors, Motor life cycle, Direct Savings and payback analysis, efficiency evaluation factor.

UNIT III HEATING AND WELDING 9

Role of electric heating for industrial applications – resistance heating – induction heating – dielectric heating - electric arc furnaces. Brief introduction to electric welding – welding generator, welding transformer and the characteristics.

UNIT IV TRACTION 9

Merits of electric traction – requirements of electric traction system – supply systems – mechanics of train movement – traction motors and control – braking – recent trends in electric traction.

UNIT V DOMESTIC UTILIZATION OF ELECTRICAL ENERGY 9

Domestic utilization of electrical energy – House wiring. Induction based appliances, Online and OFF line UPS, Batteries - Power quality aspects – nonlinear and domestic loads – Earthing – Domestic, Industrial and Substation.

TOTAL : 45 PERIODS

OUTCOMES:

- To understand the main aspects of generation, utilization and conservation.
- To identify an appropriate method of heating for any particular industrial application.
- To evaluate domestic wiring connection and debug any faults occurred.
- To construct an electric connection for any domestic appliance like refrigerator as well as to design a battery charging circuit for a specific household application.

- To realize the appropriate type of electric supply system as well as to evaluate the performance of a traction unit.
- To understand the main aspects of Traction.

TEXT BOOKS:

1. Wadhwa, C.L. "Generation, Distribution and Utilization of Electrical Energy", New Age International Pvt. Ltd, 2003.
2. Dr. Uppal S.L. and Prof. S. Rao, 'Electrical Power Systems', Khanna Publishers, New Delhi, 15th Edition, 2014.
3. Energy Efficiency in Electric Utilities, BEE Guide Book, 2010

REFERENCES

1. Partab.H, "Art and Science of Utilisation of Electrical Energy", Dhanpat Rai and Co, New Delhi, 2004.
2. Openshaw Taylor.E, "Utilization of Electrical Energy in SI Units", Orient Longman Pvt. Ltd, 2003.
3. Gupta.J.B, "Utilization of Electric Power and Electric Traction", S.K.Kataria and Sons, 2002.
4. Cleaner Production – Energy Efficiency Manual for GERIAP, UNEP, Bangkok prepared by National Productivity Council.

21153E81F	**PROFESSIONAL ETHICS IN ENGINEERING**	**LT P C**
		3 0 0 3

OBJECTIVES:

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I HUMAN VALUES 10

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT V GLOBAL ISSUES 8

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of the course, the student should be ability to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

TEXT BOOKS:

1. Mike W. Martin and Roland Schinzinger, “Ethics in Engineering”, Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1. Charles B. Fleddermann, “Engineering Ethics”, Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, “Engineering Ethics – Concepts and Cases”, Cengage Learning, 2009.
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2001.
5. Laura P. Hartman and Joe Desjardins, “Business Ethics: Decision Making for Personal Integrity and Social Responsibility” Mc Graw Hill education, India Pvt. Ltd.,New Delhi, 2013.
6. World Community Service Centre, ‘ Value Education’, Vethathiri publications, Erode, 2011.

Web sources:

1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

21153E81G **PRINCIPLES OF MANAGEMENT** **LT P C**
3 0 0 3

OBJECTIVES:

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization.

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

UNIT II PLANNING **9**

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT III ORGANISING **9**

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

UNIT IV DIRECTING **9**

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

UNIT V CONTROLLING **9**

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

OUTCOMES: **TOTAL: 45 PERIODS**

- Upon completion of the course, students will be ability to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

TEXT BOOKS:

1. JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", 6th Edition, Pearson Education, 2004.
2. Stephen P. Robbins & Mary Coulter, "Management", Prentice Hall (India)Pvt. Ltd., 10th Edition, 2009.

REFERENCES:

1. Harold Koontz & Heinz Weihrich, "Essentials of Management", Tata McGraw Hill, 1998.
2. Robert Kreitner & Mamata Mohapatra, "Management", Biztantra, 2008.
3. Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management", 7th Edition, Pearson Education, 2011.
4. Tripathy PC & Reddy PN, "Principles of Management", Tata Mcgraw Hill, 1999

21153E82A **ENERGY MANAGEMENT AND AUDITING**

L	T	P	C
3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- To impact concepts behind economic analysis and Load management.
- Energy management on various electrical equipments and metering.
- Concept of lighting systems and cogeneration.

UNIT I INTRODUCTION 9

Basics of Energy – Need for energy management – Energy accounting - Energy monitoring, targeting and reporting - Energy audit process.

UNIT II ENERGY MANAGEMENT FOR MOTORS AND COGENERATION 9

Energy management for electric motors – Transformer and reactors - Capacitors and synchronous machines, energy management by cogeneration – Forms of cogeneration – Feasibility of cogeneration – Electrical interconnection.

UNIT III LIGHTING SYSTEMS 9

Energy management in lighting systems – Task and the working space - Light sources – Ballasts – Lighting controls – Optimizing lighting energy – Power factor and effect of harmonics, lighting and energy standards.

UNIT IV METERING FOR ENERGY MANAGEMENT 9

Metering for energy management – Units of measure - Utility meters – Demand meters – Paralleling of current transformers – Instrument transformer burdens – Multi tasking solid state meters, metering location vs requirements, metering techniques and practical examples.

UNIT V ECONOMIC ANALYSIS AND MODELS 9

Economic analysis – Economic models - Time value of money - Utility rate structures – Cost of electricity – Loss evaluation, load management – Demand control techniques – Utility monitoring and control system – HVAC and energy management – Economic justification.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand the basics of Energy audit process.
- Ability to understand the basics of energy management by cogeneration
- Ability to acquire knowledge on Energy management in lighting systems
- Ability to impact concepts behind economic analysis and Load management.
- Ability to understand the importance of Energy management on various electrical equipment and metering.
- Ability to acquire knowledge on HVAC.

TEXT BOOKS:

1. Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, Guide to Energy Management, Fifth Edition, The Fairmont Press, Inc., 2006
2. Eastop T.D & Croft D.R, Energy Efficiency for Engineers and Technologists,.Logman Scientific & Technical, ISBN-0-582-03184 , 1990.

REFERENCES

1. Reay D.A, Industrial Energy Conservation, 1st edition, Pergamon Press, 1977.
2. IEEE Recommended Practice for Energy Management in Industrial and Commercial Facilities, IEEE, 196.
3. Amit K. Tyagi, Handbook on Energy Audits and Management, TERI, 2003.
4. Electricity in buildings good practice guide, McGraw-Hill Education, 2016.
5. National Productivity Council Guide Books

21153E82B **DATA STRUCTURES** **LT P C**
3 0 0 3

OBJECTIVES:

- To understand the concepts of ADTs
- To Learn linear data structures – lists, stacks, and queues
- To understand sorting, searching and hashing algorithms
- To apply Tree and Graph structures

UNIT I LINEAR DATA STRUCTURES – LIST 9

Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation –– singly linked lists- circularly linked lists- doubly-linked lists – applications of lists –Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).

UNIT II LINEAR DATA STRUCTURES – STACKS, QUEUES 9

Stack ADT – Operations - Applications - Evaluating arithmetic expressions- Conversion of Infix to postfix expression - Queue ADT – Operations - Circular Queue – Priority Queue - deQueue – applications of queues.

UNIT III NON LINEAR DATA STRUCTURES – TREES 9

Tree ADT – tree traversals - Binary Tree ADT – expression trees – applications of trees – binary search tree ADT –Threaded Binary Trees- AVL Trees – B-Tree - B+ Tree - Heap – Applications of heap.

UNIT IV NON LINEAR DATA STRUCTURES - GRAPHS 9

Definition – Representation of Graph – Types of graph - Breadth-first traversal - Depth-first traversal – Topological Sort – Bi-connectivity – Cut vertex – Euler circuits – Applications of graphs.

UNIT V SEARCHING, SORTING AND HASHING TECHNIQUES 9

Searching- Linear Search - Binary Search. Sorting - Bubble sort - Selection sort - Insertion sort - Shell sort – Radix sort. Hashing- Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Implement abstract data types for linear data structures.
- Apply the different linear and non-linear data structures to problem solutions.
- Critically analyze the various sorting algorithms.

TEXT BOOKS:

1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education,1997.
2. Reema Thareja, “Data Structures Using C”, Second Edition , Oxford University Press, 2011

REFERENCES:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", Second Edition, Mcgraw Hill, 2002.
2. Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education,1983.
3. Stephen G. Kochan, "Programming in C", 3rd edition, Pearson Education.
4. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, University Press, 2008

21153E82C	HIGH VOLTAGE DIRECT CURRENT TRANSMISSION	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Planning of DC power transmission and comparison with AC power transmission.
- HVDC converters.
- HVDC system control.
- Harmonics and design of filters.
- Power flow in HVDC system under steady state.

UNIT I INTRODUCTION 9

DC Power transmission technology–Comparison of AC and DC transmission–Application of DC transmission–Description of DC transmission system–Planning for HVDC transmission–Modern trends in HVDC technology–DC breakers–Operating problems– HVDC transmission based on VSC –Types and applications of MTDC systems.

UNIT II ANALYSIS OF HVDC CONVERTERS 9

Line commutated converter -Analysis of Graetz circuit with and without overlap -Pulse number– Choice of converter configuration – Converter bridge characteristics– Analysis of a 12 pulse converters– Analysis of VSC topologies and firing schemes.

UNIT III CONVERTER AND HVDC SYSTEM CONTROL 9

Principles of DC link control–Converter control characteristics–System control hierarchy– Firing angle control– Current and extinction angle control–Starting and stopping of DC link –Power control –Higher level controllers –Control of VSC based HVDC link.

UNIT IV REACTIVE POWER AND HARMONICS CONTROL 9

Reactive power requirements in steady state–Sources of reactive power–SVC and STATCOM– Generation of harmonics –Design of AC and DC filters– Active filters.

UNIT V POWER FLOW ANALYSIS IN AC/DC SYSTEMS 9

Per unit system for DC quantities–DC system model –Inclusion of constraints –Power flow analysis –case study

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand the principles and types of HVDC system.
- Ability to analyze and understand the concepts of HVDC converters.
- Ability to acquire knowledge on DC link control.
- Ability to understand the concepts of reactive power management, harmonics and

power flow analysis.

- Ability to get knowledge about Planning of DC power transmission and comparison with AC power transmission.
- Ability to understand the importance of power flow in HVDC system under steady state.

TEXT BOOKS:

1. Padiyar,K.R.,"HVDC power transmission system", New Age International(P)Ltd. NewDelhi, Second Edition,2010.
2. Arrillaga,J.,"High Voltage Direct Current Transmission", Peter Pregrinus, London,1983.

REFERENCES

1. Kundur P.," Power System Stability and Control", McGraw-Hill,1993.
2. Colin Adamson and Hingorani NG," High Voltage Direct Current Power Transmission", Garraway Limited, London, 1960.
3. Edward Wilson Kimbark," Direct Current Transmission", Vol.I, Wiley inter science, New York, London, Sydney,1971.

21153E82D	MICROCONTROLLER BASED SYSTEM DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Architecture of PIC microcontroller
- Interrupts and timers
- Peripheral devices for data communication and transfer
- Functional blocks of ARM processor
- Architecture of ARM processors

UNIT I INTRODUCTION TO PIC MICROCONTROLLER 9

Introduction to PIC Microcontroller–PIC 16C6x and PIC16C7x Architecture–IC16cxx–-Pipelining - Program Memory considerations – Register File Structure - Instruction Set - Addressing modes – Simple Operations.

UNIT II INTERRUPTS AND TIMER 9

PIC micro controller Interrupts- External Interrupts-Interrupt Programming–Loop time subroutine Timers-Timer Programming– Front panel I/O-Soft Keys– State machines and key switches– Display of Constant and Variability strings.

UNIT III PERIPHERALS AND INTERFACING 9

I^2C Bus for Peripherals Chip Access– Bus operation-Bus subroutines– Serial EEPROM— Analog to Digital Converter–UART-Baud rate selection–Data handling circuit–Initialization - LCD and keyboard Interfacing -ADC, DAC, and Sensor Interfacing.

UNIT IV INTRODUCTION TO ARM PROCESSOR 9

Architecture –ARM programmer's model –ARM Development tools- Memory Hierarchy – ARM Assembly Language Programming–Simple Examples–Architectural Support for

Operating systems.

UNIT V ARM ORGANIZATION 9

3-Stage Pipeline ARM Organization– 5-Stage Pipeline ARM Organization–ARM Instruction Execution- ARM Implementation– ARM Instruction Set– ARM coprocessor interface– Architectural support for High Level Languages – Embedded ARM Applications.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and apply computing platform and software for engineering problems.
- Ability to understand the concepts of Architecture of PIC microcontroller
- Ability to acquire knowledge on Interrupts and timers.
- Ability to understand the importance of Peripheral devices for data communication.
- Ability to understand the basics of sensor interfacing
- Ability to acquire knowledge in Architecture of ARM processors

TEXT BOOKS:

1. Peatman,J.B., "Design with PIC Micro Controllers"PearsonEducation,3rd Edition, 2004.

2. Furber,S., "ARM System on Chip Architecture" Addison Wesley trade Computer Publication, 2000.

REFERENCES

1. Mazidi, M.A.,"PIC Microcontroller" Rollin Mckinlay, Danny causey ,Prentice Hall of India, 2007.

21153E82E **SMART GRID**

L	T	P	C
3	0	0	3

OBJECTIVES: To impart knowledge about the following topics:

- Smart Grid technologies, different smart meters and advanced metering infrastructure.
- The power quality management issues in Smart Grid.
- The high performance computing for Smart Grid applications

UNIT I INTRODUCTION TO SMART GRID 9

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, National and International Initiatives in Smart Grid.

UNIT II SMART GRID TECHNOLOGIES 9

Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/VAR control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plugin Hybrid Electric Vehicles(PHEV).

UNIT III SMART METERS AND ADVANCED METERING INFRASTRUCTURE 9

IntroductiontoSmartMeters,AdvancedMeteringinfrastructure(AMI)driversandbenefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU), Intelligent Electronic Devices(IED)&their application for monitoring & protection.

UNIT IV POWER QUALITY MANAGEMENT IN SMART GRID 9

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, W eb based Power Quality monitoring, Power Quality Audit.

UNIT V HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS 9

Local Area Network(LAN),House Area Network(HAN), Wide Area Network(WAN), Broad band over Power line(BPL),IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will develop more understanding on the concepts of Smart Grid and its present developments.
- Learners will study about different Smart Grid technologies.
- Learners will acquire knowledge about different smart meters and advanced metering infrastructure.
- Learners will have knowledge on power quality management in Smart Grids
- Learners will develop more understanding on LAN, WAN and Cloud Computing for Smart Grid applications.

TEXT BOOKS:

1. Stuart Borlase “Smart Grid: Infrastructure, Technology and Solutions”,CRCPress2012.
2. JanakaEkanayake,NickJenkins,KithsiriLiyanage,JianzhongWu,AkihikoYokoyama, “Smart Grid: TechnologyandApplications”,Wiley2012.

REFERENCES

- VehbiC. Güngör ,Dilan Sahin, Taskin Kocak, Salih Ergüt, Concettina Buccella, Carlo Cecati, and Gerhard P. Hancke, “Smart Grid Technologies: Communication Technologies and Standards” IEEE Transactions On Industrial Informatics, Vol.7,No.4, November2011.
- Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang “SmartGrid –The New and Improved Power Grid: A Survey” ,IEEE Transaction on Smart Grids,vol.14,2012.
- James Momohe “Smart Grid: Fundamentals of Design and Analysis,”, Wiley-IEEE Press , 2012.

21153E82F BIOMEDICAL INSTRUMENTATION

L T P C
3 0 0 3

OBJECTIVES:

- To Introduce Fundamentals of Biomedical Engineering
- To study the communication mechanics in a biomedical system with few examples
- To study measurement of certain important electrical and non-electrical parameters

- To understand the basic principles in imaging techniques
- To have a basic knowledge in life assisting and therapeutic devices

UNIT I FUNDAMENTALS OF BIOMEDICAL ENGINEERING 9

Cell and its structure – Resting and Action Potential – Nervous system and its fundamentals - Basic components of a biomedical system- Cardiovascular systems- Respiratory systems -Kidney and blood flow - Biomechanics of bone - Biomechanics of soft tissues -Physiological signals and transducers - Transducers – selection criteria – Piezo electric, ultrasonic transducers - Temperature measurements - Fibre optic temperature sensors

UNIT II NON ELECTRICAL PARAMETERS MEASUREMENT AND DIAGNOSTIC PROCEDURES 9

Measurement of blood pressure - Cardiac output - Heart rate - Heart sound - Pulmonary function measurements – spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analysers, pH of blood –measurement of blood pCO2, pO2, finger-tip oxymeter - ESR, GSR measurements.

UNIT III ELECTRICAL PARAMETERS ACQUISITION AND ANALYSIS 9

Electrodes – Limb electrodes –floating electrodes – pregelled disposability electrodes - Micro, needle and surface electrodes – Amplifiers, Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier - ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms - Electrical safety in medical environment, shock hazards – leakage current-Instruments for checking safety parameters of biomedical equipment.

UNIT IV IMAGING MODALITIES AND ANALYSIS 9

Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography –Different types of biotelemetry systems - Retinal Imaging - Imaging application in Biometric systems.

UNIT V LIFE ASSISTING, THERAPEUTIC AND ROBOTIC DEVICES 9

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialysers – Lithotripsy - ICCU patient monitoring system - Nano Robots - Robotic surgery –Orthopedic prostheses fixation.

TOTAL : 45 PERIODS

OUTCOMES: At the end of the course students will have the

- Ability to understand the philosophy of the heart, lung, blood circulation and respiration system.
- Ability to provide latest ideas on devices of non-electrical devices.
- Ability to gain knowledge on various sensing and measurement devices of electrical origin.
- Ability to understand the analysis systems of various organ types.
- Ability to bring out the important and modern methods of imaging techniques and their analysis.
- Ability to explain the medical assistance/techniques, robotic and therapeutic equipments.

TEXT BOOKS:

1. Leslie Cromwell, “Biomedical Instrumentation and Measurement”, Prentice Hall of India, New Delhi, 2007.
2. Khandpur R.S, Handbook of Biomedical Instrumentation, Tata McGraw-Hill, New Delhi,2nd edition, 2003
3. Joseph J Carr and John M.Brown, Introduction to Biomedical Equipment Technology, John

Wiley and sons, New York, 4th edition, 2012

REFERENCES

1. John G. Webster, Medical Instrumentation Application and Design, John Wiley and sons, New York, 1998.
2. Duane Knudson, Fundamentals of Biomechanics, Springer, 2nd Edition, 2007.
3. Suh, Sang, Gurupur, Varadraj P., Tanik, Murat M., Health Care Systems, Technology and Techniques, Springer, 1st Edition, 2011.
4. Ed. Joseph D. Bronzino, The Biomedical Engineering Hand Book, Third Edition, Boca Raton, CRC Press LLC, 2006.
5. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.

21153E82G FUNDAMENTALS OF NANOSCIENCE L T P C

3 0 0 3

OBJECTIVES:

To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION 8

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering- Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION 9

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS 12

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO2,MgO, ZrO2, NiO, nanoalumina, CaO, AgTiO2, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications.

UNIT IV CHARACTERIZATION TECHNIQUES 9

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation.

UNIT V APPLICATIONS 7

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery.

TOTAL : 45 PERIODS

OUTCOMES:
- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS :
1. A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, “Nanoscale Charecterisation of surfaces & Interfaces”, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

REFERENCES:
1. G Timp, “Nanotechnology”, AIP press/Springer, 1999.
2. Akhlesh Lakhtakia,“The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations”. Prentice-Hall of India (P) Ltd, New Delhi, 2007.

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THANJAVUR – 613 403 - TAMIL NADU

SCHOOL OF ENGINEERING ANDTECHNOLOGY

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

PROGRAM HANDBOOK

B.TECH PART TIME

[REGULATION2019]
[for candidates admittedto B.Tech EEE program fromJune2019 onwards]

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

COURSE STRUCTURE

B.TECH PT EEE R 2019

2

B. Tech (PT) EEE R 19

SEMESTER I

Sl. No	Subject Code	Subject Name	Periods Per Week L	T	P	C
1	19148S11P	Transforms and Partial Differential Equations	3	1	0	4
2	19153C12P	Control System	3	1	0	4
3	19153C13P	Circuit Analysis and Networks	3	1	0	4
4	19153C14P	Electronic circuits	3	0	0	3
5	19153C15P	Electrical Machines-I	4	0	0	4
Total No of Credits						**19**

SEMESTER II

S. No	Subject Code	Subject Name	Periods Per Week L	T	P	C
1	19148S21P	Numerical Methods	3	1	0	4
2	19153C22P	Computer Architecture	3	0	0	3
3	19153C23P	Electrical Machines-II	3	1	0	4
4	19153C24P	Digital Electronics	3	1	0	4
5	19153C25P	Transmission and Distribution	4	0	0	4
Total No of Credits						**19**

SEMESTER III

S. No	Subject Code	Subject Name	Periods Per Week L	T	P	C
1	19148S31CP	Probability and Statistics	3	1	0	4
2	19153C32P	Analog Integrated Circuits	3	1	0	4
3	19153C33P	Power Electronics	4	0	0	4
4	19153C34P	Measurements and Instrumentation	4	0	0	4
5	19153L35P	Machines Lab	0	0	3	2
Total No of Credits						**18**

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

SEMESTER IV

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	19153C41P	Protection and switchgear	4	0	0	4
2	19153C42P	High Voltage DC Transmission	3	1	0	4
3	19153C43P	Solid State Drives	3	1	0	4
4	19153E44_P	Elective –I	4	0	0	4
5	19153L45P	Control System & Measurements Lab	0	0	3	2
Total No of Credits						**18**

SEMESTER V

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	19153C51P	Power System Analysis	3	1	0	4
2	19153C52P	Power Quality	3	1	0	4
3	19153C53P	Special Electrical Machines	4	0	0	4
4	19153E54_P	Elective –II	4	0	0	4
5	19153L55P	Power Electronics and Drives Lab	0	0	3	2
Total No of Credits						**18**

SEMESTER VI

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	19153C61P	Utilization of Electrical Energy	3	1	0	4
2	19153C62P	Solid State Relays	4	0	0	4
3	19153C63P	Power System Operation and Control	4	0	0	4
4	19153E64_P	Elective –III	4	0	0	4
5	19153L65P	Power Systems Lab	0	0	3	2
Total No of Credits						**18**

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

SEMESTER VII

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	19160S71P	Total Quality Management	3	0	0	3
2	19153C72P	Electrical Machine Design	3	1	0	4
3	19153C73P	Power Plant Engineering	4	0	0	4
4	19153E74_P	Elective –IV	3	0	0	3
5	19153P75P	Project Work	0	0	12	6
Total No of Credits						**20**

LIST OF ELECTIVES

ELECTIVE –I (IV SEMESTER)

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	19153E44AP	Field Theory	4	0	0	4
2	19153E44BP	Fuzzy Logic and its applications	4	0	0	4
3	19153E44CP	Bio Medical Instrumentation	4	0	0	4
4	19153E44DP	Modeling and Simulation of Solar Energy Systems	4	0	0	4
5	19153E44EP	Non conventional energy system & Applications	4	0	0	4

ELECTIVE –II (V SEMESTER)

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	19153E54AP	Environmental Science and Engineering	4	0	0	4
2	19153E54BP	Artificial Neural Networks	4	0	0	4
3	19153E54CP	Communication Engineering	4	0	0	4
4	19153E54DP	Robotics	4	0	0	4
5	19153E54EP	LT & HT Distribution System	4	0	0	4

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

ELECTIVE –III (VI SEMESTER)

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	19153E64AP	Principles of Management	4	0	0	4
2	19153E64BP	Professional Ethics	4	0	0	4
3	19153E64CP	Integrated opto-Electronic Devices	4	0	0	4
4	19153E64DP	Computer Aided Design of Electrical Apparatus	4	0	0	4
5	19153E64EP	Advanced DC-AC Power conversion	4	0	0	4

ELECTIVE –IV (VII SEMESTER)

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	19153E74AP	Power system transients	3	0	0	3
2	19153E74BP	EHV AC and DC Transmission systems	3	0	0	3
3	19153E74CP	Fiber Optics and Laser Instruments	3	0	0	3
4	19153E74DP	Advanced Control systems	3	0	0	3
5	19153E74EP	Switched Mode Power supplies	3	0	0	3

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

19148S11P-TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

3 1 0 4

(Common to all) **SEMESTER-1**

UNIT I FOURIER SERIES 9 + 3hrs

Periodic function-Graph of functions- Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval's identity – Harmonic Analysis.

UNIT II FOURIER TRANSFORM 9 + 3hrs

Fourier integral theorem (without proof) – Sine and Cosine transforms – Properties (without Proof) – Transforms of simple functions – Convolution theorem – Parseval's identity – Finite Fourier transform, Sine and Cosine transform.

UNIT III Z -TRANSFORM AND DIFFERENCE EQUATIONS 9 + 3hrs

Z-transform - Elementary properties (without proof) – Inverse Z – transform – Convolution theorem -Formation of difference equations – Solution of difference equations using Z – transform- Sampling of signals –an introduction.

UNIT IV PARTIAL DIFFERENTIAL EQUATIONS 9 + 3hrs

Formation of pde –solution of standard type first order equation- Lagrange's linear equation – Linear partial differential equations of second order and higher order with Constant coefficients.

UNIT V BOUNDARY VALUE PROBLEMS 9 + 3hrs

Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two-dimensional heat equation (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates. **Total no of hrs: 60hrs**

<u>COURSE OUTCOMES</u>

Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.

Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.

Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEUERSHIP

TEXT BOOKS

1. Andrews, L.A., and Shivamoggi B.K., "Integral Transforms for Engineers and Applied Mathematicians", Macmillen , New York ,1988.
2. Grewal, B.S., "Higher Engineering Mathematics", Thirty Sixth Edition, Khanna Publishers, Delhi, 2001.
3. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Engineering Mathematics Volume III", S. Chand & Company ltd., New Delhi, 1996.

REFERENCE BOOKS

1. Narayanan, S., Manicavachagom Pillay, T.K. and Ramanaiah, G., "Advanced Mathematics for Engineering Students", Volumes II and III, S. Viswanathan (Printers and Publishers) Pvt. Ltd. Chennai, 2002.
2. Churchill, R.V. and Brown, J.W., "Fourier Series and Boundary Value Problems", Fourth Edition, McGraw-Hill Book Co., Singapore, 1987.
3. Advanced Modern Engineering mathematics – Glyn James

19153C12P- CONTROL SYSTEM 3 1 0 4

SEMESTER-1

AIM

To provide sound knowledge in the basic concepts of linear control theory and design of control system.

OBJECTIVES

i. To understand the methods of representation of systems and getting their transfer function models.
ii. To provide adequate knowledge in the time response of systems and steady state error analysis.
iii. To give basic knowledge is obtaining the open loop and closed–loop frequency responses of systems.
iv. To understand the concept of stability of control system and methods of stability analysis.
v. To study the three ways of designing compensation for a control system.

UNIT I: INTRODUCTION 12

Open-loop and closed –loop systems, servomechanisms and regulator systems; Transfer function; Block diagram reduction, Signal flow graphs.

UNIT II: MATHEMATICAL MODELS OF PHYSICAL SYSTEMS 12

Mechanical systems - Translational and Rotational systems, Gear trains, Electrical systems, Thermal systems and Fluid systems.

Components of feedback control systems - Potentiometers as error sensing devices, Synch, Servomotors, Stepper motors, Tachogenerators.

UNIT III: STABILITY 12

Concept of Stability, necessary and sufficient conditions of Stability, Closed-loop systems, merits and demerits, Routh-Hurwitz Criterion.

Transient Response: Typical inputs, convolution integral, Time domain specifications, steady state errors.

State equation – Solutions – Realization – Controllability – Observability – Stability Jury's test.

UNIT IV: FREQUENCY RESPONSE 12

Definition, equivalence between transient response and frequency response, Bode plots.
Nyquist Stability Criterion: Development of criterion, gain and phase margins, m- circles and Nichol's chart.

UNIT V: ROOT LOCUS METHOD 12

Rules for sketching of root loci, Root contours.

Synthesis: Lag and Lead networks, proportional, derivative and integral controllers.

MUTLI INPUT MULTI OUTPUT (MIMO) SYSTEM:

Models of MIMO system – Matrix representation – Transfer function representation – Poles and Zeros – Decoupling – Introduction to multivariable Nyquist plot and singular values analysis – Model predictive control.

Total = 60

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

COURSE OUTCOMES

At the end of the course, the student should have the :

Ability to develop various representations of system based on the knowledge of Mathematics, Science and Engineering fundamentals.

Ability to do time domain and frequency domain analysis of various models of linear system.

Ability to interpret characteristics of the system to develop mathematical model.

Ability to design appropriate compensator for the given specifications.

Ability to come out with solution for complex control problem.

Ability to understand use of PID controller in closed loop system.

TEXT BOOK:

1. I.J.Nagrath and M.Gopal, 'Control System Engineering', Wiley Eastern Ltd., Reprint 1995.

REFERENCES:

1. M.Gopal, 'Control System Principles and Design', Tata McGraw Hill, 1998.
2. Ogatta, 'Modern Control Engineering', Tata McGraw Hill 1997.

19153C13P- CIRCUIT ANALYSIS AND NETWORKS

3 1 0 4

AIM

SEMESTER-1

To know about basic analysis and synthesis techniques used in electronics and communications.

OBJECTIVES

- To study about various network theorems and the method of application to analyse a circuit.
- To know the concept of transfer function of a network and the nature of response to external inputs.
- To synthesize a network in different forms from the transfer function.
- To know the concept and design of frequency selective filters.

UNIT-I BASIC CIRCUIT CONCEPTS & SINUSOIDAL ANALYSIS (12hrs)

Linear passive circuit elements, ideal sources (independent and dependent), V-I relationship of circuit elements –Ohm's Law - Kirchoff's Laws – analysis of series and parallel circuits – network reduction: voltage and current division, source transformation, star/delta transformation Concept of phasor and complex Impedance / Admittance – Analysis of simple series and parallel circuits – active power, reactive power, apparent power (volt -ampere), power factor– phasor diagram, impedance triangle and power triangle associated with these circuits – resonance in series and parallel circuits

UNIT-II CIRCUIT ANALYSIS & NETWEORK THEOREMS (12hrs)

Formation of matrix equations and analysis by using Mesh-current and Node-voltage methods. Superposition theorem – Thevenin's theorem – Norton's theorem - Maximum power transfer theorem - Reciprocity theorem – Compensation theorem – Substitution theorem - Millman's theorem and Tillage's theorem with applications.

Coupled circuits: self inductance - mutual inductance – coefficient of coupling – dot convention – analysis of simple coupled circuits. Equivalent inductance of the series aiding and opposing, parallel aiding and opposing coupled circuits.

UNIT-III THREE PHASE CIRCUIT AND TRANSIENT ANALYSIS (12hrs)

Three-phase systems – phase sequence - Solution of three-phase balanced circuits (Star& Delta) – Solution of three-phase unbalanced circuits (Star & Delta) - Power measurement and two-wattmeter method.

Forced and free response of RL, RC and RLC circuits with D.C. and sinusoidal excitations.

UNIT-IV TWO PORT NETWORKS (12hrs)

Characterization of two port networks in terms of Z, Y, H and T parameters – networks equivalents – relations between network parameters – Analysis of T, Ladder, Bridged–T and lattice networks – transfer function of terminated two port networks.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

UNIT-V NETWORK TOPOLOGY, FILTERS & ATTENUATORS (12hrs)

Network graphs, tree and cut – sets – tie set and cut – set schedules – primitive impedance and admittance matrices- Classification of Filters - filter networks - design of constant K, m–derived and composite filters. Analysis of T,, lattice, bridged-T, and L type attenuators.

TOTAL 60

COURSE OUTCOMES

Ability to analyse electrical circuits

Ability to apply circuit theorems

Ability to analyse transients

TEXT BOOKS:

1. Basic Electrical and Electronics Engineering – Muthu subramaniyam
2. Nageswara rao
3. Umesh sinha
4. Charavarthi

1. Sudhakar. A., and Shyammohan, "Circuits and Networks Analysis and Synthesis" Tata McGraw Hill Publishing Co.Ltd. New Delhi, 1994.
2. Roy Choudhury, "Networks and Systems", New Age International Ltd.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

19153C14P - ELECTRONIC CIRCUITS

3 0 0 3
SEMESTER-1

AIM:

To study the characteristics and applications of electronic devices.

OBJECTIVES:

To acquaint the students with construction, theory and characteristics of the following electronic devices:
Bipolar transistor, Field Effect transistor, Multivibrators, Power control/regulator devices, Feedback amplifiers and oscillators

UNIT I -RECTIFIER & POWER SUPPLY **12**

Half & Full wave rectifier – filters – shunt , inductor, LC section & Ripple factor, P calculation for C, L and LC filters – Voltage regulators – Zener –Series voltage regulator – SMPS.

UNIT II- AMPLIFIERS **12**

Amplifiers – Frequency response of RC coupled - Frequency Response of Emitter follower, gain band width product – FET amplifier at low and high frequency cascaded amplifiers.

UNIT III- FEEDBACK AMPLIFER & OSCILLATORS **12**

Four basic types of feedback – effect of feedback on amplifier performance – condition for oscillation – Barkhunsen criteria – LC oscillators – Hartley & Colpitts – RC oscillators – Wein bridge, RC phase shift crystal oscillator.

UNIT IV- MULTIVIBRATORS **12**

Collector coupled & Emitter coupled Astable multivibrator – Monostable, Bistable multivibrator – triggering methods – Storage delay and calculation of switching time – Schmitt triggering circuits – Speed up capacitor in switching.

UNIT V- POWER AMPLIFIER **12**

Classification – class A, B, C & AB – Class B push pull – Class B Complimentary – symmetry – Class S, Power sections classification – Efficiency – Distortion in amplifiers.

L = 45 T = 15 P = 0 TOTAL =60

COURSE OUTCOMES

Upon Completion of the course, the students will be ability to:
Explain the structure and working operation of basic electronic devices.
Able to identify and differentiate both active and passive elements
Analyze the characteristics of different electronic devices such as diodes and transistors
Choose and adapt the required components to construct an amplifier circuit.
Employ the acquired knowledge in design and analysis of oscillators

REFERENCE BOOKS:

1. David.A.Bell, “Solid State Pulse Circuits”, Prentice Hall of India, 4th Edition, 2001.
2. Millman Taub.H, “Pulse Digital & Switching waveform”, Tata McGRaw Hill International 2001.
3. Jacob Millman Cristas C.Halkias, “Integrated Electronics”, Tat Mc Graw Hill, Edition 1991.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

19153C15P- ELECTRICAL MACHINES – I 4 0 0 4

AIM **SEMESTER-1**

To expose the students to the concepts of electromechanical energy conversions in D.C. Machines and energy transfer in transformers and to analyze their performance.

OBJECTIVES

i. To introduce the concept of rotating machines and the principle of electromechanical energy conversion in single and multiple excited systems.
ii. To understand the generation of D.C. voltages by using different type of generators and study their performance.
iii. To study the working principles of D.C. motors and their load characteristics, starting and methods of speed control.
iv. To familiarize with the constructional details of different type of transformers, working principle and their performance.
v. To estimate the various losses taking place in D.C. machines and transformers and to study the different testing method to arrive at their performance.

UNIT I: BASIC PRINCIPLES OF ROTATING MACHINES 12

Electrical machine types – Magnetic circuits – Magnetically induced EMF and force – AC operation of magnetic circuits - core losses. Principles of Electromechanical energy conversion: Energy conversion process – Energy in magnetic system – Field energy and mechanical force – Multiply excited magnetic field systems

UNIT II: GENERATORS 12

Constructional details – emf equation – Methods of excitation – Self and separately excited generators – Characteristics of series, shunt and compound generators – Armature reaction and commutation – Parallel operation of DC shunt and compound generators.

UNIT III: DC MOTORS 12

Principle of operation – Back emf and torque equation – Characteristics of series, shunt and compound motors – Starting of DC motors – Types of starters – Speed control of DC series and shunt motors.

UNIT IV: TRANSFORMERS 12

Constructional details of core and shell type transformers – Types of windings – Principle of operation – emf equation – Transformation ratio - Equivalent circuit – Losses – Testing – Efficiency and Voltage regulation .

Transformer on load– Parallel operation of single phase transformers – Auto transformer – Three phase transformers

UNIT V: TESTING OF TRANSFORMERS AND DC MACHINES 12

Losses and efficiency in DC machines and transformers – Condition for maximum efficiency – Testing of DC machines – Brake test, Swinburne’s test, Retardation test and Hopkinson’s test – Testing of transformers – Polarity test, load test, open circuit and short circuit tests – All day efficiency.

TOTAL = 60

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

COURSE OUTCOMES

Ability to analyze the magnetic-circuits.

Ability to acquire the knowledge in constructional details of transformers. Ability to understand the concepts of electromechanical energy conversion. Ability to acquire the knowledge in working principles of DC Generator.

Ability to acquire the knowledge in working principles of DC Motor

Ability to acquire the knowledge in various losses taking place in D.C. Machines

TEXT BOOKS

1. D.P. Kothari and I.J. Nagrath, ‘Electric Machines’, Tata McGraw Hill Publishing Company Ltd, 2002.

2. P.S. Bimbhra, ‘Electrical Machinery’, Khanna Publishers, 2003.

REFERENCE BOOKS

1. A.E. Fitzgerald, Charles Kingsley, Stephen.D.Umans, ‘Electric Machinery’, Tata McGraw Hill publishing Company Ltd, 2003.

2. J .B.Gupta, ‘Theory and Performance of Electrical Machines’, S.K.Kataria and Sons, 2002.

3. K. Murugesh Kumar, ‘Electric Machines’, Vikas publishing house Pvt Ltd, 2002.

4. V.K.Mehta and Rohit Mehta, ‘Principles of Power System’, S.Chand and Company Ltd, third edition, 2003.

19148S21P-NUMERICAL METHODS

3 1 0 4
Semester II

UNIT I - SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS

9+3hrs

Solution of equations–Newton Raphson's method, Regula-falsi methods Solution of linear System of equations by Gaussian elimination and Gauss-Jordon methods- Iterative methods: Gauss Jacobi and Gauss-Seidel methods– Eigenvalue of a matrix by power method.

UNIT II- INTERPOLATION 9+3hrs

Newton's forward and backward difference formulas – Central difference formula: Bessels and Stirling's formula - Lagrangian Polynomials – Divided difference method.

UNIT III- NUMERICAL DIFFERENTIATION AND INTEGRATION

9+3hrs

Derivatives from difference tables – Divided differences and finite differences – Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Double integrals using trapezoidal and Simpson's rules.

UNIT IV - INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9+3hrs

Single step methods: Taylor series method – Euler and modified Euler methods – Fourth order Runge – Kutta method for solving first and second order equations – Multistep methods: Milne's and Adam's predictor and corrector methods.

UNIT V - BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9+3hrs

Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations.

Total no of hrs: 60hrs

COURSE OUTCOMES

- Understand the basic concepts and techniques of solving algebraic equations. Appreciate the numerical techniques of interpolation and error approximations in various intervals in real life situations.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

Apply the numerical techniques of differentiation and integration for engineering problems.

Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.

TEXT BOOKS

1. Gerald, C.F, and Wheatley, P.O, “Applied Numerical Analysis”, Sixth Edition, Pearson Education Asia, New Delhi, 2002.
2. Kandasamy, P., Thilagavathy, K. and Gunavathy, K., “Numerical Methods”, S.Chand Co. Ltd., New Delhi, 2003.

REFERENCES BOOKS

1. Burden, R.L and Faires, T.D., “Numerical Analysis”, Seventh Edition, Thomson Asia Pvt. Ltd., Singapore, 2002.
2. Balagurusamy, E., “Numerical Methods”, Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 1999.

19153C22P - COMPUTER ARCHITECTURE

3 0 0 3
SEMESTER II

AIM:
To understand the architecture of different processor and its associative units

OBJECTIVES:
To provide a clear understanding of
- Computer arithmetic and logic unit design.
- Control Mechanism and CPU functioning.
- Pipeline architecture and vector processing.
- Input and output organizations and interfacing.
- Various memories and their organization.56

UNIT I BASIC STRUCTURE OF COMPUTERS 9
Functional units – Basic operational concepts – Bus structures – Performance and Metrics – Instruction and instruction sequencing – hardware – software interface – addressing modes – instruction set – RISC – CISC – ALU design – fixed point and floating point operation.

UNIT II CONTROL AND CENTRAL PROCESSING UNIT 9
Micro programmed control – Control memory, address sequencing, micro program example, and design of control unit. Central processing unit – general register rganization, stack organization, instruction formats, addressing modes, data transfer and manipulation, program control, reduced instruction set computer.

UNIT III COMPUTER ARITHMETIC, PIPELINE AND VECTOR PROCESSING 9
Computer arithmetic – addition and subtraction, multiplication algorithms, division algorithms, floating point arithmetic operations decimal arithmetic unit, decimal arithmetic operations. Pipeline and vector processing – Parallel processing, pipelining, arithmetic pipeline, instruction pipeline, vector processing array processors.

UNIT IV INPUT OUTPUT ORGANIZATION 9
Input output organization : peripheral devices, input output interface, asynchronous data transfer , modes of transfer, priority interrupt, direct memory access, input output interface, serial communication.

UNIT V MEMORY ORGANIZATION 9
Memory organization – memory hierarchy, main memory, auxiliary memory, associative memory, cache memory, virtual memory, memory management hardware.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Develop Java programs using OOP principles

Develop Java programs with the concepts inheritance and interfaces

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

Build Java applications using exceptions and I/O streams

Develop Java applications with threads and generics classes Develop interactive Java programs using swings

TEXT BOOKS:

1. Morris Mano, 'Computer system architecture', 3rd edition, Pearson education 2002
2. Behrooz Parhami, 'Computer Architecture', Oxford University Press, 2005.

REFERENCES:

1. Vincent P. Heuring and Harry F. Jordan, ' Computer systems design and architecture', Pearson Education Asia Publications, 2004.
2. John P. Hayes , ' Computer Architecture and Organization', Tata McGraw-Hill, 1988.
3. Andrew S Tannenbaum ' Structured Computer Organization ', 5th edition Pearson Education 2007.
4. William Stallings ,' Computer Organization and architecture', 7th edition Pearson Education 2006.

Semester II

19153C23P-ELECTRICAL MACHINES-II

3 1 0 4

AIM:

To expose the students to the concepts of synchronous and asynchronous machines and
analyze their performance.

OBJECTIVES:

To impart knowledge on

i. Construction and performance of salient and non – salient type synchronous generators.
ii. Principle of operation and performance of synchronous motor.
iii. Construction, principle of operation and performance of induction machines.
iv. Starting and speed control of three-phase induction motors.
v. Construction, principle of operation and performance of single phase induction motors and special machines.

UNIT I: SYNCHRONOUS GENERATOR 12

Constructional details – Types of rotors – emf equation – Synchronous reactance – Armature reaction – Voltage regulation – e.m.f, m.m.f, z.p.f and A.S.A methods – Synchronizing and parallel operation – Synchronizing torque - Change of excitation and mechanical input – Two reaction theory – Determination of direct and quadrature axis synchronous reactance using slip test – Operating characteristics - Capability curves.

UNIT II: SYNCHRONOUS MOTOR 12

Principle of operation – Torque equation – Operation on infinite bus bars - V-curves – Power input and power developed equations – Starting methods – Current loci for constant power input, constant excitation and constant power developed.

UNIT III: THREE PHASE INDUCTION MOTOR 12

Constructional details – Types of rotors – Principle of operation – Slip – Equivalent circuit – Slip-torque characteristics - Condition for maximum torque – Losses and efficiency – Load test - No load and blocked rotor tests - Circle diagram – Separation of no load losses – Double cage rotors

UNIT IV: STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR 12

Need for starting – Types of starters – Stator resistance and reactance, rotor resistance, autotransformer and star-delta starters – Speed control – Change of voltage, torque, number of poles and slip – Cascaded connection – Slip power recovery scheme.

UNIT V: SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINE 12

Constructional details of single phase induction motor – Double revolving field theory and operation – Equivalent circuit – No load and blocked rotor test –– Starting methods of single-phase induction motors - Special machines - Shaded pole induction motor, reluctance motor, repulsion motor, hysteresis motor, stepper motor and AC series motor

Total = 60

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

COURSE OUTCOMES

Ability to understand the construction and working principle of Synchronous Generator

Ability to understand MMF curves and armature windings.

Ability to acquire knowledge on Synchronous motor.

Ability to understand the construction and working principle of Three phase Induction Motor

Ability to understand the construction and working principle of Special Machines

Ability to predetermine the performance characteristics of Synchronous Machines.

TEXT BOOKS

1. D.P. Kothari and I.J. Nagrath, 'Electric Machines', Tata McGraw Hill Publishing Company Ltd, 2002.
2. P.S. Bhimbhra, 'Electrical Machinery', Khanna Publishers, 2003.*REFERENCE BOOKS*

1. A.E. Fitzgerald, Charles Kingsley, Stephen.D.Umans, 'Electric Machinery', Tata McGraw Hill publishing Company Ltd, 2003.
2. J.B. Gupta, 'Theory and Performance of Electrical Machines', S.K.Kataria and Sons, 2002.
3. K. Murugesh Kumar, 'Electric Machines', Vikas publishing house Pvt Ltd, 2002.
4. Sheila.C.Haran, 'Synchronous, Induction and Special Machines', Scitech Publications, 2001.

Semester II

19153C24P-DIGITAL ELECTRONICS

3 1 0 4

AIM:

To introduce the fundamentals of Digital Circuits, combinational and sequential circuit.

OBJECTIVES:

i. To study various number systems and to simplify the mathematical expressions using Boolean functions simple problems.
ii. To study implementation of combinational circuits
iii. To study the design of various synchronous and asynchronous circuits.
iv. To expose the students to various memory devices.

UNIT I NUMBER SYSTEMS

12

Review of Binary, Octal and Hexa-decimal number systems – Conversions, Binary Arithmetic magnitude form – 1's, 2's complement representation, Codes: -BCD, Excess – 3, Graycode, ASCII codes, Error detecting codes (Hamming code)

UNIT II BOOLEAN ALGEBRA

12

Boolean Algebra - De Morgan's law – Simplifications of Boolean expression – sum of Products and product of sums – Karnaugh Map – Quince McClusky method of simplification (Including Don't care conditions)

UNIT III Combinational Logic

12

Design of Logic gates- Design of adder, subtractor, comparators, code converters, encoders, decoders, multiplexers and demultiplexers. Function realization using gates & multiplexers.

UNIT IV Sequential Logic Design

12

Building blocks of Sequential logic – RS, JK, Master – Slave, D and T flip- flop, Asynchronous and synchronous counters – Binary and BCD counters – shift registers – Design and Implementation of Sequential synchronous circuits

UNIT V Logic Families **12**

Memories: ROM, PROM, EPROM, PLA, PLD, FPGA, digital logic families: TTL, ECL, CMOS.

TOTAL = 60Hrs

COURSE OUTCOMES

Ability to design combinational and sequential Circuits.

Ability to simulate using software package.

Ability to study various number systems and simplify the logical expressions using

Boolean functions

Ability to design various synchronous and asynchronous circuits.

Ability to introduce asynchronous sequential circuits and PLDs

Ability to introduce digital simulation for development of application oriented logic circuits.

TEXT BOOK:

1. Albert Paul, Malvino and Donald.P.Leach , "Digital Principles and Applications", McGraw Hill Publications.
2. Floyd, "Digital Fundamentals", Universal Book Stall, New Delhi,1993.
3. Moris Mano, "Digital Electronics and Design ", Prentice Hall of India, 2000.

REFERENCE:

1. "Digital Logic & Computer Design", Prentice Hall of India, 2000.

19153C25P-TRANSMISSION AND DISTRIBUTION 4 0 0 4

Semester II

AIM

To become familiar with the function of different components used in Transmission and Distribution levels of power systems and modeling of these components.

OBJECTIVES

i. To develop expression for computation of fundamental parameters of lines.
ii. To categorize the lines into different classes and develop equivalent circuits for these classes.
iii. To analyze the voltage distribution in insulator strings and cables and methods to improve the same.

UNIT I: INTRODUCTION 12

Structure of electric power system: Various levels such as generation, transmission and distribution; HVDC and EHV AC transmission: comparison of economics of transmission, technical performance and reliability.

Radial and ring-main distributors; interconnections; AC distribution: AC distributor with concentrated load; three-phase, four-wire distribution system; sub-mains; stepped and tapered mains.

UNITII:TRANSMISSION LINE PARAMETERS 12

Resistance, Inductance and Capacitance of single and three phase transmission lines - Stranded and Bundled conductors -Symmetrical and unsymmetrical spacing - Transposition -Application of self and mutual GMD -Skin and Proximity effect - Inductive interference with neighboring circuits.

UNIT III: MODELLING AND PERFORMANCE OF TRANSMISSION LINES 12

Classification of lines: Short line, medium line and long line; equivalent circuits, attenuation constant, phase constant, surge impedance; transmission efficiency and voltage regulation; real and reactive power flow in lines: Power-angle diagram; surge-impedance loading, loadability limits based on thermal loading, angle and voltage stability considerations; shunt and series compensation; Ferranti effect and corona loss.

UNIT IV: INSULATORS AND CABLES 12

Insulators: Types, voltage distribution in insulator string and grading, improvement of string efficiency. Underground cables: Constructional features of LT and HT cables, capacitance, dielectric stress and grading, thermal characteristics.

UNIT V: DESIGN OF TRANSMISSION LINES 12

Introduction, calculation of sag and tension .Equivalent span length and sag, Effect of ice and wind loading ,Stringing chart, sag template, conductor vibrations and vibrations dampers

TOTAL =60

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

COURSE OUTCOMES

To understand the importance and the functioning of transmission line parameters.

To understand the concepts of Lines and Insulators.

To acquire knowledge on the performance of Transmission lines.

To acquire knowledge on Underground Cabilitys

TEXT BOOKS

1. B.R.Gupta, ‘Power System Analysis and Design’, S.Chand, New Delhi, 2003.
2. S.N. Singh, ‘Electric Power Generation, Transmission and Distribution’, Prentice Hall of India Pvt. Ltd, New Delhi, 2002.

REFERENCE BOOKS

1. Luces M.Fualkenberry ,Walter Coffer, ‘Electrical Power Distribution and Transmission’, Pearson Education, 1996.
2. Hadi Saadat, ‘Power System Analysis,’ Tata McGraw Hill Publishing Company’, 2003.
3.Central Electricity Authority (CEA), ‘Guidelines for Transmission System Planning’, New Delhi.
4.‘Tamil Nadu Electricity Board Handbook’, 2003.

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19148S31CP -PROBABILITY AND STATISTICS 3 1 0 4

(Common to Mech, Civil, EEE)

SEMESTER-III

UNIT I PROBABILITY AND RANDOM VARIABLE 9+3hrs

Axioms of probability - Conditional probability - Total probability - Bayes theorem - Random variable - Probability mass function - Probability density functions -Properties- Moments - Moment generating functions and their properties.

UNIT II TWO DIMENSIONAL RANDOM VARIABLES 9+3hrs

Joint distributions - Marginal and conditional distributions – Covariance - Correlation and Regression - Transformation of random variables - Central limit theorem.

UNIT III STANDARD DISTRIBUTIONS 9+3hrs

Binomial, Poisson, Geometric, Negative Binomial, Uniform, Exponential, Gamma, Weibull and Normal distributions and their properties - Functions of a random variable.

UNIT IV TESTING OF HYPOTHESIS 9+3hrs

Sampling distributions – Testing of hypothesis for mean, variance, proportions and differences using Normal, t, Chi-square and F distributions - Tests for independence of attributes and Goodness of fit.

UNIT V DESIGN OF EXPERIMENTS 9+3hrs

Analysis of variance – One way classification – Complete randomized design - Two – way classification –Randomized block design - Latin square.

Note : Use of approved statistical table permitted in **Total no of hrs: 60hrs**

COURSE OUTCOMES

Eigenvalues and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.

Gradient, divergence and curl of a vector point function and related identities.

Evaluation of line, surface and volume integrals using Gauss, Stokes and Green’s theorems and their verification.

Analytic functions, conformal mapping and complex integration.

Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

TEXT BOOKS

1. Ross. S., “A first Course in Probability”, Fifth Edition, Pearson Education, Delhi 2002. (Chapters 2 to 8)
2. Johnson. R. A., “Miller & Freund’s Probability and Statistics for Engineers”, Sixth Edition, Pearson Education, Delhi, 2000. (Chapters 7, 8, 9, 12)

REFERENCES BOOKS

1) Walpole, R. E., Myers, R. H. Myers R. S. L. and Ye. K, “Probability and Statistics for Engineers and Scientists”, Seventh Edition, Pearsons Education, Delhi, 2002.
2) Lipschutz. S and Schiller. J, “Schaum’s outlines - Introduction to Probability and Statistics”, McGraw-Hill, New Delhi, 1998.
3) Gupta, S.C, and Kapur, J.N., “Fundamentals of Mathematical Statistics”, Sultan Chand, Ninth Edition , New Delhi ,1996.

Semester III

19153C32P- ANALOG INTEGRATED CIRCUITS 3 1 0 4

AIM

To introduce the concepts for realizing functional building blocks in ICs, fabrications & application of Ics.

OBJECTIVES

i. To study the IC fabrication procedure.
ii. To study characteristics; realize circuits; design for signal analysis using Op-amp Ics.
iii. To study the applications of Op-amp.
iv. To study internal functional blocks and the applications of special Ics like Timers, PLL circuits, regulator Circuits, ADCs.

UNIT I: IC FABRICATION 9

IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realization of monolithic Ics and packaging.

UNIT II: CHARACTERISTICS OF OPAMP 9

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, offset voltage and current: voltage series feedback and shunt feedback amplifiers, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – summer and subtractor – Multiplier and divider- differentiator and integrator.

UNIT III: APPLICATIONS OF OPAMP 9

Instrumentation amplifier, V/I & I/V converters, comparators, multivibrators, waveform generators, Precision rectifier, clippers, clampers, peak detector, S/H circuit, D/A converter (R-2R ladder and weighted resistor types), A/D converter – Dual slope, successive approximation and flash types.

UNIT IV: ACTIVE FILTERS AND SPECIAL ICs 9

RC Active filters : low pass – high pass – band pass – band reject – switched capacitor filter – 555 Timer circuit – Functional block, characteristics & applications; 566-voltage controlled oscillator circuit; 565-phase lock loop circuit functioning and applications, Analog multiplier Ics**.**

UNIT V: APPLICATION ICs 9

IC voltage regulators – LM317, 723 regulators, switching regulator, MA 7840, LM 380 power amplifier, ICL 8038 function generator IC, isolation amplifiers, opto coupler, opto electronic Ics. **TOTAL = 45**

<u>COURSE OUTCOMES</u>

- Ability to acquire knowledge in IC fabrication procedure

Ability to analyze the characteristics of Op-Amp

To understand the importance of Signal analysis using Op-amp based circuits.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

Functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits.

To understand and acquire knowledge on the Applications of Op-amp

Ability to understand and analyse, linear integrated circuits their Fabrication and Application.

TEXT BOOKS

1. Ramakant A.Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, 2003 / PHI.
2. D.Roy Choudhary, Sheil B.Jani, 'Linear Integrated Circuits', II edition, New Age, 2003.

REFERENCE BOOKS

1. Jacob Millman, Christos C.Halkias, 'Integrated Electronics - Analog and Digital circuits system', Tata McGraw Hill, 2003.
2. Robert F.Coughlin, Fredrick F.Driscoll, 'Op-amp and Linear ICs', Pearson Education, 4th edition, 2002 / PHI.
3. David A.Bell, 'Op-amp & Linear ICs', Prentice Hall of India, 2nd edition, 1997.

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19153C33P - POWER ELECTRONICS 4 0 0 4

AIM:
To understand the various applications of electronic devices for conversion, control and conditioning of the electrical power.

OBJECTIVES:
- To get an overview of different types of power semiconductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers
- To study the operation, switching techniques and basics topologies of DC-DC switching regulators.
- To learn the different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
- To study the operation of AC voltage controller and Matrix converters.

UNIT I- POWER SEMI-CONDUCTOR DEVICES : 12
Overview of switching devices – Driver and snubber circuit of SCR TRIAC, GTO, IGBT,
MOSFET – Computer simulation of PE circuits.

UNIT II-PHASE CONTROLLED CONVERTERS 12
2 pulse / 3 pulse and 6 pulse converters – Effect of source inductance – performance parameters – Reactive power control of converters – Dual converters.

UNIT III -DC TO DC CONVERTERS 12
Stepdown and stepup chopper – Forced commutation techniques – Time ratio control and current limit control – Switching mode regulators Buck, Boost, Buck-Boost – concept of resonant switching.

UNIT IV- INVERTERS 12
Single phase and three phase [120& 180mode] inverters – PWM techniques – Sinusoidal PWM, Modified sinusoidal PWM and multiple PWM – Voltage and harmonic control – Series resonant inverter – current source inverter.

UNIT V- AC TO AC CONVERTERS 12
Single phase AC voltage controllers – Multistage sequence control – single phase and three phase cycloconverters – power factor control – Matrix converters.

L: 45 T: 15 TOTAL: 60 PERIODS

COURSE OUTCOMES

- Ability to analyse AC-AC and DC-DC and DC-AC converters.
-

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

Ability to choose the converters for real time applications.

TEXT BOOKS:

1. Rashid M.H., "Power Electronics Circuits, Devices and Applications", Prentice Hall India, 3rd Edition, New Delhi, 2004.
2. Ned Mohan, T.M.Undeland, W.P.Robbins, "Power Electronics: Converters, applications and design", John wiley and Sons, 3rd Edition, 2006.

REFERENCES:

1. Cyril.W.Lander, "Power Electronics", McGraw Hill International, Third Edition, 1993.
2. P.S.Bimbra "Power Electronics", Khanna Publishers, third Edition 2003.
3. Philip T.Krein, "Elements of Power Electronics" Oxford University Press, 2004 Edition.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

19153C34P-MEASUREMENTS AND INSTRUMENTATION

4 0 0 4

Semester III

AIM

To provide adequate knowledge in electrical instruments and measurements techniques.

OBJECTIVES

To make the student have a clear knowledge of the basic laws governing the operation of the instruments, relevant circuits and their working.

i. Introduction to general instrument system, error, calibration etc.
ii. Emphasis is laid on analog and digital techniques used to measure voltage, current, energy and power etc.
iii. To have an adequate knowledge of comparison methods of measurement.
iv. Elaborate discussion about storage & display devices.
v. Exposure to various transducers and data acquisition system.

UNIT I: INTRODUCTION 10

Functional elements of an Instrument -Static and Dynamic characteristics -Errors in measurement -Statistical evaluation of measurement data -Standard and Calibration.

UNIT II: ELECTRICAL AND ELECTRONICS INSTRUMENTS 12

Construction and principle of operation of moving coil, moving Iron, Principle and types analog and digital ammeters and voltmeters -Single and three phase Wattmeter and Energy meter - magnetic measurements - -Instruments for measurement of frequency and phase.

UNIT III: SIGNAL CONDITIONING CIRCUITS 12

Bridge circuits – Differential and Instrumentation amplifiers -Filter circuits - V/f and f/V converters – P/I and I/P converters – S/H Circuit, A/D and D/A converters -Multiplexing and De-multiplexing -Data acquisition systems –Grounding techniques.

UNIT IV: STORAGE AND DISPLAY DEVICES 12

Magnetic disc and Tape Recorders -Digital plotters and printers -CRT displays -Digital CRO – LED, LCD and Dot matrix displays.

UNIT V: TRANSDUCERS 14

Classification of Transducers -Selection of Transducers –Resistive, Capacitive and Inductive Transducers -Piezo electric Transducers -Transducers for measurement of displacement, temperature, level, flows, pressure, velocity, acceleration, torque, speed, viscosity and moisture.

Total = 60

<u>COURSE OUTCOMES</u>

To acquire knowledge on Basic functional elements of instrumentation

To understand the concepts of Fundamentals of electrical and electronic instruments

Ability to compare between various measurement techniques

To acquire knowledge on Various storage and display devices

To understand the concepts Various transducers and the data acquisition systems

Ability to model and analyze electrical and electronic Instruments and understand the operational features of display Devices and Data Acquisition System.

TEXT BOOKS

1. E.O. Doebelin, 'Measurement Systems – Application and Design', Tata McGraw Hill publishing company, 2003.

2. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2004.

REFERENCE BOOKS

1. A.J. Bouwens, 'Digital Instrumentation', Tata McGraw Hill, 1997.

2. D.V.S. Moorthy, 'Transducers and Instrumentation', Prentice Hall of India Pvt Ltd, 2003.

3. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw Hill, 1995.

4. Martin Reissland, 'Electrical Measurements', New Age International (P) Ltd., Delhi, 2001.

5. J. B. Gupta, 'A Course in Electronic and Electrical Measurements', S. K. Kataria & Sons, Delhi, 2003.

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19153L35P- MACHINES LAB

0 0 3 2

Semester III

LIST OF EXPERIMENTS

1. Load test on DC Shunt & DC Series motor
2. O.C.C & Load characteristics of DC Shunt generator
3. Speed control of DC shunt motor (Armature, Field control)
4. Load test on single phase transformer
5. O.C & S.C Test on a single phase transformer
6. Regulation of an alternator by EMF & MMF methods.
7. V curves and inverted V curves of synchronous Motor
8. Load test on three phase squirrel cage Induction motor
9. Speed control of three phase slip ring Induction Motor
10. Load test on single phase Induction Motor.
11. Study of DC & AC Starters

TOTAL: 45

COURSE OUTCOMES

At the end of the course, the student should have the :

Ability to understand and analyze EMF and MMF methods

Ability to analyze the characteristics of V and Inverted V curves

Ability to understand the importance of Synchronous machines

Ability to understand the importance of Induction Machines

Ability to acquire knowledge on separation of losses

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

SEMESTER-IV

19153C41P- PROTECTION AND SWITCHGEAR

4 0 0 4

AIM

To expose the students to the various faults in power system and learn the various methods of protection scheme.
To understand the current interruption in Power System and study the various switchgears.

OBJECTIVES

i. Discussion on various earthling practices usage of symmetrical components to estimate fault current and fault MVA.
ii. Study of Relays & Study of protection scheme, solid state relays.
iii. To understand instrument transformer and accuracy.
iv. To understand the method of circuit breaking various arc theories Arcing phenomena – capacitive and inductive breaking.
v. Types of circuit breakers.

UNIT I: INTRODUCTION 12

Principles and need for protective schemes – nature and causes of faults – types of faults – fault current calculation using symmetrical components – Power system earthing - Zones of protection and essential qualities of protection – Protection scheme.

UNIT II: OPERATING PRINCIPLES AND RELAY CONSTRUCTIONS 12

Need for protection – essential qualities of protective relays – Electromagnetic relays, Induction relays – Over current relays - Directional, Distance, Differential and negative sequence relays. Static relays

UNIT III: APPARATUS PROTECTION 12

Apparatus protection transformer, generator, motor, protection of bus bars, transmission lines – CTs and PTs and their applications in protection schemes.

UNIT IV: THEORY OF CIRCUIT INTERRUPTION 12

Physics of arc phenomena and arc interruption. Restricting voltage & Recovery voltage, rate of rise of recovery voltage, resistance switching, current chopping, and interruption of capacitive current – DC circuit breaking.

UNIT V: CIRCUIT BREAKERS 12

Types of Circuit Breakers – Air blast, Air break, oil SF_6 and Vacuum circuit breakers – comparative merits of different circuit breakers – Testing of circuit breakers

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

COURSE OUTCOMES

- Ability to understand and analyze Electromagnetic and Static Relays.
- Ability to suggest suitability circuit breaker.
- Ability to find the causes of abnormal operating conditions of the apparatus and system.
- Ability to analyze the characteristics and functions of relays and protection schemes. Ability to study about the apparatus protection, static and numerical relays.
- Ability to acquire knowledge on functioning of circuit breaker.

TEXT BOOKS

1. B. Ravindranath, and N. Chander, 'Power System Protection & Switchgear', Wiley Eastern Ltd., 1977.

REFERENCE BOOKS

1. Sunil S. Rao, 'Switchgear and Protection', Khanna publishers, New Delhi, 1986 .
2. C.L. Wadhwa, 'Electrical Power Systems', Newage International (P) Ltd., 2000.
3. M.L. Soni, P.V. Gupta, V.S. Bhatnagar, A. Chakrabarti, 'A Text Book on Power System Engineering', Dhanpat Rai & Co., 1998.
4. Badri Ram, Vishwakarma, 'Power System Protection and Switchgear', Tata McGraw hill, 2001.
5. Y.G. Paithankar and S.R. Bhide, 'Fundamentals of Power System Protection', Prentice Hall of India Pvt. Ltd., New Delhi – 110001, 2003.

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19153C42P -HIGH VOLTAGE DC TRANSMISSION

3 1 0 4

Semester IV

AIM:

To learn the HVDC modelling and control strategy.

OBJECTIVES:

- To study the performance of converters and modeling of DC line with controllers.
- To study about converter harmonics and its mitigation using active and passive filters.

UNIT I- DC POWER TRANSMISSION TECHNOLOGY 9

Introduction-comparison of AC and DC transmission application of DC transmission – Description of DC transmission system planning for HVDC transmission-modern trends In DC transmission.

UNIT II- ANALYSIS OF HVDC CONVERTERS 9

Pulse number, choice of converter configuration-simplified analysis of Graetz circuit converter bridge characteristics – characteristics of a twelve pulse converter-detailed analysis of converters.

UNIT III- CONVERTER AND HVDC SYSTEM CONTROL 9

General principles of DC link control-converter control characteristics-system control Hierarchy-firing angle control-current and extinction angle control-starting and stopping of DC link-power control-higher level controllers-telecommunication requirements.

UNIT IV -HARMONICS AND FILTERS 9

Introduction-generation of harmonics-design of AC filters-DC filters-carrier frequency and RI noise.

UNIT V -SIMULATION OF HVDC SYSTEMS 9

Introduction-system simulation: Philosophy and tools-HVDC system simulation-modeling of HVDC systems for digital dynamic simulation.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Ability to understand Generation and measurement of high voltage.

Ability to understand High voltage testing.

Ability to understand various types of over voltages in power system. Ability to measure over voltages.

Ability to test power apparatus and insulation coordination

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEUERSHIP

TEXT BOOKS:

1. Padiyar, K.R., HVDC power transmission system, Wiley Eastern Limited, New Delhi 1990.First edition.
2. P.Kundur, ‘Power System Stability and Control’, Tata McGraw Hill Publishing Company Ltd., USA, 1994.
3. Arrillaga, J., High Voltage direct current transmission, Peter Pregrinus, London, 1983.

REFERENCES:

1. Edward Wilson Kimbark, Direct Current Transmission, Vol. I, Wiley interscience, New York, London, Sydney, 1971.
2. Rakosh Das Begamudre, Extra high voltage AC transmission engineering New

19153C43P- SOLID STATE DRIVES

3 1 0 4

Semester IV

AIM

To study and understand the operation of electric drives controlled from a power electronic converter and to introduce the design concepts of controllers.

OBJECTIVES

i. To understand the stable steady-state operation and transient dynamics of a motor-load system.
ii. To study and analyze the operation of the converter / chopper fed dc drive and to solve simple problems.
iii. To study and understand the operation of both classical and modern induction motor drives.
iv. To understand the differences between synchronous motor drive and induction motor drive and to learn the basics of permanent magnet synchronous motor drives.
v. To analyze and design the current and speed controllers for a closed loop solid-state d.c motor drive.

UNIT I DRIVE CHARACTERISTICS **9**

Equations governing motor load dynamics - Equilibrium operating point and its steady state stability - Mathematical condition for steady state stability and problems - Multi quadrant dynamics in the speed torque plane - Basics of regenerative braking - Typical load torque characteristics - Acceleration, deceleration, starting and stopping.

UNIT II DC MOTOR DRIVE **9**

Steady state analysis of the single and three phase fully controlled converter fed separately excited D.C motor drive: Continuous and discontinuous conduction mode - Chopper fed D.C drive: Time ratio control and current limit control - Operation of four quadrant chopper.

UNIT III STATOR CONTROLLED INDUCTION MOTOR DRIVES **9**

Variable terminal voltage control – Variable frequency control – V/f control - AC voltage controllers – Four-quadrant control and closed loop operation - Frequency controlled drives- VSI and CSI fed drives – closed loop control.

UNIT IV ROTOR CONTROLLED INDUCTION MOTOR DRIVES **9**

Rotor resistance control – slip power recovery schemes - sub synchronous and super synchronous operations – closed loop control – Braking in induction motors.

UNIT V- SYNCHRONOUS MOTOR DRIVES 9

Wound field cylindrical rotor motor – operation from constant voltage and frequency source – operation from current source – operation from constant frequency – Brushless excitation – Permanent magnet synchronous motor.

Self-controlled Synchronous motor drives – Brushless dc and ac motor drives – CSI with load commutation – Cycloconverter with load commutation.

TOTAL = 45

COURSE OUTCOMES

Ability to understand and suggest a converter for solid state drive.

Ability to select suitability drive for the given application.

Ability to study about the steady state operation and transient dynamics of a motor load system. Ability to analyze the operation of the converter/chopper fed dc drive.

Ability to analyze the operation and performance of AC motor drives.

Ability to analyze and design the current and speed controllers for a closed loop solid

TEXT BOOKS

1. R. Krishnan, 'Electric Motor & Drives: Modelling, Analysis and Control', Prentice Hall of India, 2001.
2. Bimal K. Bose. 'Modern Power Electronics and AC Drives', Pearson Education, 2002.

REFERENCE BOOKS

1. G.K. Dubey, 'Power Semi-conductor Controlled Drives', Prentice Hall of India, 1989.
2. Vedam Subrahmanyam, "Electric drives concepts and applications", TMH Pub. Co.Ltd., 1994.
3. Murphy, J.M.D and Turnbull.F.G. , "Thyristor control of AC Motors", Pergamon Press, 1988.
4. Sen. P.C., "Thyristor D.C. Drives", John Wiley and Sons, 1981.

19153L45P - CONTROL SYSTEM & MEASUREMENTS LAB

0 0 3 2

Semester IV

AIM

To provide a platform for understanding the basic concepts of linear control theory and its application to practical systems and To train the students in the measurement of displacement, resistance, inductance, torque and angle etc., and to give exposure to AC, DC bridges and transient measurement.

LIST OF EXPERIMENTS

1. Determination of transfer function parameters of a DC servo motor & AC servo motor.
2. Analog simulation of type-0 and type-1 system, closed loop control system.
3. Digital simulation of linear systems & non-linear systems.
4. Design of P, PI and PID controllers,
5. Design of compensators.
6. Stability analysis of linear systems
7. Conduct test to find unknown inductance & capacitance using Maxwell's & Schering's bridges
8. Conduct test to find unknown Resistance using Wheat Stone & Kelvin's bridges.
9. Instrumentation amplifiers,
10. Conduct test to convert A/D signal using successive approximation type.
11. a) Conduct test to convert D/A signal using binary weighted resistor method.
    b) Conduct test to convert D/A signal using R-2R Ladder method.
12. Calibration of single-phase energy meter & current transformer.

P = 45 Total = 45

COURSE OUTCOMES

Ability to understand control theory and apply them to electrical engineering problems. Ability to analyze the various types of converters.

Ability to design compensators

Ability to study the simulation packages.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

19153C51P-POWER SYSTEM ANALYSIS

3 1 0 4
Semester V

AIM
To become familiar with different aspects of modeling of components and system and different methods of analysis of power system planning and operation.

OBJECTIVES

i. To model steady-state operation of large-scale power systems and to solve the power flow problems using efficient numerical methods suitable for computer simulation.
ii. To model and analyse power systems under abnormal (fault) conditions.
iii. To model and analyse the dynamics of power system for small-signal and large signal disturbances and o design the systems for enhancing stability.

UNIT I- THE POWER SYSTEM AN OVER VIEW AND MODELLING 12

Moder n Power System - Basic Components of a power system - Per Phase Analysis Generator model - Transformer model - line model. The per unit system -Change of base.

UNIT II- POWER FLOW ANALYSIS 12
Introduction - Bus Classification - Bus admittance matrix - Solution of non-linear Algebraic equations - Gauss seidal method - Newton raphson method - Fast decoupled method - Flow charts and comparison of the three methods.

UNIT III-FAULT ANALYSIS-BALANCED FAULT 12
Introduction – Balanced three phase fault – short circuit capacity – systematic fault analysis using bus impedance matrix – algorithm for formation of he bus impedance matrix.

UNIT IV-FAULT ANALYSIS – SYMMETRICAL COMPONENTS AND UNBALANCED FAULT 12
Introduction – Fundamentals of symmetrical components – sequence impedances – sequence networks – single line to ground fault – line fault - Double line to ground fault – Unbalanced fault analysis using bus impedance matrix.

UNIT V-POWER SYSTEM STABILITY 12
Dynamics of a Synchronous machine – Swing equation and Power angle equation – Steady state Stability and Transient state Stability - Equal area criterion – Cearing angle and time- Numerical solution of Swing equation for single machine

Total = 60 Hrs
COURSE OUTCOMES

Ability to model the power system under steady state operating condition

Ability to understand and apply iterative techniques for power flow analysis

Ability to model and carry out short circuit studies on power system

Ability to model and analyze stability problems in power system

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

- Ability to acquire knowledge on Fault analysis.
- Ability to model and understand various power system components and carry out power flow, short circuit and stability studies

TEXT BOOKS:

1. Hadi Saadat "Power system analysis", Tata McGraw Hill Publishing Company, New Delhi, 2002 (Unit I, II, III, IV)
2. P.Kundur, "Power System Stability and Control", Tata McGraw Hill Publishing Company, New Delhi, 1994 (Unit V)

REFERENCE BOOKS:

1. I.J.Nagrath and D.P.Kothari, 'Modern Power System Analysis', Tata McGraw-Hill publishing company, New Delhi, 1990.
2. M.A. Pai, 'Computer Techniques in power system Analysis', Tata McGraw – Hill publishing company, New Delhi, 2003.
3. John J. Grainger and Stevenson Jr. W.D., 'Power System Analysis', McGraw Hill International Edition, 1994

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19153C52P - POWER QUALITY 3 1 0 4

Semester V

UNIT I INTRODUCTION TO POWER QUALITY 3

Terms and definitions: Overloading, under voltage, sustained interruption; sags and swells; waveform distortion, Total Harmonic Distortion (THD), Computer Business Equipment Manufacturers Associations (CBEMA) curve.

UNIT II VOLTAGE SAGS AND INTERRUPTIONS 7

Sources of sags and interruptions, estimating voltage sag performance, motor starting sags, estimating the sag severity, mitigation of voltage sags, active series compensators, static transfer switches and fast transfer switches.

UNIT III OVER VOLTAGES 10

Sources of over voltages: Capacitor switching, lightning, ferro resonance; mitigation of voltage swells: Surge arresters, low pass filters, power conditioners – Lightning protection, shielding, line arresters, protection of transformers and cables.

UNIT IV HARMONICS 12

Harmonic distortion: Voltage and current distortion, harmonic indices, harmonic sources from commercial and industrial loads, locating harmonic sources; power system response characteristics, resonance, harmonic distortion evaluation, devices for controlling harmonic distortion, passive filters, active filters, IEEE and IEC standards.

UNIT V POWER QUALITY MONITORING 17

Monitoring considerations: Power line disturbance analyzer, per quality measurement equipment, harmonic/spectrum analyzer, flicker meters, disturbance analyzer, applications of expert system for power quality monitoring.

L=45 Total=45

COURSE OUTCOMES

- Ability to understand and analyze power system operation, stability, control and protection.
- The students able to understand the over voltage protection & analysis tools used for analyzing the transients.
- They are fully trained in designing and evaluating the devices of harmonic distortion.

REFERENCE BOOKS

1. Roger.C.Dugan, Mark.F.McGranagham, Surya Santoso, H.Wayne Beaty, 'Electrical Power Systems Quality' McGraw Hill, 2003.
2. PSCAD User Manual.

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SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

19153C53P- SPECIAL ELECTRICAL MACHINES **4 0 0 4**

Semester V

AIM

To expose the students to the construction, principle of operation and performance of special electrical machines as an extension to the study of basic electrical machines.

OBJECTIVES

To impart knowledge on

i. Construction, principle of operation and performance of synchronous reluctance motors.

ii. Construction, principle of operation and performance of stepping motors.

iii. Construction, principle of operation and performance of switched reluctance motors.

iv. Construction, principle of operation and performance of permanent magnet brushless D.C. motors.

v. Construction, principle of operation and performance of permanent magnet synchronous motors.

UNIT I-SYNCHRONOUS RELUCTANCE MOTORS **9**

Constructional features – types – axial and radial air gap motors – operating principle – reluctance – phasor diagram - characteristics – Vernier motor.

UNIT II -STEPPING MOTORS **9**

Constructional features – principle of operation – variable reluctance motor – Hybrid motor – single and Multi stack configurations – theory of torque predictions – linear and non-linear analysis – characteristics – drive circuits.

UNIT III-SWITCHED RELUCTANCE MOTORS **9**

Constructional features – principle of operation – torque prediction – power controllers – Nonlinear analysis – Microprocessor based control - characteristics – computer control.

UNIT IV-PERMANENT MAGNET BRUSHLESS D.C. MOTORS **9**

Principle of operation – types – magnetic circuit analysis – EMF and Torque equations – Power Controllers – Motor characteristics and control.

UNIT V-PERMANENT MAGNET SYNCHRONOUS MOTORS **9**

Principle of operation – EMF and torque equations – reactance – phasor diagram – power controllers - converter - volt-ampere requirements – torque speed characteristics - microprocessor based control.

L=45 Total=45

COURSE OUTCOMES

Ability to analyze and design controllers for special Electrical Machines.

- Ability to acquire the knowledge on construction and operation of stepper motor.
- Ability to acquire the knowledge on construction and operation of stepper switched reluctance motors.
- Ability to construction, principle of operation, switched reluctance motors.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

- Ability to acquire the knowledge on construction and operation of permanent magnet brushless D.C. motors.
- Ability to acquire the knowledge on construction and operation of permanent magnet synchronous motors.

TEXT BOOKS

1. Miller, T.J.E., 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press, Oxford, 1989.
2. Aearnley, P.P., 'Stepping Motors – A Guide to Motor Theory and Practice', Peter Perengrinus, London, 1982.

REFERENCES

1. Kenjo, T., 'Stepping Motors and their Microprocessor Controls', Clarendon Press London, 1984.
2. Kenjo, T., and Nagamori, S., 'Permanent Magnet and Brushless DC Motors', Clarendon Press, London, 1988.

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19153L55P - POWER ELECTRONICS AND DRIVES LAB

Semester V

0 0 3 2

AIM

To study the characteristics of switching devices and its applications in rectifier inverter, chopper and resonant converter.

1. Study Of V-I Characteristics Of An SCR.
2. Study Of V-I Characteristics Of A TRIAC.
3. Study Of Different Trigerring Circuits For Thyristor.
4. Study Of Uni- Junction Transistor (UJT) Trigerring Circuit.
5. Study Of A Firing Circuit Suitable For Single Phase Half Controlled Convertor.
6. Simulation On the Single Phase Ac-Dc Uncontrolled Convertor with & without the source Inductance.
7. Simulation Of A Single Phase Ac To Controlled Dc Convertor with & without the source Inductance.
8. Single Phase Half Controlled Bridge Convertor With Two Thyristors & Two Diodes.
9. Single Phase Fully Controlled Bridge Convertor Using Four Thyristors.
10. Pspice or MATH LAB Simulation Of Dc to Dc Step Down Chopper.
11. Pspice or MATH LAB Simulation Of Single Phase Controller with R-L Load.
12. Pspice or MATH LAB Simulation Of PWM Bridge Invertor Of R-L Load Using MOSFET.

<u>COURSE OUTCOMES</u>

Ability to practice and understand converter and inverter circuits and apply software for engineering problems.

Ability to analyze about AC to DC converter circuits.

Ability to analyze about DC to AC circuits.

Ability to acquire knowledge on AC to AC converters

Ability to acquire knowledge on simulation software.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

19153C61P- UTILIZATION OF ELECTRICAL ENERGY

3 1 0 4
Semester VI

AIM
To plan and design using basic principles and handbooks
To select equipment, processes and components in different situations.

OBJECTIVES
i. To ensure that the knowledge acquired is applied in various fields as per his job requirements.
ii. To orient the subject matter in the proper direction, visits to industrial establishments are recommended in order to familiarize with the new developments in different areas.

UNIT I ELECTRIC LIGHTING 12
Production of light – Definition of terms – Lighting calculations – Types of lamps – Interior and Exterior illumination systems – Lighting schemes – Design of Lighting schemes – Factory lighting – Flood lighting – Energy saving measures.

UNIT II ELECTRIC HEATING 12
Resistance heating – Induction heating – Dielectric heating – Arc furnace – Control equipment, efficiency, and losses – Energy conservation in Arc Furnace Industry.

UNIT III ELECTRIC WELDING 12
Welding equipment – Characteristics of carbon and metallic arc welding – Butt welding – Spot welding – Energy conservation in welding.

UNIT IV ELECTRIC VEHICLE 12
Traction: System of track electrification, train movement and energy consumption (speed time curves, crest speed, average speed and schedule speed) rective effort, factors affecting energy consumption (dead weight, acceleration weight and adhesion weight) starting and braking of traction motors, protective devices

UNIT V ELECTRO CHEMICAL PROCESS 12
Electrolysis – Electroplating – Electro deposition – Extraction of metals – Current, efficiency – Batteries – Types – Charging methods.

Total = 60

COURSE OUTCOMES

To understand the main aspects of generation, utilization and conservation.

To identify an appropriate method of heating for any particular industrial application.

To evaluate domestic wiring connection and debug any faults occurred.

To construct an electric connection for any domestic appliance like refrigerator as well as to design a battery charging circuit for a specific household application.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

Text Books:

1. Tripathy,S.C., “Electric Energy Utilization & Conservation” – Tata McGraw Hill Publishing Company.
2. Uppal,S.L., “Electric Power”, Khanna Publishers.
3. Soni,M.L., P.V.Gupta & Bhatnagar , “A course in Electric Power”, Dhanpat Rai & Sons.

Reference Books:

1. Partab,H., “Art & Science Utilization of Electrical Energy” – Dhanpat Rai & Sons.
2. Wadhwa,C.L., “Generation, Utilization & Distribution” - Wilsey Eastern Ltd.
3. Wadha C L - Utilization of Electric Power; New Age International
4. Suryanarayana . N.V., “Utilization of Electric Power” - Wilsey Eastern Ltd.

19153C62P SOLID STATE RELAYS 4 0 0 4

Semester VI

UNIT 1 **9**

Advantages of Static Relays – Generalized Characteristics and Operational Equations of Relays – Steady State and Transient Performance of Signal Driving Elements – Signal Mixing Techniques and Measuring Techniques – CT's and PT's in Relaying Schemes – Saturation Effects.

UNIT 2 **9**

Static Relay Circuits (Using Analog and Digital IC's) for Over Current, Inverse Time Characteristics, Differential Relay and Directional Relay.

UNIT 3 **9**

Static Relay Circuits for Generator Loss of Field, Under Frequency Distance Relays, Impedance, Reactance, MHO, Reverse Power Relays.

UNIT 4 **9**

Static Relay Circuits for Carrier Current Protection – Steady State and Transient Behavior of Static Relays – Testing and Maintenance – Tripping Circuits using Thyristor.

UNIT 5 **9**

Microprocessor Based Relays – Hardware and Software for the Measurement of Voltage, Current, Frequency, Phase Angle – Microprocessor Implementation of Over Current Relays – Inverse Time Characteristics – Impedance Relay – Directional Relay – MHO Relay.

Total=45

COURSE OUTCOMES

- Ability to suggest suitability circuit breaker.
- Ability to find the causes of abnormal operating conditions of the apparatus and system.

Text Books:

1. Badriram and Vishwakarma D.N., Power System Protection and Switchgear, Tata McGraw Hill, New Delhi, 1995.
2. Rao T.S.M., Power System Protection – Static Relays, McGraw Hill, 1979.

Reference Books:

1. Van C.Warrington, "Protection Relays – Their Theory and Practice", Chapman and Hall.
2. Ravindranath B. and Chander M., "Power System Protection and Switchgear", Wiley Eastern, 1992.
3. Russel C.Mason, "The Art and Science of Protective relays".

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

19153C63P- POWER SYSTEM OPERATION AND CONTROL

4 0 0 4
Semester VI

AIM

To become familiar with the preparatory work necessary for meeting the next day's operation and the various control actions to be implemented on the system to meet the minute-to-minute variation of system load.

OBJECTIVES

i. To get an overview of system operation and control.
ii. To understand & model power-frequency dynamics and to design power-frequency controller.
iii. To understand & model reactive power-voltage interaction and different methods of control for maintaining voltage profile against varying system load.

UNIT I INTRODUCTION 12

System load variation: System load characteristics, load curves - daily, weekly and annual, load-duration curve, load factor, diversity factor. Reserve requirements: Installed reserves, spinning reserves, cold reserves, hot reserves. Overview of system operation: Load forecasting, unit commitment, load dispatching. Overview of system control: Governor Control, LFC, EDC, AVR, system voltage control, security control.

UNIT II REAL POWER - FREQUENCY CONTROL 12

Fundamentals of Speed Governing mechanisms and modeling - Speed-Load characteristics-regulation of two Synchronous Machines in parallel - Control areas - LFC of single & Multi areas - Static & Dynamic Analysis of uncontrolled and controlled cases –Tie line with frequency bias control – Steady state instabilities.

UNIT III REACTIVE POWER–VOLTAGE CONTROL 12

Typical excitation system, modeling, static and dynamic analysis, stability compensation; generation and absorption of reactive power: Relation between voltage, power and reactive power at a node; method of voltage control: Injection of reactive power. Tap-changing transformer, numerical problems - System level control using generator voltage magnitude setting, tap setting of OLTC transformer.

UNIT IV UNIT COMMITMENT AND ECONOMIC DISPATCH 12

Statement of Unit Commitment (UC) problem; constraints in UC: spinning reserve, thermal unit constraints, hydro constraints, fuel constraints and other constraints; UC solution methods: Priority-list methods, forward dynamic programming approach, numerical problems only in priority-list method using full-load average production cost. Incremental cost curve, co-ordination equations without loss and with loss, solution by direct method and λ-iteration method. (No derivation of loss coefficients.) Base point and participation factors.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

UNIT V COMPUTER CONTROL OF POWER SYSTEMS 12

Energy control centre: Functions – Monitoring, data acquisition and control. System hardware configuration – SCADA and EMS functions: Network topology determination, state estimation, security analysis and control. Various operating states: Normal, alert, emergency, in extremis and restorative. State transition diagram showing various state transitions and control strategies. **Total = 60**

COURSE OUTCOMES

- Ability to understand the day-to-day operation of electric power system.
- Ability to analyze the control actions to be implemented on the system to meet the minute- to-minute variation of system demand.
- Ability to understand the reactive power-voltage interaction.

TEXT BOOKS

1. Olle. I. Elgerd, 'Electric Energy Systems Theory – An Introduction', Tata McGraw Hill Publishing
Company Ltd, New Delhi, Second Edition, 2003.
2. Allen.J.Wood and Bruce F.Wollenberg, 'Power Generation, Operation and Control', John Wiley & Sons,
Inc., 2003.
3. P. Kundur, 'Power System Stability & Control', McGraw Hill Publications, USA, 1994.

REFERENCE BOOKS

1. D.P. Kothari and I.J. Nagrath, 'Modern Power System Analysis', Third Edition, Tata McGraw Hill
Publishing Company Limited, New Delhi, 2003.
2. L.L. Grigsby, 'The Electric Power Engineering, Hand Book', CRC Press & IEEE Press, 2001.

19153L65P POWER SYSTEMS LAB

0 0 3 2

Semester VI

AIM

To simulate analysis and planning cases for a practical power system.

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List Of Experiments:

1. Formation of Y-Bus Matrix by Inspection and Singular transformation methods.
2. Load flow solution using Gauss Seidal method
3. Load flow solution using Newton-Raphson method
4. Load flow solution by Fast Decoupled method
5. Symmetrical short circuit analysis
6. Unsymmetrical Fault analysis
7. Solution of swing Equation using modified Euler method
8. Power Electronic Circuits, design and simulation using Pspice
9. Simulation of Electrical drives using MATLAB, PSCAD
10. Control system design using MATLAB

P = 45 Total = 45

COURSE OUTCOMES

Ability to understand power system planning and operational studies.

Ability to acquire knowledge on Formation of Bus Admittance and Impedance Matrices and Solution of Networks.

Ability to analyze the power flow using GS and NR method

Ability to find Symmetric and Unsymmetrical fault

Semester VII

19160S71P TOTAL QUALITY MANAGEMENT 3 0 0 3

UNIT – I: BASICS OF TQM 9

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT – II: PRINCIPLES OF TQM 9

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Performance Measures – Basic Concepts, Strategy, Performance Measure.

UNIT – III: QUALITY CONCEPTS 9

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Concept of six sigma,

UNIT – IV: TQM TOOLS 9

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, FMEA – Stages of FMEA.

UNIT – V: ISO STANDARDS 9

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, ISO 14000 – Concept, Requirements and Benefits.

TOTAL : 45

COURSE OUTCOMES

Upon completion of the course, students will be ability to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

TEXT BOOKS:

1. Dale H. Besterfiled, et al., “Total Quality Management”, Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6.
2. Basker, “ TOTAL QUALITY MANAGEMENT”, Anuradha Agencies.

REFERENCES:

1. Feigenbaum.A.V. “Total Quality Management”, McGraw Hill, 1991.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

2. Oakland.J.S. “Total Quality Management”, Butterworth – Hcinemann Ltd., Oxford. 1989.
3. Narayana V. and Sreenivasan, N.S. “Quality Management – Concepts and Tasks”, New Age International 1996

19153C72P - ELECTRICAL MACHINE DESIGN 3 1 0 4

Semester VII

AIM

To expose the students to the construction, principle of operation and performance of special electrical machines as an extension to the study of basic electrical machines.

OBJECTIVES

To impart knowledge on

i. Construction, principle of operation and performance of DC machine.
ii. Construction, operating Characteristics of single and three phase transformer.
iii. Design and operating characteristics of Induction motors.
iv Construction, principle of operation, Design of synchronous machines and to have knowledge of machine design in CAD

UNIT I INTRODUCTION 12

Major considerations – Limitations – Electrical Engineering Materials – Space factor – temperature gradient – Heat flow in two dimensions – thermal resistivity of winding – Temperature gradient in conductors placed in slots – Rating of machines – Eddy current losses in conductors – Standard specifications

UNIT II DC MACHINES 12

Constructional details – output equation – main dimensions - choice of specific loadings – choice of number of poles – armature design – design of field poles and field coil – design of commutator and brushes – losses and efficiency calculations.

UNIT III TRANSFORMERS 12

KVA output for single and three phase transformers – Window space factor – Overall dimensions – Operating characteristics – Regulation – No load current – Temperature rise of Transformers – Design of Tank with & without cooling tubes – Thermal rating – Methods of cooling of Transformers.

UNIT IV INDUCTION MOTORS 12

Magnetic leakage calculations – Leakage reactance of polyphase machines- Magnetizing current – Output equation of Induction motor – Main dimensions –Length of air gap- Rules for selecting rotor slots of squirrel cage machines – Design of rotor bars & slots – Design of end rings – Design of wound rotor-Operating characteristics –Short circuit current – circle diagram – Dispersion co-efficient – relation between D & L for best power factor.

UNIT V SYNCHRONOUS MACHINES 12

Runaway speed – construction – output equations – choice of loadings – Design of salient pole machines – Short circuit ratio – shape of pole face – Armature design – Armature parameters – Estimation of air gap length – Design of rotor –Design of damper winding –

Determination of full load field m.m.f – Design of field winding – Design of turbo alternators – Rotor design - Introduction to computer aided design – Program to design main dimensions of Alternators.

Total = 60

COURSE OUTCOMES

Ability to understand basics of design considerations for rotating and static electrical machines

Ability to design of field system for its application.

Ability to design sing and three phase transformer.

Ability to design armature and field of DC machines.

REFERENCE BOOKS:

1. Sawhney, A.K., 'A Course in Electrical Machine Design', Dhanpat Rai & Sons, New Delhi, 1984.
2. Sen, S.K., 'Principles of Electrical Machine Designs with Computer Programmes', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1987.

19153C73P- POWER PLANT ENGINEERING

4 0 0 4
Semester VII

UNIT I -THERMAL POWER PLANTS 9

Basic thermodynamic cycles – Various components of steam power plant – Layout – Pulverized coal burners – Fluidized bed combustion – Coal handling systems – Ash handling systems – Forced draft and induced draft fans – Boilers – Feed pumps – Super heater – Regenerator – Condenser – Dearearators – Cooling tower

UNIT II - HYDRO ELECTRIC POWER PLANTS 9

Layout – Dams – Selection of water turbines – Types – Pumped storage hydel plants

UNIT III - NUCLEAR POWER PLANTS 9

Principles of nuclear energy – Fission reactions – Nuclear reactor – Nuclear power plants

UNIT IV- GAS AND DIESEL POWER PLANTS 9

Types – Open and closed cycle gas turbine – Work output and thermal efficiency – Methods to improve performance – Reheating, intercoolings, regeneration – Advantage and disadvantages – Diesel engine power plant – Component and layout

UNIT V- NON – CONVENTIONAL POWER GENERATION 9

Solar energy collectors – OTEC – Wind power plants – Tidal power plants and geothermal resources – Fuel cell – MHD power generation – Principle – hermoelectric power generation – Thermionic power generation.

L: 45 T: 15 Total: 60

COURSE OUTCOMES

Ability to create awareness about renewable Energy Sources and technologies.

Ability to get adequate inputs on a variety of issues in harnessing renewable Energy.

Ability to recognize current and possible future role of renewable energy sources.

TEXT BOOKS

1. Arora and Domkundwar, "A Course in Power Plant Engineering", Dhanpat Rai.
2. Nag, P.K., "Power Plant Engineering", 2nd Edition, Tata McGraw Hill, 2003.

REFERENCES

1. Bernhardt, G.A., Skrotzki and William A. Vopat, "Power Station Engineering and Economy", 20th Reprint, Tata McGraw Hill, 2002.
2. Rai, G.D., "An Introduction to Power Plant Technology", Khanna Publishers.
3. El-Wakil, M.M., "Power Plant Technology", Tata McGraw Hill, 198

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

ELECTIVE-I

19153E44AP-FIELD THEORY

3 1 0 4
Semester-IV

AIM

To expose the students to the fundamentals of electromagnetic fields and their applications in Electrical Engineering**.**

OBJECTIVES: To impart knowledge on

i. Concepts of electrostatics, electrical potential, energy density and their applications.
ii. Concepts of magneto statics, magnetic flux density, scalar and vector potential and its applications.
iii. Faraday's laws, induced emf and their applications.
iv. Concepts of electromagnetic waves and Pointing vector.

UNIT I: **INTRODUCTION** **12**

Introduction-Coulomb's Law – Electric field intensity – Field due to point and continuous charges – Electric flux density-Gauss's law and application – Electrical potential –potential gradient– Divergence & Divergence theorem- Poisson's and Laplace's equations

UNIT II: **STATIC ELECTRI FIELD** **12**

Field due to dipoles- dipole moment-current & current density-conductors and dielectric –boundary conditions– Capacitance-Dielectric Dielectric interface- capacitance of a system of conductors- Dielectric constant and dielectric strength- Energy stored in a capacitor- Energy density.

UNIT III: MAGNETOSTATICS **12**

Introduction- Biot–savart Law- Ampere's Circuital Law-Curl- Stoke's theorem- Magnetic flux- – Magnetic flux density (B)- Scalar and vector potential – Force on a moving charge and current elements- force & Torque on closed circuits.

UNIT IV: ELECTROMAGNETIC INDUCTION **12**

Introduction to magnetic materials – Magnetization and permeability- Magnetic Boundary conditions- Magnetic circuits-Potential energy and forces on magnetic materials.- Faraday's laws- Inductance & mutual inductance- Inductance of solenoid, toroid and transmission lines.

UNIT V: ELECTROMAGNETICS **12**

Conduction current and - Displacement current-, Maxwell's equations (differential and integral forms) -Wave propagation in free space, lossy and lossless dielectrics- Power and Poynting vector – Propagation in good conductors- wave polarization.

TOTAL = 60

<u>COURSE OUTCOMES</u>

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

Ability to understand the basic mathematical concepts related to electromagnetic vector fields. Ability to understand the basic concepts about electrostatic fields, electrical potential, energy density and their applications.

Ability to acquire the knowledge in magneto static fields, magnetic flux density, vector potential and its applications.

Ability to understand the different methods of emf generation and Maxwell's equations

Ability to understand the basic concepts electromagnetic waves and characterizing parameters Ability to understand and compute Electromagnetic fields and apply them for design and analysis of electrical equipment and systems

TEXT BOOKS

1. John.D.Kraus, 'Electromagnetics', McGraw Hill book Co., New York, Fourth Edition, 1991.
2. William .H.Hayt, 'Engineering Electromagnetics', Tata McGraw Hill edition, 2001.

REFERENCE BOOKS

1. Joseph. A.Edminister, 'Theory and Problems of Electromagnetics', Second edition, Schaum Series, Tata McGraw Hill, 1993.
2. I.J. Nagrath, D.P. Kothari, 'Electric Machines', Tata McGraw Hill Publishing Co Ltd, Second Edition, 1997.
3. Kraus and Fleish, 'Electromagnetics with Applications', McGraw Hill International Editions, Fifth Edition, 1999.
4. Sadiku, 'Elements of Electromagnetics', Second edition, Oxford University Press, 1995.

‡†‡‡†‡‡†‡

ELECTIVE-I

19153E44BP- FUZZY LOGIC AND ITS APPLICATIONS

3 1 0 4

Semester-IV

UNIT I -FUZZY LOGIC 7

Fuzzy sets – Fuzzy operation – Fuzzy arithmetic – Fuzzy relational equations – Fuzzy measure – Fuzzy functions – approximate reasoning – Fuzzy proposition – Fuzzy quantifiers-if-then rules.

UNIT II- FUZZY LOGIC IN CONTROL 8

Structure of Fuzzy logic controller – Fuzzification models – database – rule base – inference engine – defuzzification modules – Non-Linear fuzzy control – PID like FLC – Sliding mode FLC – Sugeno FLC – adaptive fuzzy control applications – case studies.

UNIT III- NEURAL NETWORKS IN CONTROL 8

Neural Network for Non-Linear systems – schemes of Neuro control-system identification forward model and inverse model – indirect learning neural network control applications – Case studies.

UNIT IV- MODELING AND CONTROL OF FACTS DEVICES NEURAL AND FUZZY TECHNIQUE 10

FACTS-concept and general system considerations, types of FACTS devices – special purpose FACTS devices, generalized and multifunctional FACTS devices – General comments on transient stability programs.Neuro – Fuzzy based FACTS controller for improvement of Transient stability systems – GA for Adaptive fuzzy system – case study.

UNIT V- STABILITY STUDIES UNDER MULTIPLE FACTS ENVIRONMENT 12

Introduction to small signal analysis – simulation and modeling of FACTS controllers for small signal analysis. Comparison between dynamic and transient stability results. Introduction to EMTP – (Electromagnetic Transient programme / Package), Modeling of FACTS controllers for power system studies using EMTP.

TOTAL=45

COURSE OUTCOMES

- Ability to design combinational and sequential Circuits.
- Ability to simulate using software package.
- Ability to study various number systems and simplify the logical expressions using Boolean functions
- Ability to design various synchronous and asynchronous circuits.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

Ability to introduce asynchronous sequential circuits and PLDs

Ability to introduce digital simulation for development of application oriented logic circuits.

REFERENCES:

1. KOSKO. B. “Neural Networks and Fuzzy systems”, Prentice-Hall of India Pvt.Ltd., 1994.
2. Driankov, Hellendroon, “Introduction to Fuzzy control” Narosa Publisher.
3. Ronald R.Yager and Dimitar P.Filev “Essential of fuzzy modeling and control “ John Wiley & Sons, Inc.
4. Enrique Acha, Claudio R.Fuerte-Esqivel, Hugo Ambriz-Perez, Cesar Angeles-Camacho” FACTS – Modeling and simulation in Power Networks” John Wiley & Sons.
5. Kundur P., “Power system stability and control”, McGraw Hill, 1994.

ELECTIVE-I

19153E44CP - BIOMEDICAL INSTRUMENTATION

4 0 0 4
Semester-IV

AIM

The course is designed to make the student acquire an adequate knowledge of the physiological systems of the human body and relate them to the parameters that have clinical importance. The fundamental principles of equipment that are actually in use at the present day are introduced.

OBJECTIVES

i. To provide an acquaintance of the physiology of the heart, lung, blood circulation and circulation respiration. Methods of different transducers used.
ii. To introduce the student to the various sensing and measurement devices of electrical origin.
iii. To provide the latest ideas on devices of non-electrical devices.
iv. To bring out the important and modern methods of imaging techniques.
v. To provide latest knowledge of medical assistance / techniques and therapeutic equipments.

UNIT I BASIC PHYSIOLOGY 9

Cells and their structures – Transport of ions through cell membrane – Resting and excited state – Tran membrane potential – Action potential – Bio-electric potential – Nervous system – Physiology of muscles – Heart and blood circulation – Respiratory system – Urinary system.

UNIT II BASIC TRANSDUCER PRINCIPLES AND ELECTRODES 9

Transducer principles - Active transducers - Passive transducers -Transducer for Bio-medical application -Electrode theory- Bio-potential electrode - Bio - chemical transducer.

UNIT III CARDIOVASCULAR SYSTEM 9

The heart and cardiovascular system – Blood pressure – Characteristics of blood flow – Heart sounds - Electro cardiography – Measurements of blood pressure – Measurement of blood flow and cardiac O/P Plethysmography – Measurements of heart sounds.

UNIT IV X-RAY AND RADIOISOTOPE INSTRUMENTATION 9

X-ray imaging radiography – Fluoroscopy – Image intensifiers – Angiography - Medical use of radioisotopes – Beta radiations – Detectors – Radiation therapy.

UNIT V BIO-TELEMETRY 9

Introduction to biotelemetry – Physiological parameters adaptable to biotelemetry – the components of biotelemetry systems – Implantable units – Applications of telemetry in patient care – Application of computer in Bio-medical instrumentation, Anatomy of Nervous system – Measurement from the nervous system – EEG – EMG.

Total = 45

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

COURSE OUTCOMES

- Ability to understand fundamentals of Bio medical instrumentation.
- To acquire knowledge on Bio-Medical and Non-Electrical parameter measurements.
- To know the various medical imaging equipment.

REFERENCE BOOKS:

1. Lesis Cromwell Fred, J.Werbell and Erich A.Pfraffer, Biomedical instrumentation and Measurements – Prentice Hall of India, 1990.
2. M.Arumugam, Bio-medical Instrumentation – Anuradha Agencies Publishers, 1992.
3. Khandpur, Handbook on Biomedical Instrumentation – Tata McGraw Hill Co Ltd., 1989.

ELECTIVE-I
Semester-IV

19153E44DP - MODELING AND SIMULATION OF SOLAR ENERGY SYSTEMS

4 0 0 4

UNIT I: SOLAR RADIATION AND COLLECTORS 9

Solar angles - day length, angle of incidence on tilted surface - Sunpath diagrams - shadow determination - extraterrestrial characteristics - measurement and estimation on horizontal and tilted surfaces - flat plate collector thermal analysis - heat capacity effect - testing methods-evacuated tubular collectors - concentrator collectors – classification - design and performance parameters - tracking systems - compound parabolic concentrators - parabolic trough concentrators - concentrators with point focus - Heliostats – performance of the collectors.

UNIT I: APPLICATIONS OF SOLAR THERMAL TECHNOLOGY 9

Principle of working, types - design and operation of - solar heating and cooling systems - solar water heaters – thermal storage systems – solar still – solar cooker – domestic, community – solar pond – solar drying.

UNIT III: SOLAR PV FUNDAMENTALS 9

Semiconductor – properties - energy levels - basic equations of semiconductor devices physics. Solar cells - p-n junction: homo and hetro junctions - metal-semiconductor interface - dark and illumination characteristics - figure of merits of solar cell – efficiency limits - variation of efficiency with band-gap and temperature - efficiency measurements - high efficiency cells - preparation of metallurgical, electronic and solar grade Silicon - production of single crystal Silicon: Czokralski (CZ) and Float Zone (FZ) method - Design of a complete silicon – GaAs- InP solar cell - high efficiency III-V, II-VI multi junction solar cell; a-Si-H based solar cells-quantum well solar cell -thermophotovoltaics.

UNIT IV: SOLAR PHOTOVOLTAIC SYSTEM DESIGN AND APPLICATIONS 9

Solar cell array system analysis and performance prediction- Shadow analysis: reliability - solar cell array design concepts - PV system design - design process and optimization - detailed array design - storage autonomy - voltage regulation - maximum tracking – use of computers in array design - quick sizing method - array protection and trouble shooting - centralized and decentralized SPV systems - stand alone - hybrid and grid connected system - System installation - operation and maintenances - field experience - PV market analysis and economics of SPV systems.

UNIT V: SOLAR PASSIVE ARCHITECTURE 9

Thermal comfort - heat transmission in buildings- bioclimatic classification – passive heating concepts: direct heat gain - indirect heat gain - isolated gain and sunspaces - passive cooling concepts: evaporative cooling - radiative cooling - application of wind,

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

water and earth for cooling; shading - paints and cavity walls for cooling - roof radiation traps - earth air-tunnel. – energy efficient landscape design - thermal comfort – concept of solar temperature and its significance - calculation of instantaneous heat gain through building envelope.

TOTAL: 45

COURSE OUTCOMES

Basic knowledge in Power system planning, operation and modeling of large scale power systems.

Ability to understand the various faults occurring in power system and to solve load flow problems using numerical methods.

Ability to analyze the power system transients and faults and select the rating for protective devices.

TEXT BOOKS:

1. Sukhatme S P, Solar Energy, Tata McGraw Hill, 1984.
2. Kreider, J.F. and Frank Kreith, Solar Energy Handbook, McGraw Hill, 1981.
3. Goswami, D.Y., Kreider, J. F. and & Francis., Principles of Solar Engineering, 2000.

REFERENCES:

1. Garg H P., Prakash J., Solar Energy: Fundamentals & Applications, Tata BMcGraw Hill, 2000.
2. Duffie, J. A. and Beckman, W. A., Solar Engineering of Thermal Processes, John Wiley, 1991.
3. Alan L Fahrenbruch and Richard H Bube, Fundamentals of Solar Cells: PV Solar Energy Conversion, Academic Press, 1983.
4. Larry D Partain, Solar Cells and their Applications, John Wiley and Sons, Inc, 1995.
5. Roger Messenger and Jerry Vnetre, Photovoltaic Systems Engineering, CRC Press, 2004.
6. Sodha, M.S, Bansal, N.K., Bansal, P.K., Kumar, A. and Malik, M.A.S. Solar Passive Building, Science and Design, Pergamon Press, 1986.
7. Krieder, J and Rabi, A., Heating and Cooling of Buildings: Design for Efficiency, McGraw-Hill, 1994.

19153E44EP NON-CONVENTIONAL ENERGY SYSTEMS AND APPLICATIONS 2 0 2 4

AIM

To learn about the Renewable energy system and conversion technologies related to various aspects of non-conventional systems.

OBJECTIVES

- to identify suitable utility for the solar and wind energy systems,
- to conduct a site survey for installation of a windmill during Sixth Expedition ,
- to study the structural and foundation aspects for installing a windmill at Maitree station in Schirmacher hills

UNIT-I **9**

Introduction to renewable energy various aspects of energy conversion-Principle of renewable energy systems environment and social implications

UNIT-II **9**

Solar energy: Solar radiation components- measurements-estimation-solar collectors-solar water heaters- Calculation-Types-analysis-economics-Applications Solar thermal power generation Solar Photovoltaics- energy conversion principle-classifications-equivalent circuit-characteristics-Cell efficiency- Limitations-PV modules-MPPT algorithms

UNIT-III **9**

Wind energy: Basics of wind-wind turbines-power and energy from wind turbine-characteristics- types of electric generators for wind power generation. Dynamics matching- performance of wind generators - applications- economics of wind power

UNIT-IV **9**

Storage Devices: Super capacitor-SMES- Battery storage-flywheel storage- compressed air storage- Fuel cells–types and applications; MHD generators – backup -System design-industrial and domestic applications.

UNIT-V **9**

Bioenergy: Bio fuels-classification-biomass conversion technologies-applications; Ocean Energy: Tidal energy-wave energy-ocean thermal energy conversion systems-applications; - mini, micro and pico hydel power

Total : 45

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

TEXT/REFERENCE BOOKS:

1. Godfrey Boyle, “Renewable Energy: Power for a sustainable future”, Oxford University press, Second edition.
2. Rai G D, “Solar Energy Utilization”, Khanna Publishers, 1997.
3. B H Khan, “Non-Conventional Energy Resources”, The McGraw-Hill Companies, Second Edition.
4. Sukhatme, S.P, “Solar Energy -Principles of Thermal Collection and Storage”, Tata
5. McGraw-Hill, 2 ed., 1997.
6. Sammes, Nige, “Fuel Cell Technologies-State and Perspectives”, Springer publication, 2005
7. Kreith, F., and Kreider, J.F., “Principles of Solar Engineering”, Mc-Graw-Hill Book Co, 1978.
8. S.L.Soo , “Direct Energy Conversion” , Prentice Hall Publication, 1968
9. James Larminie, Andrew Dicks, “Fuel Cell Systems”, Wiley & Sons Ltd, 2ed, 2003.

19153E54AP ENVIRONMENTAL SCIENCE AND ENGINEERING 4 0 0 4

UNIT I- INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 10

Definition, scope and importance – need for public awareness – forest resources: use and over-exploitation, deforestation,. Timber extraction, mining, dams-benefits and problems – mineral resources: use and effects on forests and tribal people – water resources: use and over-utilization of surface and exploitation, environmental effects of extracting and using mineral resources, case studies – food resources: world food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – energy resources: growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies – land resources: land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources.

UNIT II-ECOSYSTEMS AND BIODIVERSITY 14

Concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem. Introduction to biodiversity – definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity –endangered and endemic species of India – conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

UNIT III -ENVIRONMENTAL POLLUTION 8

Definition – causes, effects and control measures of: (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards — role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.

UNIT IV-SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management

environmental ethics: issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents. environment production act – air (prevention and control

of pollution) act – water (prevention and control of pollution) act – wildlife protection act – forest conservation act – issues involved in enforcement of environmental legislation – public awareness

UNIT V-HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – hiv / aids – women and child welfare – role of information technology in environment and human health – case studies.

TOTAL : 45

COURSE OUTCOMES

- Play a important role in transferring a healthy environment for future generations
- Analyze the impact of engineering solutions in a global and societal context
- Discuss contemporary issues that results in environmental degradation and would attempt to provide solutions to overcome those problems

TEXT BOOKS

1. Gilbert M .Masters, "Introduction to Environmental Engineering and Science", Pearson Education Pvt., Ltd., Second Edition, ISBN 81-297-0277-0, 2004.
2. Miller T.G. Jr., "Environmental Science", Wadsworth Publishing Co.

REFERENCES

1. Bharucha Erach, "The Biodiversity of India", Mapin Publishing Pvt. Ltd., Ahmedabad India.
2. Trivedi R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media.
3. Cunningham, W.P.Cooper, T.H.Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
4. Wager K.D. "Environmental Management", W.B. Saunders Co., Philadelphia, USA, 1998.
5. Townsend C., Harper J and Michael Begon, "Essentials of Ecology, Blackwell Science.
6. Trivedi R.K. and P.K. Goel, Introduction to Air Pollution, Techno-Science Publications.

ELECTIVE-II
Semester-v

19153E54BP -ARTIFICIAL NEURAL NETWORKS

4 0 0 4

UNIT I : INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS 12

Biological neural networks - Pattern analysis tasks: Classification, Regression, Clustering - Computational models of neurons - Structures of neural networks - Learning principles

UNIT II: LINEAR MODELS FOR REGRESSION AND CLASSIFICATION 12

Polynomial curve fitting - Bayesian curve fitting - Linear basis function models - Bias-variance decomposition - Bayesian linear regression - Least squares for classification - Logistic regression for classification- Bayesian logistic regression for classification

UNIT III: FEEDFORWARD NEURAL NETWORKS 12

Pattern classification using preceptor - Multilayer feed forward neural networks (MLFFNNs) - Pattern classification and regression using MLFFNNs - Error back propagation learning - Fast learning methods: Conjugate gradient method – Auto associative neural networks - Bayesian neural networks

UNIT III: RADIAL BASIS FUNCTION NETWORKS 12

Regularization theory - RBF networks for function approximation - RBF networks for pattern classification

UNIT IV: KERNEL METHODS FOR PATTERN ANALYSIS 12

Statistical learning theory- Support vector machines for pattern classification- Support vector regression for function approximation- Relevance vector machines for classification and regression

UNIT V: SELF-ORGANIZING MAPS 12

Pattern clustering- Topological mapping- Kohonen's self-organizing map

FEEDBACK NEURAL NETWORKS

Pattern storage and retrieval- Hopfield model- Boltzmann machine- Recurrent neural networks

TOTAL=60

<u>COURSE OUTCOMES</u>

- Analysis of transients using various parametric & non parametric methods.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

- Analysis of various control schemes usend for controlling applications
- study about the adaptive control systems for various applications & study of issues in it.

Text Books:

1. B.Yegnanarayana, Artificial Neural Networks, Prentice Hall of India, 1999
2. Satish Kumar, Neural Networks – A Classroom Approach, Tata McGraw-Hill, 2003
3. S.Haykin, Neural Networks – A Comprehensive Foundation, Prentice Hall, 1998
4. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006

19153E54CP-COMMUNICATION ENGINEERING 3 1 0 4

UNIT I **9**

Need for Modulation, Amplitude Modulation, AM Demodulator, SSB Modulation, Vestigial Sideband Modulation, AM transmitter and Receiver, Noise and bandwidth in AM, Carrier Communication, Basic Principles of Pulsed and CW Radar.

UNIT II **9**

Frequency Modulation, FM Demodulator, Phase Modulation, FM transmitter and receiver, Noise and bandwidth in FM, Ground wave, sky wave and space wave propagation, Basic Principles of BW and Colour TV.

UNIT III **9**

Sampling theorem, PAM, PWM, PPM, Pulse Code Modulation, Noise in PCM, Delta Modulation, Adaptive Delta modulation, DPCM, M'ary system, FDM and TDM.

UNIT IV **9**

Digital Modulation, ASK, FSK, PSK, DPSK, Basic Principles of Optical Communication, Satellite Comm., Mobile Comm.

UNIT V **9**

Entropy, Mutual Information, Channel Capacity, Shannon Theorem, Shannon-Hartley Theorem, Shannon-Fano code, Huffman code, Parity Check Code, Hamming's Single Error Correction Code.

TOTAL 45

COURSE OUTCOMES

- The student will know about different analog modulation techniques and also about their transmitter, receivers
- The students will know about the principles behind different digital modulation techniques
- The student will know about different Multiplexing and Spread spectrum techniques.

REFERENCE BOOKS:

1. Electronics Communication System - G.Kennedy
2. Communication System-Analog & Digital - R.P.Singh & S.D.Sapre

ELECTIVE-II
Semester-v

19153E54DP- ROBOTICS

3 1 0 4

UNIT I: INTRODUCTION 9

Robot ,its evaluation; definition and aes of robotics, present application status.

UNIT II: ROBOT ANATOMY 9
configuration, robot motions, work volume. Robot drives, actuators and control; Functions and types of drives and actuators; concept of basic control systems, open loop, close loop, different type of controllers, ON-OFF, proportional, integral, PI, PD, PID.

UNIT III: ROBOT END EFFECTORS: **9**
Types of end effecters, mechanical gripper, tools and end effectors. Robot sensors: Transducers and sensors; analog and digital transducers; types of sensors, tachfile sensors, proximity and rough sensors ; miscellaneous sensors; vision systems; use of sensors in robotics.

UIT IV: ROBOT KINEMATICS 9
Position representations; forward and reverse kinematics of three and four degrees of freedom; robot arm; homogeneous transformations and robot kinematics; kinematics equations using homogeneous transformation .

UNIT V: INDUSTRIAL APPLICATION 9
Capabilities of robots; robot applications; materials handling; pick and place operation; palletiging and depalletiging; machine loading and unloading; machine casting; welding;painting,assembly; inspection; maintenance.

<u>COURSE OUTCOMES</u>

Ability to understand and develop MFC windows applications with inputs and drawing features and implement menus using VC++

Ability to understand document/view architecture and develop classic controls using VC++

Ability to understand and design event driven programming and activeX controls and manage database using visual basic

BOOKS RECOMMENDED:
1.Schilling-Fundamental of robotics; PH
2.Yoshikawa- Fundamental of robotics; PH
3. S.R.Deb-Robotics Technology and Flexible Automation
4. Introduction to Robotics, John J Craig; Pearson Education

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

19153E54EP LT & HT DISTRIBUTION SYSTEMS 2 0 2 4

AIM

To become familiar with the function of different components used in Transmission and Distribution levels of power systems and modeling of these components.

OBJECTIVES

- To develop expression for computation of fundamental parameters of Power system analysis.
- To categorize the lines into different classes and develop equivalent circuits for these classes.
- To analyze the voltage distribution in Architectures and user interface.

UNIT-I **9**

Power system-general concepts-distribution of power, load and energy forecasting-factors in power system loading, Power system analysis-load flow-fault studies-voltage control.

UNIT-II **9**

Optimization of distribution system network cost modeling-economic loading of distribution transformers. Distribution system reliability-reliability assessment techniques

UNIT-III **9**

Consumer services-maximum demand, diversity and load factor-consumer load control for power shortages, Tariffs-costing and pricing –economically efficient tariff structure. Overhead and underground lines-optimum design considerations, Power capacitors-size of capacitor for power factor improvement- HT and LT capacitor installation requirements.

UNIT-IV **9**

Distribution System Design- Electrical Design Aspects of Industrial, Commercials Buildings- Design, estimation and costing of outdoor and indoor Substations, Electrical Safety and Earthing Practices at various voltage levels- Lightning protection.-Regulations and standards.

UNIT-V **9**

Distribution Automation System : Necessity, System Control Hierarchy- Basic Architecture and implementation Strategies for SCADA and DAC systems -Basic Distribution Management System Functions. Communication Systems for Control and Automation- Wireless and wired Communications- SCADA and DAC communication Protocols, Architectures and user interface

Total: 45

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

Text/References:

1. Turan Gonen, "Electric Power Distribution system Engineering" Mc Graw-hill ,Inc,1987
2. A.S. Pabla, " Electric Power Distribution systems" Tata Mc Graw-hill Publishing company
limited, 4th edition, 1997.
3. Alexander Eigeles Emanuel, "Power Definitions and the Physical Mechanism of Power Flow", John Wiley & Sons, October 2009.
4. "Handbook of International Electrical Safety Practices", John Wiley & Sons, PERI June 2009.
5. Ali A. Chowdhury, Don O. Koval, "Power distribution system reliability-Practical methods and applications" John Wiley & sons Inc., *IEEE Press* 2009
6. Richard E.Brown, "Electric power distribution reliability" Taylor & Francis Group,LLC,2009.
7. James Northcote-Green, Robert Wilson, "Control and automation of electrical power distribution system", Taylor & Francis Group, LLC,2007.
8. S.Sivanagaraju, V.Sankar, Dhanpat Rai & Co, "Electrical Power Distribution and Automation",2006.
9. Pansini,Anthony J, "Guide to electrical power distribution system",Fairmont press, inc., 6th edition,2006.
10. Stuart A. Boyer, "SCADA-Supervisory Control and Data Acquisition" Instrument Society of America Publication,2004
11. Leveque, Francois , "Transport Pricing of Electricity Networks" Springer 2003
13. Lakervi & E J Holmes, "Electricity distribution network design", Peter Peregrimus Ltd. 2nd Edition,2003
13. William H. Kersting, "Distribution system modeling and analysis" CRC press LLC, 2002.
14. Michael Wiebe, "A Guide to Utility Automation: Amr, Scada, and It Systems for Electric Power" PennWell,1999.
15. IEEE Press: IEEE Recommended practice for Electric Power Distribution for Industrial Plants, publish

ELECTIVE III
Semester VI

19153E64AP- PRINCIPLES OF MANAGEMENT 4 0 0 4

OBJECTIVE

i. To understand the Total Quality Management concept and principles and the various tools available to achieve Total Quality Management.

ii. To understand the statistical approach for quality control.

iii. To create an awareness about the ISO and QS certification process and its need for the industries

UNIT I HISTORICAL DEVELOPMENT 12

Definition of Management – Science or Art – Management and Administration – Development of Management Thought – Contribution of Taylor and Fayol – Functions of Management – Types of Business Organisation.

UNIT II PLANNING 12

Nature & Purpose – Steps involved in Planning – Objectives – Setting Objectives – Process of Managing by Objectives – Strategies, Policies & Planning Premises- Forecasting – Decision-making.

UNIT III ORGANISING 12

Nature and Purpose – Formal and informal organization – Organization Chart – Structure and Process – Departmentation by difference strategies – Line and Staff authority – Benefits and Limitations – De-Centralization and Delegation of Authority – Staffing – Selection Process - Techniques – HRD – Managerial Effectiveness.

UNIT IV DIRECTING 12

Scope – Human Factors – Creativity and Innovation – Harmonizing Objectives – Leadership – Types of Leadership Motivation – Hierarchy of needs – Motivation theories – Motivational Techniques –Job Enrichment – Communication – Process of Communication – Barriers and Breakdown –Effective Communication – Electronic media in Communication.

UNIT V CONTROLLING 12

System and process of Controlling – Requirements for effective control – The Budget as Control Technique – Information Technology in Controlling – Use of computers in handling the information – Productivity – Problems and Management – Control of Overall Performance – Direct and Preventive Control – Reporting – The Global Environment – Globalization and Liberalization – International Management and Global theory of Management.

TOTAL = 60

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

COURSE OUTCOMES

- Basic Knowledge on management, business, organization culture, environment and planning process.
- Ability to organize business activities, motivational techniques and effective communication.
- Ability to understand the management control and budgetary techniques.

TEXT BOOKS

1. Harold Kooritz & Heinz Weihrich "Essentials of Management", Tata Mcgraw Hill,1998.

2. Joseph L Massie "Essentials of Management", Prentice Hall of India, (Pearson) Fourth Edition, 2003.

REFERENCE BOOKS

1. Tripathy PC And Reddy PN, " Principles of Management", Tata Mcgraw Hill,1999.
2. Decenzo David, Robbin Stephen A, "Personnel and Human Reasons Management", Prentice Hall of India, 1996.
3. JAF Stomer, Freeman R. E and Daniel R Gilbert Management, Pearson Education, Sixth Edition, 2004.
4. Fraidoon Mazda, " Engineering Management", Addison Wesley,-2000.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

19153E64BP- PROFESSIONAL ETHICS 4 0 0 4

AIM :

To ensure that the required technical knowledge and skills can be learnt .

OBJECTIVES :

i. To create an awareness on Engineering Ethics and Human Values.
ii. To instill Moral and Social Values and Loyalty
iii. To appreciate the rights of Others

UNIT I HUMAN VALUES 9

Morals, Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the three mile island and chernobyl case studies.

Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination.

UNIT V GLOBAL ISSUES 9

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-sample code of Ethics (Specific to a particular Engineering Discipline).

Total = 45

COURSE OUTCOMES

- Understand the ethical theories and concepts
- Understanding an engineer‟s work in the context of its impact on society
- Understand and analyze the concepts of safety and risk
- Understand the professional responsibilities and rights of Engineers

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, "Ethics in engineering", McGraw Hill, New York 1996.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

2. Govindarajan M, Natarajan S, Senthil Kumar V. S, “ Engineering Ethics”, Prentice Hall of India, New Delhi, 2004.

REFERENCE BOOKS

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education/ Prentice Hall, New Jersey, 2004 (Indian Reprint now available)
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, “ Engineering Ethics – Concepts and Cases”, Wadsworth Thompson Leatning, United States, 2000 (Indian Reprint now available)
3. John R Boatright, “ Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, “ Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2001 .

‡†‡‡†‡‡†‡

ELECTIVES-III
SEMESTER-VI

19153E64CP INTEGRATED OPTO-ELECTRONIC DEVICES 3 1 0 4

AIM

To learn different types of optical emission, detection, modulation and opto electronic integrated circuits and their applications.

OBJECTIVE

• To know the basics of solid state physics and understand the nature and characteristics of light.

• To understand different methods of luminescence, display devices and laser types and their applications.

• To understand different light modulation techniques and the concepts and applications of optical switching.

UNIT I: ELEMENTS OF LIGHT AND SOLID STATE PHYSICS 9

Wave nature of light, Polarization, Interference, Diffraction, Light Source, review of Quantum Mechanical concept, Review of Solid State Physics, Review of Semiconductor Physics and Semiconductor Junction Device.

UNIT II: DISPLAY DEVICES AND LASERS 9

Introduction, Photo Luminescence, Cathode Luminescence, Electro Luminescence, Injection Luminescence, Injection Luminescence, LED, Plasma Display, Liquid Crystal Displays, Numeric Displays, Laser Emission, Absorption, Radiation, Population Inversion, Optical Feedback, Threshold condition, Laser Modes, Classes of Lasers, Mode Locking,laserapplications.

UNIT III: OPTICAL DETECTION DEVICES 9

Photo detector, Thermal detector, Photo Devices, Photo Conductors, Photo diodes, Detector Performance.

UNIT IV OPTOELECTRONIC MODULATOR 9

Introduction, Analog and Digital Modulation, Electro-optic modulators, Magneto Optic Devices, Acoustoptic devices, Optical, Switching and Logic Devices.

UNIT V OPTOELECTRONIC INTEGRATED CIRCUITS 9

Introduction, hybrid and Monolithic Integration, Application of Opto Electronic Integrated circuits, integrated transmitters and Receivers, Guided wave devices.

COURSE OUTCOMES

- Ability to understand and analyze Instrumentation systems and their applications to various industries.
- Ability to know the basic properties of laser and to apply for industry.
- Recognize the importance of laser in medicinal and industry applications.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

TEXTBOOK

1. J. Wilson and J.Haukes, “Opto Electronics – An Introduction”, Prentice Hall of India Pvt. Ltd.,NewDelhi,1995.

REFERENCES

1. Bhattacharya “Semiconductor Opto Electronic Devices”, Prentice Hall of India Pvt., Ltd., NewDelhi,1995.
2. Jasprit Singh, “Opto Electronics – As Introduction to materials and devices”, McGraw-Hill International Edition, 1998.

ELECTIVES-III
SEMESTER-VI

19153E64DP -COMPUTER AIDED DESIGN OF ELECTRICAL APPARATUS
3 1 0 4

AIM

To introduce the basics of Computer Aided Design technology for the design of Electrical
Machines.

OBJECTIVE

At the end of this course the student will be able to
Learn the importance of computer aided design method.
Understand the basic electromagnetic field equations and the problem formulation for CAD applications.
Become familiar with Finite Element Method as applicable for Electrical Engineering.
Know the organization of a typical CAD package.
Apply Finite Element Method for the design of different Electrical apparatus.

UNIT I: INTRODUCTION 12

Conventional design procedures – Limitations – Need for field analysis based design – Review of Basic principles of energy conversion – Development of Torque/Force.

UNIT II: MATHEMATICAL FORMULATION OF FIELD PROBLEMS 12

Electromagnetic Field Equations – Magnetic Vector/Scalar potential – Electrical vector /Scalar potential – Stored energy in Electric and Magnetic fields – Capacitance - Inductance- Laplace and Poisson's Equations – Energy functional.

UNIT III: PHILOSOPHY OF FEM 12

Mathematical models – Differential/Integral equations – Finite Difference method – Finite element method – Energy minimization – Variation method- 2D field problems – Discretisation – Shape functions – Stiffness matrix – Solution techniques.

UNIT IV: CAD PACKAGES 12

Elements of a CAD System –Pre-processing – Modeling – Meshing – Material properties- Boundary Conditions – Setting up solution – Post processing.

UNIT V: DESIGN APPLICATIONS 12

Voltage Stress in Insulators – Capacitance calculation - Design of Solenoid Actuator – Inductance and force calculation – Torque calculation in Switched Reluctance Motor.

COURSE OUTCOMES

The students will obtain the knowledge of basic electric and magnetic materials and design of rotating electrical Machines and Transformers.
The students will be able to overall design the machines and transformers.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

The students will gain knowledge about the various types of electrical machines and design of both ac & dc Machines and many application.

TEXT BOOKS

1. S.J Salon, 'Finite Element Analysis of Electrical Machines', Kluwer Academic Publishers, London, 1995.

2. Nicola Bianchi, 'Electrical Machine Analysis using Finite Elements', CRC Taylor& Francis, 2005.

REFERENCES

1. Joao Pedro, A. Bastos and Nelson Sadowski, 'Electromagnetic Modeling by Finite Element Methods', Marcell Dekker Inc., 2003.

2. P.P.Silvester and Ferrari, 'Finite Elements for Electrical Engineers', Cambridge University Press, 1983.

3. D.A.Lowther and P.P Silvester, 'Computer Aided Design in Magnetics', Springer Verlag, New York, 1986.

4. S.R.H.Hoole, 'Computer Aided Analysis and Design of Electromagnetic Devices', Elsevier, New York, 1989.

5. User Manuals of MAGNET, MAXWELL & ANSYS Softwares.

19153E64EP ADVANCED DC-AC POWER CONVERSION 2 0 2 4

AIM

To study advanced DC-AC power conversion technologies

OBJECTIVE

To provide conceptual knowledge in modern power electronic converters and its applications in electric power utility.

UNIT-I TWO-LEVEL VOLTAGE SOURCE INVERTER 9

Introduction **- Sinusoidal PWM** - Modulation Scheme - Harmonic Content – Over-modulation – Third Harmonic Injection PWM - **Space Vector Modulation** - Switching States - Space Vectors - Dwell Time Calculation - Modulation Index - Switching Sequence - Spectrum Analysis - Even-Order Harmonic Elimination - Discontinuous Space Vector Modulation

UNIT-II CASCADED H-BRIDGE (CHB) MULTILEVEL INVERTERS 9

Introduction **- H-Bridge Inverter** - Bipolar Pulse-Width Modulation - Unipolar Pulse-Width Modulation –**Multilevel Inverter Topologies -** CHB Inverter with Equal dc Voltage - H-Bridges with Unequal dc Voltages.

Carrier Based PWM Schemes - Phase-Shifted Multicarrier Modulation - Level-Shifted Multicarrier Modulation - Comparison Between Phase- and Level-Shifted PWM Schemes - Staircase Modulation.

UNIT-III DIODE-CLAMPED MULTILEVEL INVERTERS 9

Introduction **-Three-Level Inverter -** Converter Configuration - Switching State - Commutation - Space Vector Modulation - Stationary Space Vectors - Dwell Time Calculation - Relationship Between *Vref* Location and Dwell Times - Switching Sequence Design -Inverter Output Waveforms and Harmonic Content - Even-Order Harmonic Elimination - **Neutral-Point Voltage Control** - Causes of Neutral-Point Voltage Deviation – Effect of Motoring and Regenerative Operation - Feedback Control of Neutral-Point Voltage

UNIT-IV 9

Other Space Vector Modulation Algorithms - Discontinuous Space Vector Modulation - SVM Based on Two-level Algorithm **High-Level Diode-Clamped Inverters** - Four- and Five-Level Diode-Clamped Inverters - Carrier-Based PWM– **Other Multilevel Voltage Source Inverters – Introduction - NPC/H-Bridge Inverter - Inverter** Topology - Modulation Scheme - Waveforms and Harmonic Content - **Multilevel Flying-Capacitor Inverters** – Inverter Configuration - Modulation Schemes

UNIT-V PWM CURRENT SOURCE INVERTERS 9

Introduction **-** PWM Current Source Inverter - Trapezoidal Modulation - Selective Harmonic Elimination -**Space Vector Modulation** - Switching States - Space Vectors - Dwell Time Calculation - Switching Sequence -Harmonic Content - SVM Versus TPWM and SHE - **Parallel Current Source Inverters** - Inverter Topology -Space Vector Modulation for Parallel Inverters - Effect of Medium Vectors on dc Currents - dc Current Balance Control - Load-Commutated Inverter (LCI) **Total: 45**

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

TEXT/REFERENCE BOOKS:

1. B. Woo, “High Power Converters and AC Drives”, John Wiley & Sons, 2006
2. Ned Mohan et.al , “Power Electronics” ,John Wiley and Sons,2006
3. Rashid, “Power Electronics, Circuits Devices and Applications”, Pearson Education, 3rd edition, 2004.
4. G.K.Dubey, Thyristorised Power Controllers, Wiley Eastern Ltd, 1993.
5. Dewan & Straughen, Power Semiconductor Circuits, John Wiley & Sons, 1975.
6. Cyril W Lander, Power Electronics, Mc Graw Hill, 3rd edition, 1993.

ELECTIVES-IV
SEMESTER-VII

19153E74AP - POWER SYSTEM TRANSIENTS

3 0 0 3

Semester VII

AIM

To understand generation of switching and lighting transients, their propagation, reflection and refraction a on the grid ad their impact on the grid equipment.

OBJECTIVES

i. To study the generation of switching transients and their control using circuit – theoretical concept.
ii. To study the mechanism of lighting strokes and the production of lighting surges.
iii. To study the propagation, reflection and refraction of travelling waves.
iv. To study the impact of voltage transients caused by faults, circuit breaker action, load rejection on integrated power system.

UNIT I INTRODUCTION AND SURVEY 7

Various types of power system transients - effects of transients on power systems.

UNIT II LIGHTNING AND SWITCHING SURGES 19

Electrification of thunder clouds – lightning current surges, parameters – closing and reclosing of lines – load rejection – fault clearing – short line faults – ferro-resonance – temporary over voltages – harmonics.

UNIT III MODELLING OF POWER SYSTEM EQUIPMENT 14

Surge parameters of power systems equipment, equivalent circuit representation, lumped and distributed circuit transients.

UNIT IV COMPUTATION OF TRANSIENT OVERVOLTAGES 14

Computation of transients – traveling wave method, Bewley's lattice diagram – analysis in time and frequency domain, EMTP for transient computation.

UNIT V INSULATION COORDINATION 12

Insulation co-ordination – over voltage protective devises principles of recent co-ordination and design of EHV lines. **Total = 60**

COURSE OUTCOMES

- Ability to understand and analyze power system transients and types of switching transients.
- To get knowledge about lightening transients and high voltage transient behavior travelling on line.
- To get knowledge about transients in integrated power systems.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

TEXT BOOKS

1. Allan Greenwood, 'Electrical Transients in Power Systems', Wiley Inter science, New York, 2nd edition 1991**.**

2. R.D Begamudre, 'Extra High Voltage AC Transmission Engineering', Wiley Eastern Limited, 1986.

REFERENCES

1. Klaus Ragaller, 'Surges in High Voltage Networks', Plenum Press, New York, 1980.

2. Diesengrof, W., 'Overvoltages on High Voltage Systems', Rensealer Bookstore, Troy, New York, 1971.

19153E74BP -EHV AC and DC TRANSMISSION SYSTEMS

3 0 0 3

UNIT I TRANSMISSION ENGINEERING **9**

Transmission line trends – Standard transmission voltages – Power handling capacity and line losses Cost of transmission lines and equipment – Mechanical consideration – Transmission Engineering principles.

UNIT II LINE PARAMETER **9**

Calculation of line and ground parameters - Resistance, capacitance and Inductance calculation – Bundle conductors – modes propagation – Effect of earth.

UNIT III POWER CONTROL **9**

Power frequency and voltage control – voltage control – Over voltages – Power circle diagram – Voltage control using shunt and series compensation – Static VAR compensation – Higher Phase order system – FACTs.

UNIT IV EHV AC Transmission **9**

Design of EHV lines based in steady state limits and transient over voltages – Design of extra HV cable transmission – XLPE cables – Gas insulated cable – Corona and RIV.

UNIT V HVDC TRANSMISSION **9**

HVDC Transmission principles – Comparison of HVAC and HVDC transmission – Economics – types of Converters – HVDC links – HVDC control – Harmonics – Filters – Multi terminal DC System – HVDC cables and HVDC circuit breakers.

Total=45

COURSE OUTCOMES

- Basic knowledge of HVDC Transmission, its components, types and applications
- Ability to analyze and design the Converter circuits, System Control Techniques
- Ability to design filters for harmonic control and perform power flow analysis using Per unit system for DC Quantities.

Reference Books:

1. Rakosh Das Begamudre, ‘Extra HVDC Transmission Engineering’, Wiley Eastern Ltd, 1990.
2. Padiyar K.R., ‘HVDC Power Transmission systems’, Wiley Eastern Ltd, 1993.
3. Allan Greenwood, ‘Electrical transients in power Systems’, John Eastern Ltd, New York, 1992.
4. Arrilaga J., ‘HVDC transmission’, Peter Perengrinus Ltd, London, 1983.

19153E74CP - FIBRE OPTICS AND LASER INSTRUMENTS 3 0 0 3

AIM:

To contribute to the knowledge of Fibre optics and Laser Instrumentation and its Industrial & Medical Application.

OBJECTIVES

i. To expose the students to the basic concepts of optical fibres and their properties.
ii. To provide adequate knowledge about the Industrial applications of optical fibres.
iii. To expose the students to the Laser fundamentals.
iv. To provide adequate knowledge about Industrial application of lasers.
v. To provide adequate knowledge about holography & Medical applications of Lasers.

1. OPTICAL FIBRES AND THEIR PROPERTIES 12

Principles of light propagation through a fibre - Different types of fibres and their properties, fibre characteristics – Absorption losses – Scattering losses – Dispersion – Connectors & splicers – Fibre termination – Optical sources – Optical detectors.

2. INDUSTRIAL APPLICATION OF OPTICAL FIBRES 9

Fibre optic sensors – Fibre optic instrumentation system – Different types of modulators – Interferometric method of measurement of length – Moire fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain.

3. LASER FUNDAMENTALS 9

Fundamental characteristics of lasers – Three level and four level lasers – Properties of laser – Laser modes – Resonator configuration – Q-switching and mode locking – Cavity damping – Types of lasers – Gas lasers, solid lasers, liquid lasers, semiconductor lasers.

4. INDUSTRIAL APPLICATION OF LASERS 6

Laser for measurement of distance, length, velocity, acceleration, current, voltage and Atmospheric effect – Material processing – Laser heating, welding, melting and trimming of material – Removal and vaporization.

5. HOLOGRAM AND MEDICAL APPLICATIONS 9

Holography – Basic principle - Methods – Helographic interferometry and application, Holography for non-destructive testing – Holographic components – Medical applications of lasers, laser and tissue interactive – Laser instruments for surgery, removal of tumours of vocal cards, brain surgery, plastic surgery, gynaecology and oncology. **L= 45 Total = 45**

COURSE OUTCOMES

- Ability to understand and analyze Instrumentation systems and their applications to various industries.
- Ability to know the basic properties of laser and to apply for industry.
- Recognize the importance of laser in medicinal and industry applications.

TEXT BOOKS

1. J.M. Senior, 'Optical Fibre Communication – Principles and Practice', Prentice Hall of India, 1985.
2. J. Wilson and J.F.B. Hawkes, 'Introduction to Opto Electronics', Prentice Hall of India, 2001.

REFERENCE BOOKS

1. Donald J.Sterling Jr, 'Technicians Guide to Fibre Optics', 3rd Edition, Vikas Publishing House, 2000.
2. M. Arumugam, 'Optical Fibre Communication and Sensors', Anuradha Agencies, 2002.
3. John F. Read, 'Industrial Applications of Lasers', Academic Press, 1978.
4. Monte Ross, 'Laser Applications', McGraw Hill, 1968
5. G. Keiser, 'Optical Fibre Communication', McGraw Hill, 1995.
6. Mr. Gupta, 'Fiber Optics Communication', Prentice Hall of India, 2004.

19153E74DP - ADVANCED CONTROL SYSTEMS 3 0 0 3

AIM

To gain knowledge in analysis of non-linear system and digital control of linear system.

OBJECTIVES

i. To study the description and stability of non-linear system.
ii. To study the conventional technique of non-linear system analysis.
iii. To study the analysis discrete time systems using conventional techniques.
iv. To study the analysis of digital control system using state-space formulation.
v. To study the formulation and analysis of multi input multi output (MIMO) system.

UNIT I NON-LINEAR SYSTEM – DESCRIPTION & STABILITY 9

Linear vs non-linear – Examples – Incidental and Intentional – Mathematical description - Equilibria and linearisation - Stability – Lyapunov function – Construction of Lyapunov function.

UNIT II PHASE PLANE AND DESCRIBING FUNCTION ANALYSIS 9

Construction of phase trajectory – Isocline method – Direct or numerical integration – Describing function definition – Computation of amplitude and frequency of oscillation.

UNIT III Z-TRANSFORM AND DIGITAL CONTROL SYSTEM 9

Z transfer function – Block diagram – Signal flow graph – Discrete root locus – Bode plot.

UNIT IV STATE-SPACE DESIGN OF DIGITAL CONTROL SYSTEM 9

State equation – Solutions – Realization – Controllability – Observability – Stability Jury's test.

UNIT V MUTLI INPUT MULTI OUTPUT (MIMO) SYSTEM: 9

Models of MIMO system – Matrix representation – Transfer function representation – Poles and Zeros – Decoupling – Introduction to multivariable Nyquist plot and singular values analysis – Model predictive control. **L = 45 Total = 45**

COURSE OUTCOMES

- Develop mathematical models and understand the mathematical relationships between
- the sensitivity functions and how they govern the fundamentals in control systems.
- Design and fine tune PID controllers and understand the roles of P, I and D in feedback control and develop state-space models
- Advanced filters design for various control applications with proper error estimation techniques.

TEXT BOOKS

1. Benjamin C. Kuo, ‘Digital Control Systems’, Oxford University Press, 1992.
2. George J. Thaler, ‘Automatic Control Systems’, Jaico Publishers, 1993.

REFERENCE BOOKS

1. I.J. Nagrath and M. Gopal, ‘Control Systems Engineering’, New Age International Publishers, 2003.
2. Raymond T. Stefani & Co., ‘Design of feed back Control systems’, Oxford University, 2002.
3. William L. Luyben and Michael L. Luyben, ‘Essentials of Process Control’, McGraw Hill International Editions, Chemical Engineering Series, 1997.

19153E74EP SWITCHED MODE POWER SUPPLIES 2 0 2 4

AIM

To study low power SMPS and UPS technologies

OBJECTIVE

To provide conceptual knowledge in modern power electronic converters and its applications in electric power utility.

UNIT-I Introduction 9

Linear regulator Vs. Switching regulator – Topologies of SMPS – isolated and non isolated topologies – Buck – Boost – Buck boost – Cuk – Polarity inverting topologies – Push pull and forward converters half bridge and full bridge – Fly back converters Voltage fed and current fed topologies. EMI issues.

UNIT-II Design Concepts 9

Magnetic Circuits and design – Transformer design - core selection – winding wire selection – temperature rise calculations - Inductor design. Core loss – copper loss – skin effect - proximity effect. Power semiconductor selection and its drive circuit design – snubber circuits. Closing the feedback loop – Control design – stability considerations

UNIT-III Control Modes 9

Voltage Mode Control of SMPS.. Transfer Function and Frequency response of Error Amp. Transconductance Error Amps. PWM Control ICs (SG 3525,TL 494,MC34060 etc.) Current Mode Control and its advantages. Current Mode Vs Voltage Mode. Current Mode PWM Control IC(eg.UC3842).

UNIT-IV Applications of SMPS 9

Active front end – power factor correction – High frequency power source for fluorescent lamps - power supplies for portable electronic gadgets.

UNIT-V Resonant converters 9

Principle of operation – modes of operation – quasi resonant operation- advantages.

Total : 45

Text/Reference Books:

1. Abraham I Pressman - Switching power supply design – 2nd edition 1998 Mc-Graw hill Publishing Company.
2. Keith H Billings - Switch mode power supply handbook – 1st edition 1989 Mc-Graw hill Publishing Company.
3. Sanjaya Maniktala - Switching power supplies A to Z. – 1st edition 2006, Elsevier Inc.
4. Daniel M Mitchell : DC-DC Switching Regulator Analysis. McGraw Hill Publishing Company
5. Ned Mohan et.al : Power Electronics. John Wiley and Sons.
6. Otmar Kilgenstein : Switched Mode Power Supplies in Practice. John Wiley and Sons.

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

7. Mark J Nave : Power Line Filter Design for Switched-Mode Power Supplies. Van Nostrand Reinhold, New York.

19153P75P Project Work

- The student will use their ability to design electrical, electronic systems and signals through modeling, simulation, experimentation, interpretation and analysis to build, test, and debug prototype circuits and systems and analyze results using the principles of design to solve open-ended engineering problems.
- The students will be able to take professional decisions based on the impact of socio- economic issues by their self-confidence, a high degree of personal integrity, and the belief that they can each make a difference by developing persuasive communication skills in a variety of media by engaging them in team-based activities, and by strengthening their interpersonal skills. This will lead to develop the leadership qualities by making the students to identify their personal values and demonstrate the practice of ethical leadership.
- The students will be able to appreciate the importance of optimization, commercialization, and innovation as the desired features of the designed system

PONNAIYAH RAMAJAYAM INSTITUTE OF SCIENCE & TECHNOLOGY (PRIST)

Declared as DEEMED-TO-BE-UNIVERSITY
U/s 3 of UGC Act, 1956

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

PROGRAM HANDBOOK

B.Tech PART TIME

[Regulation2022]

[for candidates admitted to B.Tech EEE program from June2022 onwards]

COURSE STRUCTURE

B.TECH PT
EEE
R 2022

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

B. Tech (PT) EEE R 22

SEMESTER I

Sl. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22148S11P	Transforms and Partial Differential Equations	3	1	0	4
2	22153C12P	Control System	3	1	0	4
3	22153C13P	Circuit Theory	3	1	0	4
4	22153C14P	Electronic circuits	3	0	0	3
5	22153C15P	Electrical Machines-I	4	0	0	4
Total No of Credits						**19**

SEMESTER II

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22148S21P	Numerical Methods	3	1	0	4
2	22153C22P	Optimization Techniques	3	0	0	3
3	22153C23P	Electrical Machines-II	3	1	0	4
4	22153C24P	Digital Electronics	3	1	0	4
5	22153C25P	Transmission and Distribution	4	0	0	4
Total No of Credits						**19**

SEMESTER III

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22148S31CP	Probability and Statistics	3	1	0	4
2	22153C32P	Linear Integrated Circuits and Applications	3	1	0	4
3	22153C33P	Power Electronics	4	0	0	4
4	22153C34P	Measurements and Instrumentation	4	0	0	4
5	22153L35P	DC and AC Electrical Machines Laboratory	0	0	3	2
Total No of Credits						**20**

SEMESTER IV

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22153C41P	Protection and switchgear	4	0	0	4
2	22153C42P	High Voltage DC Transmission	3	1	0	4
3	22153C43P	Solid State Drives	3	1	0	4
4	22153E44_P	Elective –I	4	0	0	4
5	22153L45P	Control and Instrumentation Laboratory	0	0	3	2
Total No of Credits						**18**

SEMESTER V

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22153C51P	Power System Analysis	3	1	0	4
2	22153C52P	Power Quality	3	1	0	4
3	22153C53P	Special Electrical Machines	4	0	0	4
4	22153E54_P	Elective –II	4	0	0	4
5	22153L55P	Power Electronics and Drives Lab	0	0	3	2
Total No of Credits						**18**

SEMESTER VI

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22153C61P	Utilization of Electrical Energy	3	1	0	4
2	22153C62P	Solid State Relays	4	0	0	4
3	22153C63P	Power System Operation and Control	4	0	0	4
4	22153E64_P	Elective –III	4	0	0	4
5	22153L65P	Power Systems Lab	0	0	3	2
Total No of Credits						**18**

SEMESTER VII

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22160S71P	Total Quality Management	3	0	0	3
2	22153C72P	Electrical Machine Design	3	1	0	4
3	22153C73P	Power Plant Engineering	4	0	0	4
4	22153E74_P	Elective –IV	3	0	0	3
5	22153P75P	Project Work	0	0	12	6
Total No of Credits						**20**

LIST OF ELECTIVES

ELECTIVE –I (IV SEMESTER)

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22153E44AP	Circuit Theory	4	0	0	4
2	22153E44BP	Fuzzy Logic and its Applications	4	0	0	4
3	22153E44CP	Deep learning	4	0	0	4
4	22153E44DP	Modeling and Simulation of Solar Energy Systems	4	0	0	4
5	22153E44EP	Electronics equipment integration and prototype building	4	0	0	4

ELECTIVE –II (V SEMESTER)

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22153E54AP	Environmental Science and Engineering	4	0	0	4
2	22153E54BP	Artificial Neural Networks	4	0	0	4
3	22153E54CP	VLSI Design	4	0	0	4
4	22153E54DP	Micro sensor	4	0	0	4
5	22153E54EP	Fundamentals of Power Electronics	4	0	0	4

ELECTIVE –III (VI SEMESTER)

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22153E64AP	PrinciplesofManagement	4	0	0	4
2	22153E64BP	MicroElectroMechanical Systems	4	0	0	4
3	22153E64CP	Integratedopto-Electronic Devices	4	0	0	4
4	22153E64DP	Control engineering	4	0	0	4
5	22153E64EP	Linear dynamic systems	4	0	0	4

ELECTIVE –IV (VII SEMESTER)

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	22153E74AP	Power system transients	3	0	0	3
2	22153E74BP	EHV AC and DC Transmission systems	3	0	0	3
3	22153E74CP	Fundamentals of Nanoscience	3	0	0	3
4	22153E74DP	Advanced Control systems	3	0	0	3
5	22153E74EP	Microwave integrated circuits	3	0	0	3

HOD **DEAN**

DEAN ACADEMIC AFFAIRS

22148S11P-TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

3 1 0 4

(Common to all) **SEMESTER-1**

UNIT I FOURIER SERIES 9 + 3hrs

Periodic function-Graph of functions- Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval's identity – Harmonic Analysis.

UNIT II FOURIER TRANSFORM 9 + 3hrs

Fourier integral theorem (without proof) – Sine and Cosine transforms – Properties (without Proof) – Transforms of simple functions – Convolution theorem – Parseval's identity – Finite Fourier transform, Sine and Cosine transform.

UNIT III Z -TRANSFORM AND DIFFERENCE EQUATIONS 9 + 3hrs

Z-transform - Elementary properties (without proof) – Inverse Z – transform – Convolution theorem -Formation of difference equations – Solution of difference equations using Z –transform- Sampling of signals –an introduction.

UNIT IV PARTIAL DIFFERENTIAL EQUATIONS 9 + 3hrs

Formation of pde –solution of standard type first order equation- Lagrange's linear equation – Linear partial differential equations of second order and higher order with Constant coefficients.

UNIT V BOUNDARY VALUE PROBLEMS 9 + 3hrs

Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two-dimensional heat equation (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates. **Total no of hrs: 60hrs**

COURSE OUTCOMES

- Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
- Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
- Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

TEXT BOOKS

1. Andrews, L.A., and Shivamoggi B.K., “Integral Transforms for Engineers and Applied

   Mathematicians”, Macmillen , New York ,2288.
2. Grewal, B.S., “Higher Engineering Mathematics”, Thirty Sixth Edition, Khanna Publishers,

   Delhi, 2001.
3. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., “Engineering Mathematics Volume

   III”, S. Chand & Company ltd., New Delhi, 1996.

REFERENCE BOOKS

1. Narayanan, S., Manicavachagom Pillay, T.K. and Ramanaiah, G., “Advanced Mathematics for Engineering Students”, Volumes II and III, S. Viswanathan (Printers and Publishers) Pvt. Ltd. Chennai, 2002.
2. Churchill, R.V. and Brown, J.W., “Fourier Series and Boundary Value Problems”, Fourth Edition, McGraw-Hill Book Co., Singapore, 1987.
3. Advanced Modern Engineering mathematics – Glyn James

22153C12P- CONTROL SYSTEM 3 1 0 4

SEMESTER-1

AIM

To provide sound knowledge in the basic concepts of linear control theory and design of control system.

OBJECTIVES

i. To understand the methods of representation of systems and getting their transfer function models.
ii. To provide adequate knowledge in the time response of systems and steady state error analysis.
iii. To give basic knowledge is obtaining the open loop and closed–loop frequency responses of systems.
iv. To understand the concept of stability of control system and methods of stability analysis.
v. To study the three ways of designing compensation for a control system.

UNIT I: INTRODUCTION 12

Open-loop and closed –loop systems, servomechanisms and regulator systems; Transfer function; Block diagram reduction, Signal flow graphs.

UNIT II: MATHEMATICAL MODELS OF PHYSICAL SYSTEMS 12

Mechanical systems - Translational and Rotational systems, Gear trains, Electrical systems, Thermal systems and Fluid systems.

Components of feedback control systems - Potentiometers as error sensing devices, Synch, Servomotors, Stepper motors, Tachogenerators.

UNIT III: STABILITY 12

Concept of Stability, necessary and sufficient conditions of Stability, Closed-loop systems, merits and demerits, Routh-Hurwitz Criterion.

Transient Response: Typical inputs, convolution integral, Time domain specifications, steady state errors.

State equation – Solutions – Realization – Controllability – Observability – Stability Jury's test.

UNIT IV: FREQUENCY RESPONSE 12

Definition, equivalence between transient response and frequency response, Bode plots.

Nyquist Stability Criterion: Development of criterion, gain and phase margins, m- circles and Nichol's chart.

UNIT V: ROOT LOCUS METHOD 12

Rules for sketching of root loci, Root contours.

Synthesis: Lag and Lead networks, proportional, derivative and integral controllers.

MUTLI INPUT MULTI OUTPUT (MIMO) SYSTEM:

Models of MIMO system – Matrix representation – Transfer function representation – Poles and Zeros – Decoupling – Introduction to multivariable Nyquist plot and singular values analysis – Model predictive control.

Total = 60

COURSE OUTCOMES

At the end of the course, the student should have the :

- Ability to develop various representations of system based on the knowledge of
- Mathematics, Science and Engineering fundamentals.
- Ability to do time domain and frequency domain analysis of various models of linear system.
- Ability to interpret characteristics of the system to develop mathematical model.
- Ability to design appropriate compensator for the given specifications.
- Ability to come out with solution for complex control problem.
- Ability to understand use of PID controller in closed loop system.

TEXT BOOK:

1. I.J.Nagrath and M.Gopal, ‘Control System Engineering’, Wiley Eastern Ltd., Reprint 1995.

REFERENCES:

1. M.Gopal, ‘Control System Principles and Design’, Tata McGraw Hill, 1998.
2. Ogatta, ‘Modern Control Engineering’, Tata McGraw Hill 1997.

22153C13P- CIRCUIT THEORY

3 1 0 3
SEMESTER-1

AIM

To know about basic analysis and synthesis techniques used in electronics and communications.

OBJECTIVES

- To introduce electric circuits and its analysis
- To impart knowledge on solving circuits using network theorems
- To introduce the phenomenon of resonance in coupled circuits.
- To educate on obtaining the transient response of circuits.
- To Phasor diagrams and analysis of three phase circuits

UNIT-I BASIC CIRCUITS ANALYSIS (9)

Ohm's Law – Kirchoffs laws – DC and AC Circuits – Resistors in series and parallel circuits – Mesh current and node voltage method of analysis for D.C and A.C. circuits – Phasor Diagram – Power, Power Factor and Energy.

UNIT-II NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS (9)

Network reduction: voltage and current division, source transformation – star delta conversion. Thevenins and Novton & Theorem – Superposition Theorem – Maximum power transfer theorem –Reciprocity Theorem..

UNIT-III RESONANCE AND COUPLED CIRCUITS (9)

Series and paralled resonance – their frequency response – Quality factor and Bandwidth - Self andmutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

UNIT-IV TRANSIENT RESPONSE FOR DC CIRCUITS (9hrs)

Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input – Characterization of two port networks in terms of Z,Y and h parameters.

UNIT-V THREE PHASE CIRCUITS (9hrs)

Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits.

TOTAL 45

COURSE OUTCOMES

- Ability analyse electrical circuits
- Ability to apply circuit theorems
- Ability to analyse AC and DC Circuits

TEXT BOOKS:

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers,6 th edition, New Delhi, 2003.

2. Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, Tata McGraw-Hill, New Delhi, 2001.

REFERENCES:

1. Paranjothi SR, "Electric Circuits Analysis," New Age International Ltd., New Delhi, 1996.

2. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", Tata McGraw Hill, 2007.

3. Chakrabati A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, 1999.

4. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, 2003.

22153C14P - ELECTRONIC CIRCUITS

3 0 0 3
SEMESTER-1

AIM:
To study the characteristics and applications of electronic devices.
OBJECTIVES:

- To acquaint the students with construction, theory and characteristics of the following electronic devices:
- Bipolar transistor, Field Effect transistor, Multivibrators, Power control/regulator devices, Feedback amplifiers and oscillators

UNIT I -RECTIFIER & POWER SUPPLY 12
Half & Full wave rectifier – filters – shunt , inductor, LC section & Ripple factor, P calculation for C, L and LC filters – Voltage regulators – Zener –Series voltage regulator – SMPS.
UNIT II- AMPLIFIERS 12
Amplifiers – Frequency response of RC coupled - Frequency Response of Emitter follower, gain band width product – FET amplifier at low and high frequency cascaded amplifiers.
UNIT III- FEEDBACK AMPLIFER & OSCILLATORS 12
Four basic types of feedback – effect of feedback on amplifier performance – condition for oscillation – Barkhunsen criteria – LC oscillators – Hartley & Colpitts – RC oscillators – Wein bridge, RC phase shift crystal oscillator.
UNIT IV- MULTIVIBRATORS 12
Collector coupled & Emitter coupled Astable multivibrator – Monostable, Bistable multivibrator – triggering methods – Storage delay and calculation of switching time – Schmitt triggering circuits – Speed up capacitor in switching.
UNIT V- POWER AMPLIFIER 12
Classification – class A, B, C & AB – Class B push pull – Class B Complimentary – symmetry – Class S, Power sections classification – Efficiency – Distortion in amplifiers.

L = 45 T = 15 P = 0 TOTAL =60

<u>COURSE OUTCOMES</u>

- Upon Completion of the course, the students will be ability to:
- Explain the structure and working operation of basic electronic devices.
- Able to identify and differentiate both active and passive elements
- Analyze the characteristics of different electronic devices such as diodes and transistors
- Choose and adapt the required components to construct an amplifier circuit. Employ the acquired knowledge in design and analysis of oscillators

REFERENCE BOOKS:
1. David.A.Bell, "Solid State Pulse Circuits", Prentice Hall of India, 4th Edition, 2001.
2. Millman Taub.H, "Pulse Digital & Switching waveform", Tata McGRaw Hill International 2001.
3. Jacob Millman Cristas C.Halkias, "Integrated Electronics", Tat Mc Graw Hill, Edition 1991.

22153C15P- ELECTRICAL MACHINES – I 4 0 0 4

AIM **SEMESTER-1**

To expose the students to the concepts of electromechanical energy conversions in D.C. Machines and energy transfer in transformers and to analyze their performance.

OBJECTIVES

i. To introduce the concept of rotating machines and the principle of electromechanical energy conversion in single and multiple excited systems.
ii. To understand the generation of D.C. voltages by using different type of generators and study their performance.
iii. To study the working principles of D.C. motors and their load characteristics, starting and methods of speed control.
iv. To familiarize with the constructional details of different type of transformers, working principle and their performance.
v. To estimate the various losses taking place in D.C. machines and transformers and to study the different testing method to arrive at their performance.

UNIT I: BASIC PRINCIPLES OF ROTATING MACHINES 12

Electrical machine types – Magnetic circuits – Magnetically induced EMF and force – AC operation of magnetic circuits - core losses. Principles of Electromechanical energy conversion: Energy conversion process – Energy in magnetic system – Field energy and mechanical force – Multiply excited magnetic field systems

UNIT II: GENERATORS 12

Constructional details – emf equation – Methods of excitation – Self and separately excited generators – Characteristics of series, shunt and compound generators – Armature reaction and commutation – Parallel operation of DC shunt and compound generators.

UNIT III: DC MOTORS 12

Principle of operation – Back emf and torque equation – Characteristics of series, shunt and compound motors – Starting of DC motors – Types of starters – Speed control of DC series and shunt motors.

UNIT IV: TRANSFORMERS 12

Constructional details of core and shell type transformers – Types of windings – Principle of operation – emf equation – Transformation ratio - Equivalent circuit – Losses –Testing – Efficiency and Voltage regulation . Transformer on load– Parallel operation of single phase transformers – Auto transformer – Three phase transformers

UNIT V: TESTING OF TRANSFORMERS AND DC MACHINES 12

Losses and efficiency in DC machines and transformers – Condition for maximum efficiency – Testing of DC machines – Brake test, Swinburne's test, Retardation test and Hopkinson's test – Testing of transformers – Polarity test, load test, open circuit and short circuit tests – All day efficiency.

TOTAL = 60

COURSE OUTCOMES

- Ability to analyze the magnetic-circuits.
- Ability to acquire the knowledge in constructional details of transformers. Ability to understand the concepts of electromechanical energy conversion. Ability to acquire the knowledge in working principles of DC Generator.
- Ability to acquire the knowledge in working principles of DC Motor
- Ability to acquire the knowledge in various losses taking place in D.C. Machines

TEXT BOOKS

1. D.P. Kothari and I.J. Nagrath, 'Electric Machines', Tata McGraw Hill Publishing Company Ltd, 2002.
2. P.S. Bimbhra, 'Electrical Machinery', Khanna Publishers, 2003.

REFERENCE BOOKS

1. A.E. Fitzgerald, Charles Kingsley, Stephen.D.Umans, 'Electric Machinery', Tata McGraw Hill publishing Company Ltd, 2003.

2. J .B.Gupta, 'Theory and Performance of Electrical Machines', S.K.Kataria and Sons, 2002.

3. K. Murugesh Kumar, 'Electric Machines', Vikas publishing house Pvt Ltd, 2002.

4. V.K.Mehta and Rohit Mehta, 'Principles of Power System', S.Chand and Company Ltd, third edition, 2003.

22148S21P-NUMERICAL METHODS

3 1 0 4
Semester II

UNIT I - SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS
9+3hrs

Solution of equations–Newton Raphson's method, Regula-falsi methods Solution of linear System of equations by Gaussian elimination and Gauss-Jordon methods- Iterative methods: Gauss Jacobi and Gauss-Seidel methods– Eigenvalue of a matrix by power method.

UNIT II- INTERPOLATION 9+3hrs

Newton's forward and backward difference formulas – Central difference formula: Bessels and Stirling's formula - Lagrangian Polynomials – Divided difference method.

UNIT III- NUMERICAL DIFFERENTIATION AND INTEGRATION
9+3hrs

Derivatives from difference tables – Divided differences and finite differences – Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Double integrals using trapezoidal and Simpson's rules.

UNIT IV - INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9+3hrs

Single step methods: Taylor series method – Euler and modified Euler methods – Fourth order Runge – Kutta method for solving first and second order equations – Multistep methods: Milne's and Adam's predictor and corrector methods.

UNIT V - BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9+3hrs

Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations.

Total no of hrs: 60hrs

COURSE OUTCOMES

- Understand the basic concepts and techniques of solving algebraic equations.
- Appreciate the numerical techniques of interpolation and error approximations in various intervals in real life situations.
- Apply the numerical techniques of differentiation and integration for engineering problems.
- Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.

TEXT BOOKS

1. Gerald, C.F, and Wheatley, P.O, "Applied Numerical Analysis", Sixth Edition, Pearson Education Asia, New Delhi, 2002.
2. Kandasamy, P., Thilagavathy, K. and Gunavathy, K., "Numerical Methods", S.Chand Co. Ltd., New Delhi, 2003.

REFERENCES BOOKS

1. Burden, R.L and Faires, T.D., "Numerical Analysis", Seventh Edition, Thomson Asia Pvt. Ltd., Singapore, 2002.
2. Balagurusamy, E., "Numerical Methods", Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 1999.

22153C22P - OPTIMISATION TECHNIQUES

3 0 0 3
SEMESTER II

AIM:
To understand the architecture of different optimization techniques and its applications
OBJECTIVES:
To provide a clear understanding of

- To introduce the basic concepts of linear programming
- To educate on the advancements in Linear programming techniques
- To introduce non-linear programming techniques
- To introduce the interior point methods of solving problems
- To introduce the dynamic programming method

UNIT I LINEAR PROGRAMMING 9
Introduction - formulation of linear programming model-Graphical solution–solving LPP using simplex algorithm – Revised Simplex Method
UNIT II ADVANCES IN LPP 9
Dualit theory- Dual simplex method - Sensitivity analysis-–Transportation problems–Assignment problems-Traveling sales man problem -Data Envelopment Analysis..

UNIT III NON LINEAR PROGRAMMING 9
Classification of Non Linear programming – Lagrange multiplier method – Karush – Kuhn Tucker conditions–Reduced gradient algorithms–Quadratic programming method – Penalty and Barrier method.
UNIT IV INTERIOR POINT METHODS 9
Karmarkar's algorithm–Projection Scaling method–Dual affine algorithm–Primal affine algorithm Barrier algorithm.
UNIT V DYNAMIC PROGRAMMING 9
Formulation of Multi stage decision problem–Characteristics–Concept of sub-optimization and the principle of optimality–Formulation of Dynamic programming–Backward and Forward recursion– Computational procedure–Conversion offinal value problem in to Initial value problem.

TOTAL: 45 PERIODS

COURSE OUTCOMES

- To understand ethical issues, environmental impact and acquire management skills.

TEXT BOOKS:
1. Hillier and Lieberman "Introduction to Operations Research", TMH, 2000.
2. R.Panneerselvam, "Operations Research", PHI, 2006.
3. Hamdy ATaha, "Operations Research –An Introduction", Prentice Hall India, 2003.

REFERENCES:
1. Philips, Ravindran and Solberg, "Operations Research", John Wiley, 2002.
2. Ronald L.Rardin, "Optimization in Operation Research" Pearson Education Pvt. Ltd. New Delhi, 2005.

Semester II

22153C23P-ELECTRICAL MACHINES-II

3 1 0 4

AIM:
To expose the students to the concepts of synchronous and asynchronous machines and analyze their performance.

OBJECTIVES:
To impart knowledge on

i. Construction and performance of salient and non – salient type synchronous generators.
ii. Principle of operation and performance of synchronous motor.
iii. Construction, principle of operation and performance of induction machines.
iv. Starting and speed control of three-phase induction motors.
v. Construction, principle of operation and performance of single phase induction motors and special machines.

UNIT I: SYNCHRONOUS GENERATOR 12
Constructional details – Types of rotors – emf equation – Synchronous reactance – Armature reaction – Voltage regulation – e.m.f, m.m.f, z.p.f and A.S.A methods – Synchronizing and parallel operation – Synchronizing torque - Change of excitation and mechanical input – Two reaction theory – Determination of direct and quadrature axis synchronous reactance using slip test – Operating characteristics - Capability curves.

UNIT II: SYNCHRONOUS MOTOR 12
Principle of operation – Torque equation – Operation on infinite bus bars - V-curves – Power input and power developed equations – Starting methods – Current loci for constant power input, constant excitation and constant power developed.

UNIT III: THREE PHASE INDUCTION MOTOR 12
Constructional details – Types of rotors – Principle of operation – Slip – Equivalent circuit – Slip-torque characteristics - Condition for maximum torque – Losses and efficiency – Load test - No load and blocked rotor tests - Circle diagram – Separation of no load losses – Double cage rotors

UNIT IV: STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR 12
Need for starting – Types of starters – Stator resistance and reactance, rotor resistance, autotransformer and star-delta starters – Speed control – Change of voltage, torque, number of poles and slip – Cascaded connection – Slip power recovery scheme.

UNIT V: SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINE 12

Constructional details of single phase induction motor – Double revolving field theory and operation – Equivalent circuit – No load and blocked rotor test — Starting methods of single-phase induction motors - Special machines - Shaded pole induction motor, reluctance motor, repulsion motor, hysteresis motor, stepper motor and AC series motor.

Total = 60

COURSE OUTCOMES

Ability to understand the construction and working principle of Synchronous Generator

- Ability to understand MMF curves and armature windings.
- Ability to acquire knowledge on Synchronous motor.
- Ability to understand the construction and working principle of Three phase Induction Motor
- Ability to understand the construction and working principle of Special Machines
- Ability to predetermine the performance characteristics of Synchronous Machines.

TEXT BOOKS

1. D.P. Kothari and I.J. Nagrath, ‘Electric Machines’, Tata McGraw Hill Publishing Company Ltd, 2002.
2. P.S. Bhimbhra, ‘Electrical Machinery’, Khanna Publishers, 2003.*REFERENCE BOOKS*

1. A.E. Fitzgerald, Charles Kingsley, Stephen.D.Umans, ‘Electric Machinery’, Tata McGraw Hill publishing Company Ltd, 2003.
2. J.B. Gupta, ‘Theory and Performance of Electrical Machines’, S.K.Kataria and Sons, 2002.
3. K. Murugesh Kumar, ‘Electric Machines’, Vikas publishing house Pvt Ltd, 2002.
4. Sheila.C.Haran, ‘Synchronous, Induction and Special Machines’, Scitech Publications, 2001.

semester II

22153C24P-DIGITAL ELECTRONICS

3 1 0 4

AIM:
To introduce the fundamentals of Digital Circuits, combinational and sequential circuit.

OBJECTIVES:

i. To study various number systems and to simplify the mathematical expressions using Boolean functions simple problems.
ii. To study implementation of combinational circuits
iii. To study the design of various synchronous and asynchronous circuits.
iv. To expose the students to various memory devices.

UNIT I NUMBER SYSTEMS

12

Review of Binary, Octal and Hexa-decimal number systems – Conversions, Binary Arithmetic magnitude form – 1's, 2's complement representation, Codes: -BCD, Excess – 3, Graycode, ASCII codes, Error detecting codes (Hamming code)

UNIT II BOOLEAN ALGEBRA

12

Boolean Algebra - De Morgan's law – Simplifications of Boolean expression – sum of Products and product of sums – Karnaugh Map – Quince McClusky method of simplification (Including Don't care conditions)

UNIT III Combinational Logic

12

Design of Logic gates- Design of adder, subtractor, comparators, code converters, encoders, decoders, multiplexers and demultiplexers. Function realization using gates & multiplexers.

UNIT IV Sequential Logic Design

12

Building blocks of Sequential logic – RS, JK, Master – Slave, D and T flip- flop, Asynchronous and synchronous counters – Binary and BCD counters – shift registers – Design and Implementation of Sequential synchronous circuits

UNIT V Logic Families

12

Memories: ROM, PROM, EPROM, PLA, PLD, FPGA, digital logic families: TTL, ECL, CMOS.

TOTAL = 60Hrs

COURSE OUTCOMES

- Ability to design combinational and sequential Circuits.
- Ability to simulate using software package.
- Ability to study various number systems and simplify the logical expressions using
- Boolean functions
- Ability to design various synchronous and asynchronous circuits.
- Ability to introduce asynchronous sequential circuits and PLDs
- Ability to introduce digital simulation for development of application oriented logic circuits.

TEXT BOOK:

1. Albert Paul, Malvino and Donald.P.Leach , "Digital Principles and Applications", McGraw Hill Publications.
2. Floyd, "Digital Fundamentals", Universal Book Stall, New Delhi,1993.
3. Moris Mano, "Digital Electronics and Design ", Prentice Hall of India, 2000.

REFERENCE:

1. "Digital Logic & Computer Design", Prentice Hall of India, 2000.

22153C25P-TRANSMISSION AND DISTRIBUTION 4 0 0 4

Semester II

AIM

To become familiar with the function of different components used in Transmission and Distribution levels of power systems and modeling of these components.

OBJECTIVES

i. To develop expression for computation of fundamental parameters of lines.
ii. To categorize the lines into different classes and develop equivalent circuits for these classes.
iii. To analyze the voltage distribution in insulator strings and cables and methods to improve the same.

UNIT I: INTRODUCTION 12

Structure of electric power system: Various levels such as generation, transmission and distribution; HVDC and EHV AC transmission: comparison of economics of transmission, technical performance and reliability.

Radial and ring-main distributors; interconnections; AC distribution: AC distributor with concentrated load; three-phase, four-wire distribution system; sub-mains; stepped and tapered mains.

UNITII:TRANSMISSION LINE PARAMETERS 12

Resistance, Inductance and Capacitance of single and three phase transmission lines - Stranded and Bundled conductors -Symmetrical and unsymmetrical spacing - Transposition -Application of self and mutual GMD -Skin and Proximity effect - Inductive interference with neighboring circuits.

UNIT III: MODELLING AND PERFORMANCE OF TRANSMISSION LINES 12

Classification of lines: Short line, medium line and long line; equivalent circuits, attenuation constant, phase constant, surge impedance; transmission efficiency and voltage regulation; real and reactive power flow in lines: Power-angle diagram; surge-impedance loading, loadability limits based on thermal loading, angle and voltage stability considerations; shunt and series compensation; Ferranti effect and corona loss.

UNIT IV: INSULATORS AND CABLES 12

Insulators: Types, voltage distribution in insulator string and grading, improvement of string efficiency. Underground cables: Constructional features of LT and HT cables, capacitance, dielectric stress and grading, thermal characteristics.

UNIT V: DESIGN OF TRANSMISSION LINES 12

Introduction, calculation of sag and tension .Equivalent span length and sag, Effect of ice and wind loading ,Stringing chart, sag template, conductor vibrations and vibrations dampers

TOTAL =60

COURSE OUTCOMES

To understand the importance and the functioning of transmission line parameters.

- To understand the concepts of Lines and Insulators.
- To acquire knowledge on the performance of Transmission lines.
- To acquire knowledge on Underground Cabilitys

TEXT BOOKS

1. B.R.Gupta, 'Power System Analysis and Design', S.Chand, New Delhi, 2003.
2. S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall of India Pvt. Ltd, New Delhi, 2002.

REFERENCE BOOKS

1. Luces M.Fualkenberry ,Walter Coffer, 'Electrical Power Distribution and Transmission', Pearson Education, 1996.
2. Hadi Saadat, 'Power System Analysis,' Tata McGraw Hill Publishing Company', 2003.
3.Central Electricity Authority (CEA), 'Guidelines for Transmission System Planning', New Delhi.
4.'Tamil Nadu Electricity Board Handbook', 2003.

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22148S31CP - PROBABILITY AND STATISTICS 3 1 0 4

(Common to Mech, Civil, EEE)

SEMESTER-III

UNIT I PROBABILITY AND RANDOM VARIABLE 9+3hrs

Axioms of probability - Conditional probability - Total probability - Bayes theorem - Random variable - Probability mass function - Probability density functions -Properties- Moments - Moment generating functions and their properties.

UNIT II TWO DIMENSIONAL RANDOM VARIABLES 9+3hrs

Joint distributions - Marginal and conditional distributions – Covariance - Correlation and Regression - Transformation of random variables - Central limit theorem.

UNIT III STANDARD DISTRIBUTIONS 9+3hrs

Binomial, Poisson, Geometric, Negative Binomial, Uniform, Exponential, Gamma, Weibull and Normal distributions and their properties - Functions of a random variable.

UNIT IV TESTING OF HYPOTHESIS 9+3hrs

Sampling distributions – Testing of hypothesis for mean, variance, proportions and differences using Normal, t, Chi-square and F distributions - Tests for independence of attributes and Goodness of fit.

UNIT V DESIGN OF EXPERIMENTS 9+3hrs

Analysis of variance – One way classification – Complete randomized design - Two – way classification –Randomized block design - Latin square.

Note : Use of approved statistical table permitted in **Total no of hrs: 60hrs**

COURSE OUTCOMES

- Eigenvalues and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.
- Gradient, divergence and curl of a vector point function and related identities.
- Evaluation of line, surface and volume integrals using Gauss, Stokes and

Green's theorems and their verification.

- Analytic functions, conformal mapping and complex integration.
- Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients

TEXT BOOKS

1. Ross. S., "A first Course in Probability", Fifth Edition, Pearson Education, Delhi 2002. (Chapters 2 to 8)
2. Johnson. R. A., "Miller & Freund's Probability and Statistics for Engineers", Sixth Edition, Pearson Education, Delhi, 2000. (Chapters 7, 8, 9, 12)

REFERENCES BOOKS

1) Walpole, R. E., Myers, R. H. Myers R. S. L. and Ye. K, "Probability and Statistics for Engineers and Scientists", Seventh Edition, Pearsons Education, Delhi, 2002.
2) Lipschutz. S and Schiller. J, "Schaum's outlines - Introduction to Probability and Statistics", McGraw-Hill, New Delhi, 1998.
3) Gupta, S.C, and Kapur, J.N., "Fundamentals of Mathematical Statistics", Sultan Chand, Ninth Edition , New Delhi ,1996.

Semester III

22153C32P- LINEAR INTEGRATED CIRCUITS AND APPLICATIONS

3 1 0 4

AIM

To introduce the concepts for realizing functional building blocks in ICs, fabrications & application of ICs.

OBJECTIVES

- To study the IC fabrication procedure.
- To study characteristics; realize circuits; design for signal analysis using
- To study the applications of Op-amp.
- To study internal functional blocks and the applications of special ICs like circuits, regulator Circuits, ADCs.

UNIT I: IC FABRICATION 9

IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realisation of monolithic ICs and packaging. Fabrication of diodes, capacitance, resistance and FETs.

UNIT II: CHARACTERISTICS OF OPAMP 9

Ideal OP-AMP characteristics, DC characteristics, AC characteristics,, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – Inverting and Non-inverting Amplifiers-V/I & I/V converters ,summer, differentiator and integrator.

UNIT III: APPLICATIONS OF OPAMP 9

Instrumentation amplifier, Log and Antilog Amplifiers, first and second order active filters, comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R- 2R ladder and weighted resistor types), A/D converters using opamps.

UNIT IV: SPECIAL ICs 9

Functional block, characteristics & application circuits with 555 Timer Ic-566 voltage controlled oscillator Ic; 565-phase lock loop Ic ,Analog multiplier ICs.

UNIT V: APPLICATION ICs

IC voltage regulators –LM78XX,79XX Fixed voltage regulators - LM317, 723 Variable voltage regulators, switching regulator- SMPS- LM 380 power amplifier- ICL 8038 function generator IC.

TOTAL = 45

COURSE OUTCOMES

- Ability to understand and analyse, linear and digital electronic circuits.

TEXT BOOKS

1. David A.Bell, 'Op-amp & Linear ICs', Oxford, 2013.
2. D.Roy Choudhary, Sheil B.Jani, 'Linear Integrated Circuits', II edition, New Age, 2003.
3. Ramakant A.Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, 2003 / PHI. 2000.

REFERENCE BOOKS

1. Fiore,"Opamps & Linear Integrated Circuits Concepts & Applications",Cengage,2010.
2. Floyd ,Buchla,"Fundamentals of Analog Circuits, Pearson, 2013.
3. Jacob Millman, Christos C.Halkias, 'Integrated Electronics - Analog and Digital circuits system',Tata McGraw Hill, 2003.
4. Robert F.Coughlin, Fredrick F. Driscoll, 'Op-amp and Linear ICs', PHI Learning, 6th edition,2012.

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SEMESTER-III

22153C33P - POWER ELECTRONICS 4 0 0 4

AIM:

To understand the various applications of electronic devices for conversion, control and conditioning of the electrical power.

OBJECTIVES:

- To get an overview of different types of power semiconductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers
- To study the operation, switching techniques and basics topologies of DC-DC switching regulators.
- To learn the different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
- To study the operation of AC voltage controller and Matrix converters.

UNIT I- POWER SEMI-CONDUCTOR DEVICES : 12

Overview of switching devices – Driver and snubber circuit of SCR TRIAC, GTO, GBT, MOSFET – Computer simulation of PE circuits.

UNIT II-PHASE CONTROLLED CONVERTERS 12

2 pulse / 3 pulse and 6 pulse converters – Effect of source inductance – performance parameters – Reactive power control of converters – Dual converters.

UNIT III -DC TO DC CONVERTERS 12

Stepdown and stepup chopper – Forced commutation techniques – Time ratio control and current limit control – Switching mode regulators Buck, Boost, Buck-Boost – concept of resonant switching.

UNIT IV- INVERTERS 12

Single phase and three phase [120& 180mode] inverters – PWM techniques –Sinusoidal PWM, Modified sinusoidal PWM and multiple PWM – Voltage and harmonic control – Series resonant inverter – current source inverter.

UNIT V- AC TO AC CONVERTERS

12

Single phase AC voltage controllers – Multistage sequence control – single phase andthree phase cycloconverters – power factor control – Matrix converters.

L: 45 T: 15 TOTAL: 60 PERIODS

COURSE OUTCOMES

- Ability to analyse AC-AC and DC-DC and DC-AC converters.
- Ability to choose the converters for real time applications.

TEXT BOOKS:

1. Rashid M.H., "Power Electronics Circuits, Devices and Applications", Prentice Hall India, 3rd Edition, New Delhi, 2004.
2. Ned Mohan, T.M.Undeland, W.P.Robbins, "Power Electronics: Converters, applications and design", John wiley and Sons, 3rd Edition, 2006.

REFERENCES:

1. Cyril.W.Lander, "Power Electronics", McGraw Hill International, Third Edition, 1993.
2. P.S.Bimbra "Power Electronics", Khanna Publishers, third Edition 2003.
3. Philip T.Krein, "Elements of Power Electronics" Oxford University Press, 2004 Edition.

22153C34P-MEASUREMENTS AND INSTRUMENTATION

4 0 0 4

Semester III

AIM

To provide adequate knowledge in electrical instruments and measurements techniques.

OBJECTIVES

To make the student have a clear knowledge of the basic laws governing the operation of the instruments, relevant circuits and their working.

i. Introduction to general instrument system, error, calibration etc.
ii. Emphasis is laid on analog and digital techniques used to measure voltage, current, energy and power etc.
iii. To have an adequate knowledge of comparison methods of measurement.
iv. Elaborate discussion about storage & display devices.
v. Exposure to various transducers and data acquisition system.

UNIT I: INTRODUCTION 10

Functional elements of an Instrument -Static and Dynamic characteristics -Errors in measurement -Statistical evaluation of measurement data -Standard and Calibration.

UNIT II: ELECTRICAL AND ELECTRONICS INSTRUMENTS 12

Construction and principle of operation of moving coil, moving Iron, Principle and types analog and digital ammeters and voltmeters -Single and three phase Wattmeter and Energy meter - magnetic measurements - -Instruments for measurement of frequency and phase.

UNIT III: SIGNAL CONDITIONING CIRCUITS 12

Bridge circuits – Differential and Instrumentation amplifiers -Filter circuits - V/f and f/V converters – P/I and I/P converters – S/H Circuit, A/D and D/A converters -Multiplexing and De-multiplexing -Data acquisition systems –Grounding techniques.

UNIT IV: STORAGE AND DISPLAY DEVICES 12

Magnetic disc and Tape Recorders -Digital plotters and printers -CRT displays -Digital CRO – LED, LCD and Dot matrix displays.

UNIT V: TRANSDUCERS 14

Classification of Transducers -Selection of Transducers –Resistive, Capacitive and Inductive Transducers -Piezo electric Transducers -Transducers for measurement of displacement, temperature, level, flows, pressure, velocity, acceleration, torque, speed, viscosity and moisture.

Total = 60

COURSE OUTCOMES

To acquire knowledge on Basic functional elements of instrumentation

- To understand the concepts of Fundamentals of electrical and electronic instruments
- Ability to compare between various measurement techniques
- To acquire knowledge on Various storage and display devices
- To understand the concepts Various transducers and the data acquisition systems
- Ability to model and analyze electrical and electronic Instruments and understand the operational features of display Devices and Data Acquisition System.

TEXT BOOKS

1. E.O. Doebelin, 'Measurement Systems – Application and Design', Tata McGraw Hill publishing company, 2003.
2. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2004.

REFERENCE BOOKS

1. A.J. Bouwens, 'Digital Instrumentation', Tata McGraw Hill, 1997.
2. D.V.S. Moorthy, 'Transducers and Instrumentation', Prentice Hall of India Pvt Ltd, 2003.
3. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw Hill, 1995.
4. Martin Reissland, 'Electrical Measurements', New Age International (P) Ltd., Delhi, 2001.
5. J. B. Gupta, 'A Course in Electronic and Electrical Measurements', S. K. Kataria & Sons, Delhi, 2003.

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22153L35P- DC AND AC ELECTRICAL MACHINES LABORATORY 0 0 3 2

Semester III

OBJECTIVES:

- To impart hands on experience in verification of circuit laws and theorems, measurement of circuit parameters, study of circuit characteristics and simulation of time response.
- To expose the students to the basic operation of electrical machines and help them to develop experimental skills.

LIST OF EXPERIMENTS

1. Open circuit characteristics of D.C. shunt generator.
2. Load characteristics of D.C. shunt generator.
3. Load test on D.C. shunt and Compound Motor.
4. Load test on D.C. series motor.
5. Swinburne's test and speed control of D.C. shunt motor
6. Hopkinson's test on D.C. motor generation set.
7. Load test on single phase and three phase transformer
8. open circuit and short circuit tests on single phase and three phase transformer (Determination of equivalent circuit parameters).
9. Load test on single phase induction motor.
10. No load and blocked rotor tests on three phase induction motor (Determination of equivalent circuit parameters)
11. Load test on Three phase induction motor.
12. Study of Starters **TOTAL: 45**

COURSE OUTCOMES

At the end of the course, the student should have the :

- Ability to conduct performance tests on DC and AC machines
- Ability to understand and analyze EMF and MMF methods
- Ability to analyze the characteristics of V and Inverted V curves
- Ability to understand the importance of Synchronous machines
- Ability to understand the importance of Induction Machines

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. DC Shunt Motor with Loading Arrangement – 3 nos
2. Single Phase Transformer – 4 nos
3. DC Series Motor with Loading Arrangement – 1 No.

4. Three Phase Induction Motor with Loading Arrangement – 2 nos
5. Single Phase Induction Motor with Loading Arrangement – 1 No
6. DC Shunt Motor Coupled With DC Compound Generator – 2 nos
7. DC Shunt Motor Coupled With DC Shunt Generator – 1 No.
8. Tachometer -Digital/Analog – 8 nos
9. Single Phase Auto Transformer – 2 nos
10. Three Phase Auto Transformer – 1 No.
11. Single Phase Resistive Loading Bank – 2 nos
12. Three Phase Resistive Loading Bank. – 2 nos
13. SPST switch – 2 nos
14. Single Phase Transformer - 1 No.
15. Three Phase Transformer - 1 No.

22153C41P- PROTECTION AND SWITCHGEAR

4 0 0 4

AIM

To expose the students to the various faults in power system and learn the various methods of protection scheme.
To understand the current interruption in Power System and study the various switchgears.

OBJECTIVES

i. Discussion on various earthling practices usage of symmetrical components to estimate fault current and fault MVA.
ii. Study of Relays & Study of protection scheme, solid state relays.
iii. To understand instrument transformer and accuracy.
iv. To understand the method of circuit breaking various arc theories Arcing phenomena – capacitive and inductive breaking.
v. Types of circuit breakers.

UNIT I: INTRODUCTION 12

Principles and need for protective schemes – nature and causes of faults – types of faults – fault current calculation using symmetrical components – Power system earthing - Zones of protection and essential qualities of protection – Protection scheme.

UNIT II: OPERATING PRINCIPLES AND RELAY CONSTRUCTIONS 12

Need for protection – essential qualities of protective relays – Electromagnetic relays, Induction relays – Over current relays - Directional, Distance, Differential and negative sequence relays. Static relays

UNIT III: APPARATUS PROTECTION 12

Apparatus protection transformer, generator, motor, protection of bus bars, transmission lines – CTs and PTs and their applications in protection schemes.

UNIT IV: THEORY OF CIRCUIT INTERRUPTION 12

Physics of arc phenomena and arc interruption. Restricting voltage & Recovery voltage, rate of rise of recovery voltage, resistance switching, current chopping, and interruption of capacitive current – DC circuit breaking.

UNIT V: CIRCUIT BREAKERS 12

Types of Circuit Breakers – Air blast, Air break, oil SF_6 and Vacuum circuit breakers – comparative merits of different circuit breakers – Testing of circuit breakers

COURSE OUTCOMES

- Ability to understand and analyze Electromagnetic and Static Relays.
- Ability to suggest suitability circuit breaker.
- Ability to find the causes of abnormal operating conditions of the apparatus and system.
- Ability to analyze the characteristics and functions of relays and protection schemes. Ability to study about the apparatus protection, static and numerical relays.
- Ability to acquire knowledge on functioning of circuit breaker.

TEXT BOOKS

1. B. Ravindranath, and N. Chander, 'Power System Protection & Switchgear', Wiley Eastern Ltd., 1977.

REFERENCE BOOKS

1. Sunil S. Rao, 'Switchgear and Protection', Khanna publishers, New Delhi, 1986 .
2. C.L. Wadhwa, 'Electrical Power Systems', Newage International (P) Ltd., 2000.
3. M.L. Soni, P.V. Gupta, V.S. Bhatnagar, A. Chakrabarti, 'A Text Book on Power System Engineering', Dhanpat Rai & Co., 1998.
4. Badri Ram, Vishwakarma, 'Power System Protection and Switchgear', Tata McGraw hill, 2001.
5. Y.G. Paithankar and S.R. Bhide, 'Fundamentals of Power System Protection', Prentice Hall of India Pvt. Ltd., New Delhi – 110001, 2003.

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22153C42P -HIGH VOLTAGE DC TRANSMISSION

3 1 0 4

Semester IV

AIM:
To learn the HVDC modelling and control strategy.

OBJECTIVES:
 To study the performance of converters and modeling of DC line with controllers.
 To study about converter harmonics and its mitigation using active and passive filters.

UNIT I- DC POWER TRANSMISSION TECHNOLOGY 9
Introduction-comparison of AC and DC transmission application of DC transmission – Description of DC transmission system planning for HVDC transmission-modern trends In DC transmission.

UNIT II- ANALYSIS OF HVDC CONVERTERS 9
Pulse number, choice of converter configuration-simplified analysis of Graetz circuit converter bridge characteristics – characteristics of a twelve pulse converter-detailed analysis of converters.

UNIT III- CONVERTER AND HVDC SYSTEM CONTROL 9
General principles of DC link control-converter control characteristics-system control Hierarchy-firing angle control-current and extinction angle control-starting and stopping of DC link-power control-higher level controllers-telecommunication requirements.

UNIT IV -HARMONICS AND FILTERS 9
Introduction-generation of harmonics-design of AC filters-DC filters-carrier frequency and RI noise.

UNIT V -SIMULATION OF HVDC SYSTEMS 9
Introduction-system simulation: Philosophy and tools-HVDC system simulation-modeling of HVDC systems for digital dynamic simulation.

TOTAL: 45 PERIODS

COURSE OUTCOMES

- Ability to understand Generation and measurement of high voltage.
- Ability to understand High voltage testing.
- Ability to understand various types of over voltages in power system. Ability to measure over voltages.
- Ability to test power apparatus and insulation coordination

TEXT BOOKS:

1. Padiyar, K.R., HVDC power transmission system, Wiley Eastern Limited, New Delhi 1990.First edition.
2. P.Kundur, 'Power System Stability and Control', Tata McGraw Hill Publishing Company Ltd., USA, 1994.
3. Arrillaga, J., High Voltage direct current transmission, Peter Pregrinus, London, 1983.

REFERENCES:

1. Edward Wilson Kimbark, Direct Current Transmission, Vol. I, Wiley interscience, New York, London, Sydney, 1971.
2. Rakosh Das Begamudre, Extra high voltage AC transmission engineering New

22153C43P- SOLID STATE DRIVES

3 1 0 4

Semester IV

AIM

To study and understand the operation of electric drives controlled from a power electronic converter and to introduce the design concepts of controllers.

OBJECTIVES

i. To understand the stable steady-state operation and transient dynamics of a motor-load system.
ii. To study and analyze the operation of the converter / chopper fed dc drive and to solve simple problems.
iii. To study and understand the operation of both classical and modern induction motor drives.
iv. To understand the differences between synchronous motor drive and induction motor drive and to learn the basics of permanent magnet synchronous motor drives.
v. To analyze and design the current and speed controllers for a closed loop solid-state d.c motor drive.

UNIT I DRIVE CHARACTERISTICS **9**

Equations governing motor load dynamics - Equilibrium operating point and its steady state stability - Mathematical condition for steady state stability and problems - Multi quadrant dynamics in the speed torque plane - Basics of regenerative braking - Typical load torque characteristics - Acceleration, deceleration, starting and stopping.

UNIT II DC MOTOR DRIVE **9**

Steady state analysis of the single and three phase fully controlled converter fed separately excited D.C motor drive: Continuous and discontinuous conduction mode - Chopper fed D.C drive: Time ratio control and current limit control - Operation of four quadrant chopper.

UNIT III STATOR CONTROLLED INDUCTION MOTOR DRIVES **9**

Variable terminal voltage control – Variable frequency control – V/f control - AC voltage controllers – Four-quadrant control and closed loop operation - Frequency controlled drives- VSI and CSI fed drives – closed loop control.

UNIT IV ROTOR CONTROLLED INDUCTION MOTOR DRIVES **9**

Rotor resistance control – slip power recovery schemes - sub synchronous and super synchronous operations – closed loop control – Braking in induction motors.

UNIT V- SYNCHRONOUS MOTOR DRIVES 9

Wound field cylindrical rotor motor – operation from constant voltage and frequency source – operation from current source – operation from constant frequency – Brushless excitation – Permanent magnet synchronous motor.

Self-controlled Synchronous motor drives – Brushless dc and ac motor drives – CSI with load commutation – Cycloconverter with load commutation.

TOTAL = 45

COURSE OUTCOMES

- Ability to understand and suggest a converter for solid state drive.
- Ability to select suitability drive for the given application.
- Ability to study about the steady state operation and transient dynamics of a motor load system. Ability to analyze the operation of the converter/chopper fed dc drive.
- Ability to analyze the operation and performance of AC motor drives.
- Ability to analyze and design the current and speed controllers for a closed loop solid

TEXT BOOKS

1. R. Krishnan, 'Electric Motor & Drives: Modelling, Analysis and Control', Prentice Hall of India, 2001.
2. Bimal K. Bose. 'Modern Power Electronics and AC Drives', Pearson Education, 2002.

REFERENCE BOOKS

1. G.K. Dubey, 'Power Semi-conductor Controlled Drives', Prentice Hall of India, 1989.
2. Vedam Subrahmanyam, "Electric drives concepts and applications", TMH Pub. Co.Ltd., 1994.
3. Murphy, J.M.D and Turnbull.F.G. , "Thyristor control of AC Motors", Pergamon Press, 1988.
4. Sen. P.C., "Thyristor D.C. Drives", John Wiley and Sons, 1981.

22153L45P CONTROL AND INSTRUMENTATION LABORATORY

0 0 3 2

Semester IV

AIM

To provide knowledge on analysis and design of control and instrumentation

LIST OF EXPERIMENTS

CONTROLSYSTEMS:

1. P, PI and PID controllers
2. Stability Analysis
3. Modeling of Systems – Machines, Sensors and Transducers
4. Design of Lag, Lead and Lag-Lead Compensators
5. Position Control Systems
6. Synchro-Transmitter- Receiver and Characteristics
7. Simulation of Control Systems by Mathematical development tools.

INSTRUMENTATION:

8. Bridge Networks –AC and DC Bridges
9. Dynamics of Sensors/Transducers

a. Temperature
b. Pressure
c. Displacement
d. Optical
e. Strain f. Flow

10. Power and Energy Measurement
11. Signal Conditioning

a. Instrumentation Amplifier
b. Analog – Digital and Digital –Analog converters (ADC and DACs)

12. Process Simulation. **P = 45**

Total = 45

COURSE OUTCOMES

Ability to understand and apply basic science, circuit theory, Electro-magnetic field theory control theory and apply them to electrical engineering problems.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CONTROLSYSTEMS:

1. PID kit – 1 No.

DSO – 1 No.

CRO Probe – 2 nos

Personal computers

3. DC motor – 1 No.

Generator – 1 No. Rheostats – 2 nos

Ammeters Voltmeters

Connecting wires (3/20)
4. CRO 30MHz – 1 No.
2MHz Function Generator – 1No.
5. Position Control Systems Kit (with manual) – 1 No., Tacho Generator Coupling set
6. AC Synchro transmitter& receiver – 1No.
Digital multi meters

INSTRUMENTATION:
7. R, L, C Bridge kit (with manual)
8. a) Electric heater – 1No.
Thermometer – 1No.Thermistor (silicon type) RTD nickel type – 1No.

b) 30 psi Pressure chamber (complete set) – 1No. Current generator (0 – 20mA)
Air foot pump – 1 No. (with necessary connecting tubes)
c) LVDT20mm core length movable type – 1No. CRO 30MHz – 1No.
d) Optical sensor – 1 No. Light source
e) Strain Gauge Kit with Handy lever beam – 1No.
100gm weights – 10 nos
f) Flow measurement Trainer kit – 1 No.
(1/2 HP Motor, Water tank, Digital Milliammeter, complete set)
9. Single phase Auto transformer – 1No.
Watthour meter (energy meter) – 1No. Ammeter
Voltmeter Rheostat Stop watch
Connecting wires (3/20)
10. IC Transistor kit – 1No.

22153C51P-POWER SYSTEM ANALYSIS

3 1 0 4
Semester V

AIM

To become familiar with different aspects of modeling of components and system and different methods of analysis of power system planning and operation.

OBJECTIVES

i. To model steady-state operation of large-scale power systems and to solve the power flow problems using efficient numerical methods suitable for computer simulation.
ii. To model and analyse power systems under abnormal (fault) conditions.
iii. To model and analyse the dynamics of power system for small-signal and large signal disturbances and o design the systems for enhancing stability.

UNIT I- THE POWER SYSTEM AN OVER VIEW AND MODELLING 12

Moder n Power System - Basic Components of a power system - Per Phase Analysis Generator model - Transformer model - line model. The per unit system -Change of base.

UNIT II- POWER FLOW ANALYSIS 12

Introduction - Bus Classification - Bus admittance matrix - Solution of non-linear Algebraic equations - Gauss seidal method - Newton raphson method - Fast decoupled method - Flow charts and comparison of the three methods.

UNIT III-FAULT ANALYSIS-BALANCED FAULT 12

Introduction – Balanced three phase fault – short circuit capacity – systematic fault analysis using bus impedance matrix – algorithm for formation of he bus impedance matrix.

UNIT IV-FAULT ANALYSIS – SYMMETRICAL COMPONENTS AND UNBALANCED FAULT 12

Introduction – Fundamentals of symmetrical components – sequence impedances – sequence networks – single line to ground fault – line fault - Double line to ground fault – Unbalanced fault analysis using bus impedance matrix.

UNIT V-POWER SYSTEM STABILITY 12

Dynamics of a Synchronous machine – Swing equation and Power angle equation – Steady state Stability and Transient state Stability - Equal area criterion – Cearing angle and time- Numerical solution of Swing equation for single machine

Total = 60 Hrs

COURSE OUTCOMES

- Ability to model the power system under steady state operating condition

  Ability to understand and apply iterative techniques for power flow analysis

  Ability to model and carry out short circuit studies on power system

- Ability to model and analyze stability problems in power system

- Ability to acquire knowledge on Fault analysis.
- Ability to model and understand various power system components and carry out power flow, short circuit and stability studies

TEXT BOOKS:

1. Hadi Saadat "Power system analysis", Tata McGraw Hill Publishing Company, New Delhi, 2002 (Unit I, II, III, IV)
2. P.Kundur, "Power System Stability and Control", Tata McGraw Hill Publishing Company, New Delhi, 1994 (Unit V)

REFERENCE BOOKS:

1. I.J.Nagrath and D.P.Kothari, 'Modern Power System Analysis', Tata McGraw-Hill publishing company, New Delhi, 1990.
2. M.A. Pai, 'Computer Techniques in power system Analysis', Tata McGraw – Hill publishing company, New Delhi, 2003.
3. John J. Grainger and Stevenson Jr. W.D., 'Power System Analysis', McGraw Hill International Edition, 1994

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22153C52P - POWER QUALITY

3 1 0 4
Semester V

UNIT I INTRODUCTION TO POWER QUALITY 3
Terms and definitions: Overloading, under voltage, sustained interruption; sags and swells; waveform distortion, Total Harmonic Distortion (THD), Computer Business Equipment Manufacturers Associations (CBEMA) curve.

UNIT II VOLTAGE SAGS AND INTERRUPTIONS 7

Sources of sags and interruptions, estimating voltage sag performance, motor starting sags, estimating the sag severity, mitigation of voltage sags, active series compensators, static transfer switches and fast transfer switches.

UNIT III OVER VOLTAGES 10
Sources of over voltages: Capacitor switching, lightning, ferro resonance; mitigation of voltage swells: Surge arresters, low pass filters, power conditioners – Lightning protection, shielding, line arresters, protection of transformers and cables.

UNIT IV HARMONICS 12
Harmonic distortion: Voltage and current distortion, harmonic indices, harmonic sources from commercial and industrial loads, locating harmonic sources; power system response characteristics, resonance, harmonic distortion evaluation, devices for controlling harmonic distortion, passive filters, active filters, IEEE and IEC standards.

UNIT V POWER QUALITY MONITORING 17
Monitoring considerations: Power line disturbance analyzer, per quality measurement equipment, harmonic/spectrum analyzer, flicker meters, disturbance analyzer, applications of expert system for power quality monitoring.

L=45 Total=45

COURSE OUTCOMES

- Ability to understand and analyze power system operation, stability, control and protection.
- The students able to understand the over voltage protection & analysis tools used for analyzing the transients.
- They are fully trained in designing and evaluating the devices of harmonic distortion.

REFERENCE BOOKS

1. Roger.C.Dugan, Mark.F.McGranagham, Surya Santoso, H.Wayne Beaty, 'Electrical Power Systems Quality' McGraw Hill, 2003.
2. PSCAD User Manual.

22153C53P- SPECIAL ELECTRICAL MACHINES **4 0 0 4**

Semester V

AIM

To expose the students to the construction, principle of operation and performance of special electrical machines as an extension to the study of basic electrical machines.

OBJECTIVES

To impart knowledge on

i. Construction, principle of operation and performance of synchronous reluctance motors.

ii. Construction, principle of operation and performance of stepping motors.

iii. Construction, principle of operation and performance of switched reluctance motors.

iv. Construction, principle of operation and performance of permanent magnet brushless D.C. motors.

v. Construction, principle of operation and performance of permanent magnet synchronous motors.

UNIT I-SYNCHRONOUS RELUCTANCE MOTORS 9

Constructional features – types – axial and radial air gap motors – operating principle – reluctance – phasor diagram - characteristics – Vernier motor.

UNIT II -STEPPING MOTORS 9

Constructional features – principle of operation – variable reluctance motor – Hybrid motor – single and Multi stack configurations – theory of torque predictions – linear and non-linear analysis – characteristics – drive circuits.

UNIT III-SWITCHED RELUCTANCE MOTORS 9

Constructional features – principle of operation – torque prediction – power controllers – Nonlinear analysis – Microprocessor based control - characteristics – computer control.

UNIT IV-PERMANENT MAGNET BRUSHLESS D.C. MOTORS 9

Principle of operation – types – magnetic circuit analysis – EMF and Torque equations – Power Controllers – Motor characteristics and control.

UNIT V-PERMANENT MAGNET SYNCHRONOUS MOTORS 9

Principle of operation – EMF and torque equations – reactance – phasor diagram – power controllers - converter - volt-ampere requirements – torque speed characteristics - microprocessor based control.

L=45 Total=45

COURSE OUTCOMES

- Ability to analyze and design controllers for special Electrical Machines.
- Ability to acquire the knowledge on construction and operation of stepper motor.
- Ability to acquire the knowledge on construction and operation of stepper switched reluctance motors.
- Ability to construction, principle of operation, switched reluctance motors.

- Ability to acquire the knowledge on construction and operation of permanent magnet brushless D.C. motors.
- Ability to acquire the knowledge on construction and operation of permanent magnet synchronous motors.

TEXT BOOKS

1. Miller, T.J.E., ‘Brushless Permanent Magnet and Reluctance Motor Drives’, Clarendon Press, Oxford, 2289.
2. Aearnley, P.P., ‘Stepping Motors – A Guide to Motor Theory and Practice’, Peter Perengrinus, London, 1982.

REFERENCES

1. Kenjo, T., ‘Stepping Motors and their Microprocessor Controls’, Clarendon Press London, 1984.
2. Kenjo, T., and Nagamori, S., ‘Permanent Magnet and Brushless DC Motors’, Clarendon Press, London, 1988.

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22153L55P - POWER ELECTRONICS AND DRIVES LAB

Semester V

0 0 3 2

AIM

To study the characteristics of switching devices and its applications in rectifier inverter, chopper and resonant converter.

1. Study Of V-I Characteristics Of An SCR.
2. Study Of V-I Characteristics Of A TRIAC.
3. Study Of Different Trigerring Circuits For Thyristor.
4. Study Of Uni- Junction Transistor (UJT) Trigerring Circuit.
5. Study Of A Firing Circuit Suitable For Single Phase Half Controlled Convertor.
6. Simulation On the Single Phase Ac-Dc Uncontrolled Convertor with & without the source Inductance.
7. Simulation Of A Single Phase Ac To Controlled Dc Convertor with & without the source Inductance.
8. Single Phase Half Controlled Bridge Convertor With Two Thyristors & Two Diodes.
9. Single Phase Fully Controlled Bridge Convertor Using Four Thyristors.
10. Pspice or MATH LAB Simulation Of Dc to Dc Step Down Chopper.
11. Pspice or MATH LAB Simulation Of Single Phase Controller with R-L Load.
12. Pspice or MATH LAB Simulation Of PWM Bridge Invertor Of R-L Load Using MOSFET.

COURSE OUTCOMES

- Ability to practice and understand converter and inverter circuits and apply software for engineering problems.
- Ability to analyze about AC to DC converter circuits.
- Ability to analyze about DC to AC circuits.
- Ability to acquire knowledge on AC to AC converters
- Ability to acquire knowledge on simulation software.

22153C61P- UTILIZATION OF ELECTRICAL ENERGY

3 1 0 4
Semester VI

AIM
To plan and design using basic principles and handbooks
To select equipment, processes and components in different situations.

OBJECTIVES
i. To ensure that the knowledge acquired is applied in various fields as per his job requirements.
ii. To orient the subject matter in the proper direction, visits to industrial establishments are recommended in order to familiarize with the new developments in different areas.

UNIT I ELECTRIC LIGHTING 12
Production of light – Definition of terms – Lighting calculations – Types of lamps – Interior and Exterior illumination systems – Lighting schemes – Design of Lighting schemes – Factory lighting – Flood lighting – Energy saving measures.

UNIT II ELECTRIC HEATING 12
Resistance heating – Induction heating – Dielectric heating – Arc furnace – Control equipment, efficiency, and losses – Energy conservation in Arc Furnace Industry.

UNIT III ELECTRIC WELDING 12
Welding equipment – Characteristics of carbon and metallic arc welding – Butt welding – Spot welding – Energy conservation in welding.

UNIT IV ELECTRIC VEHICLE 12
Traction: System of track electrification, train movement and energy consumption (speed time curves, crest speed, average speed and schedule speed) rective effort, factors affecting energy consumption (dead weight, acceleration weight and adhesion weight) starting and braking of traction motors, protective devices

UNIT V ELECTRO CHEMICAL PROCESS 12
Electrolysis – Electroplating – Electro deposition – Extraction of metals – Current, efficiency – Batteries – Types – Charging methods.

Total = 60

COURSE OUTCOMES

- T o understand the main aspects of generation, utilization and conservation.
- To identify an appropriate method of heating for any particular industrial application.
- To evaluate domestic wiring connection and debug any faults occurred.
- To construct an electric connection for any domestic appliance like refrigerator as well as to design a battery charging circuit for a specific household application.

Text Books:

1. Tripathy,S.C., “Electric Energy Utilization & Conservation” – Tata McGraw Hill Publishing Company.
2. Uppal,S.L., “Electric Power”, Khanna Publishers.
3. Soni,M.L., P.V.Gupta & Bhatnagar , “A course in Electric Power”, Dhanpat Rai & Sons.

Reference Books:

1. Partab,H., “Art & Science Utilization of Electrical Energy” – Dhanpat Rai & Sons.
2. Wadhwa,C.L., “Generation, Utilization & Distribution” - Wilsey Eastern Ltd.
3. Wadha C L - Utilization of Electric Power; New Age International
4. Suryanarayana . N.V., “Utilization of Electric Power” - Wilsey Eastern Ltd.

22153C62P SOLID STATE RELAYS **4 0 0 4**

Semester VI

UNIT 1 **9**

Advantages of Static Relays – Generalized Characteristics and Operational Equations of Relays – Steady State and Transient Performance of Signal Driving Elements – Signal Mixing Techniques and Measuring Techniques – CT's and PT's in Relaying Schemes – Saturation Effects.

UNIT 2 **9**

Static Relay Circuits (Using Analog and Digital IC's) for Over Current, Inverse Time Characteristics, Differential Relay and Directional Relay.

UNIT 3 **9**

Static Relay Circuits for Generator Loss of Field, Under Frequency Distance Relays, Impedance, Reactance, MHO, Reverse Power Relays.

UNIT 4 **9**

Static Relay Circuits for Carrier Current Protection – Steady State and Transient Behavior of Static Relays – Testing and Maintenance – Tripping Circuits using Thyristor.

UNIT 5 **9**

Microprocessor Based Relays – Hardware and Software for the Measurement of Voltage, Current, Frequency, Phase Angle – Microprocessor Implementation of Over Current Relays – Inverse Time Characteristics – Impedance Relay – Directional Relay – MHO Relay.

Total=45

COURSE OUTCOMES

- Ability to suggest suitability circuit breaker.
- Ability to find the causes of abnormal operating conditions of the apparatus and system.

Text Books:

1. Badriram and Vishwakarma D.N., Power System Protection and Switchgear, Tata McGraw Hill, New Delhi, 1995.
2. Rao T.S.M., Power System Protection – Static Relays, McGraw Hill, 1979.

Reference Books:

1. Van C.Warrington, "Protection Relays – Their Theory and Practice", Chapman and Hall.
2. Ravindranath B. and Chander M., "Power System Protection and Switchgear", Wiley Eastern, 1992.
3. Russel C.Mason, "The Art and Science of Protective relays".

22153C63P- POWER SYSTEM OPERATION AND CONTROL

4 0 0 4

Semester VI

AIM

To become familiar with the preparatory work necessary for meeting the next day's operation and the various control actions to be implemented on the system to meet the minute-to-minute variation of system load.

OBJECTIVES

i. To get an overview of system operation and control.
ii. To understand & model power-frequency dynamics and to design power-frequency controller.
iii. To understand & model reactive power-voltage interaction and different methods of control for maintaining voltage profile against varying system load.

UNIT I INTRODUCTION 12

System load variation: System load characteristics, load curves - daily, weekly and annual, load-duration curve, load factor, diversity factor. Reserve requirements: Installed reserves, spinning reserves, cold reserves, hot reserves. Overview of system operation: Load forecasting, unit commitment, load dispatching. Overview of system control: Governor Control, LFC, EDC, AVR, system voltage control, security control.

UNIT II REAL POWER - FREQUENCY CONTROL 12

Fundamentals of Speed Governing mechanisms and modeling - Speed-Load characteristics-regulation of two Synchronous Machines in parallel - Control areas - LFC of single & Multi areas - Static & Dynamic Analysis of uncontrolled and controlled cases –Tie line with frequency bias control – Steady state instabilities.

UNIT III REACTIVE POWER–VOLTAGE CONTROL 12

Typical excitation system, modeling, static and dynamic analysis, stability compensation; generation and absorption of reactive power: Relation between voltage, power and reactive power at a node; method of voltage control: Injection of reactive power. Tap-changing transformer, numerical problems - System level control using generator voltage magnitude setting, tap setting of OLTC transformer.

UNIT IV UNIT COMMITMENT AND ECONOMIC DISPATCH 12

Statement of Unit Commitment (UC) problem; constraints in UC: spinning reserve, thermal unit constraints, hydro constraints, fuel constraints and other constraints; UC solution methods: Priority-list methods, forward dynamic programming approach, numerical problems only in priority-list method using full-load average production cost. Incremental cost curve, co-ordination equations without loss and with loss, solution by direct method and λ-iteration method. (No derivation of loss coefficients.) Base point and participation factors.

UNIT V COMPUTER CONTROL OF POWER SYSTEMS 12

Energy control centre: Functions – Monitoring, data acquisition and control. System hardware configuration – SCADA and EMS functions: Network topology determination, state estimation, security analysis and control. Various operating states: Normal, alert, emergency, in extremis and restorative. State transition diagram showing various state transitions and control strategies. **Total = 60**

COURSE OUTCOMES

- Ability to understand the day-to-day operation of electric power system.
- Ability to analyze the control actions to be implemented on the system to meet the minute- to-minute variation of system demand.
- Ability to understand the reactive power-voltage interaction.

TEXT BOOKS

1. Olle. I. Elgerd, 'Electric Energy Systems Theory – An Introduction', Tata McGraw Hill Publishing Company Ltd, New Delhi, Second Edition, 2003.
2. Allen.J.Wood and Bruce F.Wollenberg, 'Power Generation, Operation and Control', John Wiley & Sons, Inc., 2003.
3. P. Kundur, 'Power System Stability & Control', McGraw Hill Publications, USA, 1994.

REFERENCE BOOKS

1. D.P. Kothari and I.J. Nagrath, 'Modern Power System Analysis', Third Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.
2. L.L. Grigsby, 'The Electric Power Engineering, Hand Book', CRC Press & IEEE Press, 2001.

22153L65P POWER SYSTEMS LAB

0 0 3 2

AIM

To simulate analysis and planning cases for a practical power system.

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List Of Experiments:

1. Formation of Y-Bus Matrix by Inspection and Singular transformation methods.
2. Load flow solution using Gauss Seidal method
3. Load flow solution using Newton-Raphson method
4. Load flow solution by Fast Decoupled method
5. Symmetrical short circuit analysis
6. Unsymmetrical Fault analysis
7. Solution of swing Equation using modified Euler method
8. Power Electronic Circuits, design and simulation using Pspice
9. Simulation of Electrical drives using MATLAB, PSCAD
10. Control system design using MATLAB

P = 45 Total = 45

COURSE OUTCOMES

- Ability to understand power system planning and operational studies.
- Ability to acquire knowledge on Formation of Bus Admittance and Impedance Matrices and Solution of Networks.
- Ability to analyze the power flow using GS and NR method
- Ability to find Symmetric and Unsymmetrical fault

Semester VII

22160S71P TOTAL QUALITY MANAGEMENT 3 0 0 3

UNIT – I: BASICS OF TQM 9

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT – II: PRINCIPLES OF TQM 9

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Performance Measures – Basic Concepts, Strategy, Performance Measure.

UNIT – III: QUALITY CONCEPTS 9

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Concept of six sigma,

UNIT – IV: TQM TOOLS 9

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, FMEA – Stages of FMEA.

UNIT – V: ISO STANDARDS 9

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, ISO 14000 – Concept, Requirements and Benefits.

TOTAL : 45

COURSE OUTCOMES

- Upon completion of the course, students will be ability to have clear understanding of managerial functions like planning,
- organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

TEXT BOOKS:

1. Dale H. Besterfiled, et al., “Total Quality Management”, Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6.
2. Basker, “ TOTAL QUALITY MANAGEMENT”, Anuradha Agencies.

REFERENCES:

1. Feigenbaum.A.V. “Total Quality Management”, McGraw Hill, 1991.

2. Oakland.J.S. “Total Quality Management”, Butterworth – Hcinemann Ltd., Oxford. 1989.
3. Narayana V. and Sreenivasan, N.S. “Quality Management – Concepts and Tasks”, New Age International 1996

22153C72P - ELECTRICAL MACHINE DESIGN 3 1 0 4

Semester VII

AIM

To expose the students to the construction, principle of operation and performance of special electrical machines as an extension to the study of basic electrical machines.

OBJECTIVES

To impart knowledge on

i. Construction, principle of operation and performance of DC machine.
ii. Construction, operating Characteristics of single and three phase transformer.
iii. Design and operating characteristics of Induction motors.
iv Construction, principle of operation, Design of synchronous machines and to have knowledge of machine design in CAD

UNIT I INTRODUCTION 12

Major considerations – Limitations – Electrical Engineering Materials – Space factor – temperature gradient – Heat flow in two dimensions – thermal resistivity of winding – Temperature gradient in conductors placed in slots – Rating of machines – Eddy current losses in conductors – Standard specifications

UNIT II DC MACHINES 12

Constructional details – output equation – main dimensions - choice of specific loadings – choice of number of poles – armature design – design of field poles and field coil – design of commutator and brushes – losses and efficiency calculations.

UNIT III TRANSFORMERS 12

KVA output for single and three phase transformers – Window space factor – Overall dimensions – Operating characteristics – Regulation – No load current – Temperature rise of Transformers – Design of Tank with & without cooling tubes – Thermal rating – Methods of cooling of Transformers.

UNIT IV INDUCTION MOTORS 12

Magnetic leakage calculations – Leakage reactance of polyphase machines- Magnetizing current – Output equation of Induction motor – Main dimensions –Length of air gap-Rules for selecting rotor slots of squirrel cage machines – Design of rotor bars & slots – Design of end rings – Design of wound rotor-Operating characteristics –Short circuit current – circle diagram – Dispersion co-efficient – relation between D & L for best power factor.

UNIT V SYNCHRONOUS MACHINES 12

Runaway speed – construction – output equations – choice of loadings – Design of salient pole machines – Short circuit ratio – shape of pole face – Armature design – Armature parameters – Estimation of air gap length – Design of rotor –Design of damper winding – Determination of full load field m.m.f – Design of field winding – Design of turbo alternators – Rotor design - Introduction to computer aided design – Program to design main dimensions of Alternators.

Total = 60

COURSE OUTCOMES

- Ability to understand basics of design considerations for rotating and static electrical machines
- Ability to design of field system for its application.
- Ability to design sing and three phase transformer.
- Ability to design armature and field of DC machines.

REFERENCE BOOKS:

1. Sawhney, A.K., 'A Course in Electrical Machine Design', Dhanpat Rai & Sons, New Delhi, 1984.
2. Sen, S.K., 'Principles of Electrical Machine Designs with Computer Programmes', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1987.

22153C73P- POWER PLANT ENGINEERING

4 0 0 4
Semester VII

UNIT I -THERMAL POWER PLANTS 9

Basic thermodynamic cycles – Various components of steam power plant – Layout – Pulverized coal burners – Fluidized bed combustion – Coal handling systems – Ash handling systems – Forced draft and induced draft fans – Boilers – Feed pumps – Super heater – Regenerator – Condenser – Deaerators – Cooling tower

UNIT II - HYDRO ELECTRIC POWER PLANTS 9

Layout – Dams – Selection of water turbines – Types – Pumped storage hydel plants

UNIT III - NUCLEAR POWER PLANTS 9

Principles of nuclear energy – Fission reactions – Nuclear reactor – Nuclear power plants

UNIT IV- GAS AND DIESEL POWER PLANTS 9

Types – Open and closed cycle gas turbine – Work output and thermal efficiency – Methods to improve performance – Reheating, intercoolings, regeneration – Advantage and disadvantages – Diesel engine power plant – Component and layout

UNIT V- NON – CONVENTIONAL POWER GENERATION 9

Solar energy collectors – OTEC – Wind power plants – Tidal power plants and geothermal resources – Fuel cell – MHD power generation – Principle – thermoelectric power generation – Thermionic power generation.

L: 45 T: 15 Total: 60

COURSE OUTCOMES

- Ability to create awareness about renewable Energy Sources and technologies.
- Ability to get adequate inputs on a variety of issues in harnessing renewable Energy.
- Ability to recognize current and possible future role of renewable energy sources.

TEXT BOOKS

1. Arora and Domkundwar, “A Course in Power Plant Engineering”, Dhanpat Rai.
2. Nag, P.K., “Power Plant Engineering”, 2nd Edition, Tata McGraw Hill, 2003.

REFERENCES

1. Bernhardt, G.A., Skrotzki and William A. Vopat, “Power Station Engineering and Economy”, 20th Reprint, Tata McGraw Hill, 2002.
2. Rai, G.D., “An Introduction to Power Plant Technology”, Khanna Publishers.
3. El-Wakil, M.M., “Power Plant Technology”, Tata McGraw Hill, 198

ELECTIVE-I

22153E44AP- ELECTROMAGNETIC THEORY

3 1 0 4
Semester-IV

AIM

To expose the students to the fundamentals of electromagnetic fields and their applications in Electrical Engineering**.**

OBJECTIVES:

- To introduce the basic mathematical concepts related to electromagnetic vector fields
- To impart knowledge on the concepts of electrostatics, electrical potential, energy density and their applications.
- To impart knowledge on the concepts of magneto statics, magnetic flux density, scalar and vector potential and its applications.
- To impart knowledge on the concepts of Faraday's law, induced Emf and Maxwell's equations
- To impart knowledge on the concepts of Concepts of electromagnetic waves and Pointing vector.

UNIT I: ELECTROSTATICS – I 12

Sources and effects of electromagnetic fields – Coordinate Systems – Vector fields – Gradient, Divergence, Curl – theorems and applications - Coulomb's Law – Electric field intensity – Field due to discrete and continuous charges – Gauss's law and applications

UNIT II: ELECTROSTATICS – II 12

Electric potential – Electric field and equipotential plots, Uniform and Non-Uniform field, Utilization factor – Electric field in free space, conductors, dielectrics - Dielectric polarization – Dielectric strength - Electric field in multiple dielectrics – Boundary conditions, Poisson's and Laplace's equations, Capacitance, Energy density, Applications.

UNIT III: MAGNETOSTATICS 12

Lorentz force, magnetic field intensity (H) – Biot–Savart's Law - Ampere's Circuit Law – H due to straight conductors, circular loop, infinite sheet of current, Magnetic flux density (B) – B in free space, conductor, magnetic materials – Magnetization, Magnetic field in multiple media – Boundary conditions, scalar and vector potential, Poisson's Equation, Magnetic force, Torque, Inductance, Energy density, Applications

UNIT IV: ELECTRODYNAMIC FIELDS 12

Magnetic Circuits - Faraday's law – Transformer and motional EMF – Displacement current - Maxwell's equations (differential and integral form) – Relation between field theory and circuit theory – Applications

UNIT V: ELECTROMAGNETIC WAVES 12

Electromagnetic wave generation and equations – Wave parameters; velocity, intrinsic impedance, propagation constant – Waves in free space, lossy and lossless dielectrics, conductors- skin depth - Poynting vector – Plane wave reflection and refraction – Standing Wave – Applications.

TOTAL = 45

COURSE OUTCOMES

- Ability to understand and apply basic science, circuit theory, Electro-magnetic field theory control theory and apply them to electrical engineering problems.

TEXT BOOKS

1. Mathew N. O. Sadiku, 'Principles of Electromagnetics', 4 th Edition ,Oxford University Press Inc, First India edition, 2009.
2. Ashutosh Pramanik, 'Electromagnetism – Theory and Applications', PHI Learning Private Limited, New Delhi, Second Edition-2009.
3. K.A. Gangadhar, P.M. Ramanthan ' Electromagnetic Field Theory (including Antennaes and wave propagation', 16th Edition, Khanna Publications, 2007..

REFERENCE BOOKS

1. Joseph. A.Edminister, 'Schaum's Outline of Electromagnetics, Third Edition Schaum's Outline Series), Tata McGraw Hill, 2010.
2. William H. Hayt and John A. Buck, 'Engineering Electromagnetics', Tata McGraw Hill 8th Revised edition, 2011.
3. Kraus and Fleish, 'Electromagnetics with Applications', McGraw Hill International Editions, Fifth Edition, 2010.
4. Bhag Singh Guru and Hüseyin R. Hiziroglu "Electromagnetic field theory Fundamentals", Cambridge University Press; Second Revised Edition, 2009

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ELECTIVE-I

22153E44BP- FUZZY LOGIC AND ITS APPLICATIONS

3 1 0 4

Semester-IV

UNIT I -FUZZY LOGIC 7

Fuzzy sets – Fuzzy operation – Fuzzy arithmetic – Fuzzy relational equations – Fuzzy measure – Fuzzy functions – approximate reasoning – Fuzzy proposition – Fuzzy quantifiers-if-then rules.

UNIT II- FUZZY LOGIC IN CONTROL 8

Structure of Fuzzy logic controller – Fuzzification models – database – rule base – inference engine – defuzzification modules – Non-Linear fuzzy control – PID like FLC – Sliding mode FLC – Sugeno FLC – adaptive fuzzy control applications – case studies.

UNIT III- NEURAL NETWORKS IN CONTROL 8

Neural Network for Non-Linear systems – schemes of Neuro control-system identification forward model and inverse model – indirect learning neural network control applications – Case studies.

UNIT IV- MODELING AND CONTROL OF FACTS DEVICES NEURAL AND FUZZY TECHNIQUE 10

FACTS-concept and general system considerations, types of FACTS devices – special purpose FACTS devices, generalized and multifunctional FACTS devices – General comments on transient stability programs.Neuro – Fuzzy based FACTS controller for improvement of Transient stability systems – GA for Adaptive fuzzy system – case study.

UNIT V- STABILITY STUDIES UNDER MULTIPLE FACTS ENVIRONMENT 12

Introduction to small signal analysis – simulation and modeling of FACTS controllers for small signal analysis. Comparison between dynamic and transient stability results. Introduction to EMTP – (Electromagnetic Transient programme / Package), Modeling of FACTS controllers for power system studies using EMTP.

TOTAL=45

COURSE OUTCOMES

- Ability to design combinational and sequential Circuits.
- Ability to simulate using software package.
- Ability to study various number systems and simplify the logical expressions using Boolean functions
- Ability to design various synchronous and asynchronous circuits.
- Ability to introduce asynchronous sequential circuits and PLDs

- Ability to introduce digital simulation for development of application oriented logic circuits.

REFERENCES:

1. KOSKO. B. “Neural Networks and Fuzzy systems”, Prentice-Hall of India Pvt.Ltd., 1994.
2. Driankov, Hellendroon, “Introduction to Fuzzy control” Narosa Publisher.
3. Ronald R.Yager and Dimitar P.Filev “Essential of fuzzy modeling and control “ John Wiley & Sons, Inc.
4. Enrique Acha, Claudio R.Fuerte-Esqivel, Hugo Ambriz-Perez, Cesar Angeles-Camacho” FACTS – Modeling and simulation in Power Networks” John Wiley & Sons.
5. Kundur P., “Power system stability and control”, McGraw Hill, 1994.

ELECTIVE-I

22153E44CP - BIOMEDICAL INSTRUMENTATION

4 0 0 4

Semester-IV

AIM

The course is designed to make the student acquire an adequate knowledge of the physiological systems of the human body and relate them to the parameters that have clinical importance. The fundamental principles of equipment that are actually in use at the present day are introduced.

OBJECTIVES

i. To provide an acquaintance of the physiology of the heart, lung, blood circulation and circulation respiration. Methods of different transducers used.
ii. To introduce the student to the various sensing and measurement devices of electrical origin.
iii. To provide the latest ideas on devices of non-electrical devices.
iv. To bring out the important and modern methods of imaging techniques.
v. To provide latest knowledge of medical assistance / techniques and therapeutic equipments.

UNIT I BASIC PHYSIOLOGY 9

Cells and their structures – Transport of ions through cell membrane – Resting and excited state – Tran membrane potential – Action potential – Bio-electric potential – Nervous system – Physiology of muscles – Heart and blood circulation – Respiratory system – Urinary system.

UNIT II BASIC TRANSDUCER PRINCIPLES AND ELECTRODES 9

Transducer principles - Active transducers - Passive transducers -Transducer for Bio-medical application -Electrode theory- Bio-potential electrode - Bio - chemical transducer.

UNIT III CARDIOVASCULAR SYSTEM 9

The heart and cardiovascular system – Blood pressure – Characteristics of blood flow – Heart sounds - Electro cardiography – Measurements of blood pressure – Measurement of blood flow and cardiac O/P Plethysmography – Measurements of heart sounds.

UNIT IV X-RAY AND RADIOISOTOPE INSTRUMENTATION 9

X-ray imaging radiography – Fluoroscopy – Image intensifiers – Angiography - Medical use of radioisotopes – Beta radiations – Detectors – Radiation therapy.

UNIT V BIO-TELEMETRY 9

Introduction to biotelemetry – Physiological parameters adaptable to biotelemetry – the components of biotelemetry systems – Implantable units – Applications of telemetry in patient care – Application of computer in Bio-medical instrumentation, Anatomy of Nervous system – Measurement from the nervous system – EEG – EMG.

Total = 45

COURSE OUTCOMES

- Ability to understand fundamentals of Bio medical instrumentation.
- To acquire knowledge on Bio-Medical and Non-Electrical parameter measurements.

- To know the various medical imaging equipment.

REFERENCE BOOKS:

1. Lesis Cromwell Fred, J.Werbell and Erich A.Pfraffer, Biomedical instrumentation and Measurements – Prentice Hall of India, 1990.
2. M.Arumugam, Bio-medical Instrumentation – Anuradha Agencies Publishers, 1992.
3. Khandpur, Handbook on Biomedical Instrumentation – Tata McGraw Hill Co Ltd., 1989.

ELECTIVE-I
Semester-IV

22153E44DP - MODELING AND SIMULATION OF SOLAR ENERGY SYSTEMS

4 0 0 4

UNIT I: SOLAR RADIATION AND COLLECTORS 9

Solar angles - day length, angle of incidence on tilted surface - Sunpath diagrams - shadow determination - extraterrestrial characteristics - measurement and estimation on horizontal and tilted surfaces - flat plate collector thermal analysis - heat capacity effect - testing methods-evacuated tubular collectors - concentrator collectors – classification - design and performance parameters - tracking systems - compound parabolic concentrators - parabolic trough concentrators - concentrators with point focus - Heliostats – performance of the collectors.

UNIT I: APPLICATIONS OF SOLAR THERMAL TECHNOLOGY 9

Principle of working, types - design and operation of - solar heating and cooling systems - solar water heaters – thermal storage systems – solar still – solar cooker – domestic, community – solar pond – solar drying.

UNIT III: SOLAR PV FUNDAMENTALS 9

Semiconductor – properties - energy levels - basic equations of semiconductor devices physics. Solar cells - p-n junction: homo and hetro junctions - metal-semiconductor interface - dark and illumination characteristics - figure of merits of solar cell – efficiency limits - variation of efficiency with band-gap and temperature - efficiency measurements - high efficiency cells - preparation of metallurgical, electronic and solar grade Silicon - production of single crystal Silicon: Czokralski (CZ) and Float Zone (FZ) method - Design of a complete silicon – GaAs- InP solar cell - high efficiency III-V, II-VI multi junction solar cell; a-Si-H based solar cells-quantum well solar cell -thermophotovoltaics.

UNIT IV: SOLAR PHOTOVOLTAIC SYSTEM DESIGN AND APPLICATIONS 9

Solar cell array system analysis and performance prediction- Shadow analysis: reliability - solar cell array design concepts - PV system design - design process and optimization - detailed array design - storage autonomy - voltage regulation - maximum tracking – use of computers in array design - quick sizing method - array protection and trouble shooting - centralized and decentralized SPV systems - stand alone - hybrid and grid connected system - System installation - operation and maintenances - field experience - PV market analysis and economics of SPV systems.

UNIT V: SOLAR PASSIVE ARCHITECTURE 9

Thermal comfort - heat transmission in buildings- bioclimatic classification – passive heating concepts: direct heat gain - indirect heat gain - isolated gain and sunspaces - passive cooling concepts: evaporative cooling - radiative cooling - application of wind, water and earth for cooling; shading - paints and cavity walls for cooling - roof radiation traps - earth air-tunnel. – energy efficient landscape design - thermal comfort – concept of solar temperature and its significance - calculation of instantaneous heat gain through building envelope.

TOTAL: 45

COURSE OUTCOMES

- Basic knowledge in Power system planning, operation and modeling of large scale power systems.
- Ability to understand the various faults occurring in power system and to solve load flow problems using numerical methods.
- Ability to analyze the power system transients and faults and select the rating for protective devices.

TEXT BOOKS:

1. Sukhatme S P, Solar Energy, Tata McGraw Hill, 1984.
2. Kreider, J.F. and Frank Kreith, Solar Energy Handbook, McGraw Hill, 1981.
3. Goswami, D.Y., Kreider, J. F. and & Francis., Principles of Solar Engineering, 2000.

REFERENCES:

1. Garg H P., Prakash J., Solar Energy: Fundamentals & Applications, Tata BMcGraw Hill, 2000.
2. Duffie, J. A. and Beckman, W. A., Solar Engineering of Thermal Processes, John Wiley, 1991.
3. Alan L Fahrenbruch and Richard H Bube, Fundamentals of Solar Cells: PV Solar Energy Conversion, Academic Press, 1983.
4. Larry D Partain, Solar Cells and their Applications, John Wiley and Sons, Inc, 1995.
5. Roger Messenger and Jerry Vnetre, Photovoltaic Systems Engineering, CRC Press, 2004.
6. Sodha, M.S, Bansal, N.K., Bansal, P.K., Kumar, A. and Malik, M.A.S. Solar Passive Building, Science and Design, Pergamon Press, 1986.
7. Krieder, J and Rabi, A., Heating and Cooling of Buildings: Design for Efficiency, McGraw-Hill, 1994.

22153E44EP NON-CONVENTIONAL ENERGY SYSTEMS AND APPLICATIONS 2 0 2 4

AIM

To learn about the Renewable energy system and conversion technologies related to various aspects of non-conventional systems.

OBJECTIVES

- to identify suitable utility for the solar and wind energy systems,
- to conduct a site survey for installation of a windmill during Sixth Expedition ,
- to study the structural and foundation aspects for installing a windmill at Maitree station in Schirmacher hills

UNIT-I **9**

Introduction to renewable energy various aspects of energy conversion-Principle of renewable energy systems environment and social implications.

Indian energy scenario in various sectors— Present conventional and renewable energy status- Global energy status-Per capita energy consumption-Future energy plans.

UNIT-II **9**

Solar energy: Solar radiation components- measurements-estimation-solar collectors-solar water heaters- Calculation-Types-analysis-economics-Applications Solar thermal power generation Solar Photovoltaics- energy conversion principle-classifications-equivalent circuit-characteristics-Cell efficiency- Limitations-PV modules-MPPT algorithms

UNIT-III **9**

Wind energy: Basics of wind-wind turbines-power and energy from wind turbine-characteristics- types of electric generators for wind power generation. Dynamics matching- performance of wind generators - applications- economics of wind power

UNIT-IV **9**

Storage Devices: Super capacitor-SMES- Battery storage-flywheel storage- compressed air storage- Fuel cells–types and applications; MHD generators – backup -System design-industrial and domestic applications.

UNIT-V **9**

Bioenergy: Bio fuels-classification-biomass conversion technologies-applications; Ocean Energy: Tidal energy-wave energy-ocean thermal energy conversion systems-applications; - mini, micro and pico hydel power

Total : 45

TEXT/REFERENCE BOOKS:

1. Godfrey Boyle, "Renewable Energy: Power for a sustainable future", Oxford University press, Second edition.

2. Rai G D, “Solar Energy Utilization”, Khanna Publishers, 1997.
3. B H Khan, “Non-Conventional Energy Resources”, The McGraw-Hill Companies, Second Edition.
4. Sukhatme, S.P, “Solar Energy -Principles of Thermal Collection and Storage”, Tata
5. McGraw-Hill, 2 ed., 1997.
6. Sammes, Nige, “Fuel Cell Technologies-State and Perspectives”, Springer publication, 2005
7. Kreith, F., and Kreider, J.F., “Principles of Solar Engineering”, Mc-Graw-Hill Book Co, 1978.
8. S.L.Soo , “Direct Energy Conversion” , Prentice Hall Publication, 1968
9. James Larminie, Andrew Dicks, “Fuel Cell Systems”, Wiley & Sons Ltd, 2ed, 2003.

Referance from Reputed University

Percentage of syllabus revised 10%

Syllabus Focus on Environment

ELECTIVE-II

SEMESTER-V

22153E54AP ENVIRONMENTAL SCIENCE AND ENGINEERING 4 0 0 4

UNIT I- INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 10

Definition, scope and importance – need for public awareness – forest resources: use and over-exploitation, deforestation,. Timber extraction, mining, dams-benefits and problems – mineral resources: use and effects on forests and tribal people – water resources: use and over-utilization of surface and exploitation, environmental effects of extracting and using mineral resources, case studies – food resources: world food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – energy resources: growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies – land resources: land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources.

UNIT II-ECOSYSTEMS AND BIODIVERSITY 14

Concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem. Introduction to biodiversity – definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity –endangered and endemic species of India – conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

UNIT III -ENVIRONMENTAL POLLUTION 8

Definition – causes, effects and control measures of: (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards –– role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.

UNIT IV-SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management

environmental ethics: issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents. environment production act – air (prevention and control

of pollution) act – water (prevention and control of pollution) act – wildlife protection act – forest conservation act – issues involved in enforcement of environmental legislation – public awareness

UNIT V-HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – hiv / aids – women and child welfare – role of information technology in environment and human health – case studies.

TOTAL : 45

COURSE OUTCOMES

- Play a important role in transferring a healthy environment for future generations
- Analyze the impact of engineering solutions in a global and societal context
- Discuss contemporary issues that results in environmental degradation and would attempt to provide solutions to overcome those problems

TEXT BOOKS

1. Gilbert M .Masters, "Introduction to Environmental Engineering and Science", Pearson Education Pvt., Ltd., Second Edition, ISBN 81-297-0277-0, 2004.
2. Miller T.G. Jr., "Environmental Science", Wadsworth Publishing Co.

REFERENCES

1. Bharucha Erach, "The Biodiversity of India", Mapin Publishing Pvt. Ltd., Ahmedabad India.
2. Trivedi R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media.
3. Cunningham, W.P.Cooper, T.H.Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
4. Wager K.D. "Environmental Management", W.B. Saunders Co., Philadelphia, USA, 1998.
5. Townsend C., Harper J and Michael Begon, "Essentials of Ecology, Blackwell Science.
6. Trivedi R.K. and P.K. Goel, Introduction to Air Pollution, Techno-Science Publications.

ELECTIVE-II
Semester-v

22153E54BP -ARTIFICIAL NEURAL NETWORKS 4 0 0 4

UNIT I : INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS 12

Biological neural networks - Pattern analysis tasks: Classification, Regression, Clustering - Computational models of neurons - Structures of neural networks - Learning principles

UNIT II: LINEAR MODELS FOR REGRESSION AND CLASSIFICATION 12

Polynomial curve fitting - Bayesian curve fitting - Linear basis function models - Bias-variance decomposition - Bayesian linear regression - Least squares for classification - Logistic regression for classification- Bayesian logistic regression for classification

UNIT III: FEEDFORWARD NEURAL NETWORKS 12

Pattern classification using preceptor - Multilayer feed forward neural networks (MLFFNNs) - Pattern classification and regression using MLFFNNs - Error back propagation learning - Fast learning methods: Conjugate gradient method – Auto associative neural networks - Bayesian neural networks

UNIT III: RADIAL BASIS FUNCTION NETWORKS 12

Regularization theory - RBF networks for function approximation - RBF networks for pattern classification

UNIT IV: KERNEL METHODS FOR PATTERN ANALYSIS 12

Statistical learning theory- Support vector machines for pattern classification- Support vector regression for function approximation- Relevance vector machines for classification and regression

UNIT V: SELF-ORGANIZING MAPS 12

Pattern clustering- Topological mapping- Kohonen's self-organizing map

FEEDBACK NEURAL NETWORKS

Pattern storage and retrieval- Hopfield model- Boltzmann machine- Recurrent neural networks

TOTAL=60

COURSE OUTCOMES

- Analysis of transients using various parametric & non parametric methods.
- Analysis of various control schemes usend for controlling applications
- study about the adaptive control systems for various applications & study of issues in it.

Text Books:

1. B.Yegnanarayana, Artificial Neural Networks, Prentice Hall of India, 1999
2. Satish Kumar, Neural Networks – A Classroom Approach, Tata McGraw-Hill, 2003
3. S.Haykin, Neural Networks – A Comprehensive Foundation, Prentice Hall, 1998
4. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006

22153E54CP-VLSI DESIGN 3 1 0 4

OBJECTIVES:

- In this course, the MOS circuit realization of the various building blocks that is common to any
- microprocessor or digital VLSI circuit is studied.
- Architectural choices and performance tradeoffs involved in designing and realizing the circuits in
- CMOS technology are discussed.
- The main focus in this course is on the transistor circuit level design and realization for digital

UNIT I MOS TRANSISTOR PRINCIPLE 9

NMOS and PMOS transistors, Process parameters for MOS and CMOS, Electrical properties of CMOS circuits and device modeling, Scaling principles and fundamental limits, CMOS inverter scaling, propagation delays, Stick diagram, Layout diagrams

UNIT II COMBINATIONAL LOGIC CIRCUITS 9

Examples of Combinational Logic Design, Elmore's constant, Pass transistor Logic, Transmission gates, static and dynamic CMOS design, Power dissipation – Low power design principles

UNIT III SEQUENTIAL LOGIC CIRCUITS 9

Static and Dynamic Latches and Registers, Timing issues, pipelines, clock strategies, Memory architecture and memory control circuits, Low power memory circuits, Synchronous and Asynchronous design

UNIT IV DESIGNING ARITHMETIC BUILDING BLOCKS 9

Data path circuits, Architectures for ripple carry adders, carry look ahead adders, High speed adders, accumulators, Multipliers, dividers, Barrel shifters, speed and area tradeoff

UNIT V IMPLEMENTATION STRATEGIES 9

Full custom and Semi custom design, Standard cell design and cell libraries, FPGA building block architectures, FPGA interconnect routing procedures.

TOTAL 45

COURSE OUTCOMES

Upon completion of the course, students should

- Explain the basic CMOS circuits and the CMOS process technology.
- Discuss the techniques of chip design using programmable devices.
- Model the digital system using Hardware Description Language.

TEXTBOOKS:

1. Jan Rabaey, Anantha Chandrakasan, B.Nikolic, "Digital Integrated Circuits: A Design Perspective", Second Edition, Prentice Hall of India, 2003.
2. M.J. Smith, "Application Specific Integrated Circuits", Addisson Wesley, 1997

REFERENCES:

1. N.Weste, K.Eshraghian, “Principles of CMOS VLSI Design”, Second Edition, Addision Wesley 1993

2. R.Jacob Baker, Harry W.LI., David E.Boyee, “CMOS Circuit Design, Layout and Simulation”, Prentice Hall of India 2005

3. A.Pucknell, Kamran Eshraghian, “BASIC VLSI Design”, Third Edition, Prentice Hall of India, 2007.

ELECTIVE-II
Semester-v

22153E54DP- ROBOTICS

3 1 0 4

UNIT I: INTRODUCTION 9

Robot ,its evaluation; definition and aes of robotics, present application status.

UNIT II: ROBOT ANATOMY 9
configuration, robot motions, work volume. Robot drives, actuators and control; Functions and types of drives and actuators; concept of basic control systems, open loop, close loop, different type of controllers, ON-OFF, proportional, integral, PI, PD, PID.

UNIT III: ROBOT END EFFECTORS: **9**
Types of end effecters, mechanical gripper, tools and end effectors. Robot sensors: Transducers and sensors; analog and digital transducers; types of sensors, tachfile sensors, proximity and rough sensors ; miscellaneous sensors; vision systems; use of sensors in robotics.

UIT IV: ROBOT KINEMATICS 9
Position representations; forward and reverse kinematics of three and four degrees of freedom; robot arm; homogeneous transformations and robot kinematics; kinematics equations using homogeneous transformation .

UNIT V: INDUSTRIAL APPLICATION 9
Capabilities of robots; robot applications; materials handling; pick and place operation; palletiging and depalletiging; machine loading and unloading; machine casting; welding;painting,assembly; inspection; maintenance.

COURSE OUTCOMES

- Ability to understand and develop MFC windows applications with inputs and drawing features and implement menus using VC++
- Ability to understand document/view architecture and develop classic controls using VC++
- Ability to understand and design event driven programming and activeX controls and manage database using visual basic

BOOKS RECOMMENDED:
1.Schilling-Fundamental of robotics; PH
2.Yoshikawa- Fundamental of robotics; PH
3. S.R.Deb-Robotics Technology and Flexible Automation
4. Introduction to Robotics, John J Craig; Pearson Education

22153E54EP LT & HT DISTRIBUTION SYSTEMS 2 0 2 4

AIM

To become familiar with the function of different components used in Transmission and Distribution levels of power systems and modeling of these components.

OBJECTIVES

- To develop expression for computation of fundamental parameters of Power system analysis.
- To categorize the lines into different classes and develop equivalent circuits for these classes.
- To analyze the voltage distribution in Architectures and user interface.

UNIT-I 9

Power system-general concepts-distribution of power, load and energy forecasting-factors in power system loading, Power system analysis-load flow-fault studies-voltage control.

UNIT-II 9

Optimization of distribution system network cost modeling-economic loading of distribution transformers. Distribution system reliability-reliability assessment techniques

UNIT-III 9

Consumer services-maximum demand, diversity and load factor-consumer load control for power shortages, Tariffs-costing and pricing –economically efficient tariff structure. Overhead and underground lines-optimum design considerations, Power capacitors-size of capacitor for power factor improvement- HT and LT capacitor installation requirements.

UNIT-IV 9

Distribution System Design- Electrical Design Aspects of Industrial, Commercials Buildings- Design, estimation and costing of outdoor and indoor Substations, Electrical Safety and Earthing Practices at various voltage levels- Lightning protection.-Regulations and standards.

UNIT-V 9

Distribution Automation System : Necessity, System Control Hierarchy- Basic Architecture and implementation Strategies for SCADA and DAC systems -Basic Distribution Management System Functions. Communication Systems for Control and Automation- Wireless and wired Communications- SCADA and DAC communication Protocols, Architectures and user interface

Total: 45

Text/References:

1. Turan Gonen, “Electric Power Distribution system Engineering” Mc Graw-hill ,Inc,1987
2. A.S. Pabla, “ Electric Power Distribution systems” Tata Mc Graw-hill Publishing company
limited, 4th edition, 1997.
3. Alexander Eigeles Emanuel, “Power Definitions and the Physical Mechanism of Power Flow”, John Wiley & Sons, October 2009.
4. “Handbook of International Electrical Safety Practices”, John Wiley & Sons, PERI June 2009.
5. Ali A. Chowdhury, Don O. Koval, “Power distribution system reliability-Practical methods and applications” John Wiley & sons Inc., *IEEE Press* 2009
6. Richard E.Brown, “Electric power distribution reliability” Taylor & Francis Group,LLC,2009.
7. James Northcote-Green, Robert Wilson, “Control and automation of electrical power distribution system”, Taylor & Francis Group, LLC,2007.
8. S.Sivanagaraju, V.Sankar, Dhanpat Rai & Co, “Electrical Power Distribution and Automation”,2006.
9. Pansini,Anthony J, “Guide to electrical power distribution system”,Fairmont press, inc., 6th edition,2006.
10. Stuart A. Boyer, “SCADA-Supervisory Control and Data Acquisition” Instrument Society of America Publication,2004
11. Leveque, Francois , “Transport Pricing of Electricity Networks” Springer 2003
13. Lakervi & E J Holmes, “Electricity distribution network design”, Peter Peregrimus Ltd. 2nd Edition,2003
13. William H. Kersting, “Distribution system modeling and analysis” CRC press LLC, 2002.
14. Michael Wiebe, “A Guide to Utility Automation: Amr, Scada, and It Systems for Electric Power” PennWell,1999.
15. IEEE Press: IEEE Recommended practice for Electric Power Distribution for Industrial Plants, publish

ELECTIVE III
Semester VI

22153E64AP- PRINCIPLES OF MANAGEMENT 4 0 0 4

OBJECTIVE

i. To understand the Total Quality Management concept and principles and the various tools available to achieve Total Quality Management.

ii. To understand the statistical approach for quality control.

iii. To create an awareness about the ISO and QS certification process and its need for the industries

UNIT I HISTORICAL DEVELOPMENT 12

Definition of Management – Science or Art – Management and Administration – Development of Management Thought – Contribution of Taylor and Fayol – Functions of Management – Types of Business Organisation.

UNIT II PLANNING 12

Nature & Purpose – Steps involved in Planning – Objectives – Setting Objectives – Process of Managing by Objectives – Strategies, Policies & Planning Premises- Forecasting – Decision-making.

UNIT III ORGANISING 12

Nature and Purpose – Formal and informal organization – Organization Chart – Structure and Process – Departmentation by difference strategies – Line and Staff authority – Benefits and Limitations – De-Centralization and Delegation of Authority – Staffing – Selection Process - Techniques – HRD – Managerial Effectiveness.

UNIT IV DIRECTING 12

Scope – Human Factors – Creativity and Innovation – Harmonizing Objectives – Leadership – Types of Leadership Motivation – Hierarchy of needs – Motivation theories – Motivational Techniques –Job Enrichment – Communication – Process of Communication – Barriers and Breakdown –Effective Communication – Electronic media in Communication.

UNIT V CONTROLLING 12

System and process of Controlling – Requirements for effective control – The Budget as Control Technique – Information Technology in Controlling – Use of computers in handling the information – Productivity – Problems and Management – Control of Overall Performance – Direct and Preventive Control – Reporting – The Global Environment – Globalization and Liberalization – International Management and Global theory of Management.

TOTAL = 60

COURSE OUTCOMES

- Basic Knowledge on management, business, organization culture, environment and planning process.
- Ability to organize business activities, motivational techniques and effective communication.
- Ability to understand the management control and budgetary techniques.

TEXT BOOKS

1. Harold Kooritz & Heinz Weihrich “Essentials of Management”, Tata Mcgraw Hill,1998.
2. Joseph L Massie “Essentials of Management”, Prentice Hall of India, (Pearson) Fourth Edition, 2003.

REFERENCE BOOKS

1. Tripathy PC And Reddy PN, “ Principles of Management”, Tata Mcgraw Hill,1999.
2. Decenzo David, Robbin Stephen A, ”Personnel and Human Reasons Management”, Prentice Hall of India, 1996.
3. JAF Stomer, Freeman R. E and Daniel R Gilbert Management, Pearson Education, Sixth Edition, 2004.
4. Fraidoon Mazda, “ Engineering Management”, Addison Wesley,-2000.

22153E64BP- MICRO ELECTRO MECHANICAL SYSTEMS 4 0 0 4

AIM :

- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- To educate on the rudiments of Micro fabrication techniques.
- To introduce various sensors and actuators
- To introduce different materials used for MEMS
- To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

UNIT I INTRODUCTION 9

Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis –
Flexural beam bending- Torsional deflection.

UNIT II SENSORS AND ACTUATORS-I 9

Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors - Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph - Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys.

UNIT III SENSORS AND ACTUATORS-I 9

Piezoresistive sensors – Piezoresistive sensor materials - Stress analysis of mechanical elements –Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators –
piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

UNIT IV MICROMACHINING 9

Silicon Anisotropic Etching – Anisotrophic Wet Etching – Dry Etching of Silicon – Plasma Etching –Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies - Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process..

UNIT V POLYMER AND OPTICAL MEMS 9

Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

Total = 45

COURSE OUTCOMES

- Ability to understand the operation of micro devices, micro systems and their applications.
- Ability to design the micro devices, micro systems using the MEMS fabrication process.

TEXT BOOKS

1. Chang Liu, ‘Foundations of MEMS’, Pearson Education Inc., 2012.
2. Stephen D Senturia, ‘Microsystem Design’, Springer Publication, 2000.
3. Tai Ran Hsu, “MEMS & Micro systems Design and Manufacture” Tata McGraw Hill, New Delhi, 2002.

REFERENCE BOOKS

1. Nadim Maluf,“An Introduction to Micro Electro Mechanical System Design”, Artech House, 2000.
2. Mohamed Gad-el-Hak, editor, “The MEMS Handbook”, CRC press Baco Raton, 2001.
3. Julian w. Gardner, Vijay K. Varadan, Osama O. Awadelkarim, Micro Sensors MEMS and Smart Devices, John Wiley & Son LTD, 2002.
4. James J.Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005.
5. Thomas M.Adams and Richard A.Layton, “Introduction MEMS, Fabrication and Application,” Springer, 2010.

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ELECTIVES-III
SEMESTER-VI

22153E64CP INTEGRATED OPTO-ELECTRONIC DEVICES

3 1 0 4

AIM

To learn different types of optical emission, detection, modulation and opto electronic integrated circuits and their applications.

OBJECTIVE

• To know the basics of solid state physics and understand the nature and characteristics of light.
• To understand different methods of luminescence, display devices and laser types and their applications.
• To understand different light modulation techniques and the concepts and applications of optical switching.

UNIT I: ELEMENTS OF LIGHT AND SOLID STATE PHYSICS 9

Wave nature of light, Polarization, Interference, Diffraction, Light Source, review of Quantum Mechanical concept, Review of Solid State Physics, Review of Semiconductor Physics and Semiconductor Junction Device.

UNIT II: DISPLAY DEVICES AND LASERS 9

Introduction, Photo Luminescence, Cathode Luminescence, Electro Luminescence, Injection Luminescence, Injection Luminescence, LED, Plasma Display, Liquid Crystal Displays, Numeric Displays, Laser Emission, Absorption, Radiation, Population Inversion, Optical Feedback, Threshold condition, Laser Modes, Classes of Lasers, Mode Locking,laserapplications.

UNIT III: OPTICAL DETECTION DEVICES 9

Photo detector, Thermal detector, Photo Devices, Photo Conductors, Photo diodes, Detector Performance.

UNIT IV OPTOELECTRONIC MODULATOR 9

Introduction, Analog and Digital Modulation, Electro-optic modulators, Magneto Optic Devices, Acoustoptic devices, Optical, Switching and Logic Devices.

UNIT V OPTOELECTRONIC INTEGRATED CIRCUITS 9

Introduction, hybrid and Monolithic Integration, Application of Opto Electronic Integrated circuits, integrated transmitters and Receivers, Guided wave devices.

<u>COURSE OUTCOMES</u>

- Ability to understand and analyze Instrumentation systems and their applications to various industries.
- Ability to know the basic properties of laser and to apply for industry.
- Recognize the importance of laser in medicinal and industry applications.

TEXTBOOK

1. J. Wilson and J.Haukes, “Opto Electronics – An Introduction”, Prentice Hall of India Pvt. Ltd.,NewDelhi,1995.

REFERENCES

1. Bhattacharya “Semiconductor Opto Electronic Devices”, Prentice Hall of India Pvt., Ltd., NewDelhi,1995.

2. Jasprit Singh, “Opto Electronics – As Introduction to materials and devices”, McGraw-Hill International Edition, 1998.

ELECTIVES-III
SEMESTER-VI

22153E64DP -COMPUTER AIDED DESIGN OF ELECTRICAL APPARATUS

3 1 0 4

AIM

To introduce the basics of Computer Aided Design technology for the design of Electrical Machines.

OBJECTIVE

At the end of this course the student will be able to

- Learn the importance of computer aided design method.
- Understand the basic electromagnetic field equations and the problem formulation for CAD applications.
- Become familiar with Finite Element Method as applicable for Electrical Engineering.
- Know the organization of a typical CAD package.
- Apply Finite Element Method for the design of different Electrical apparatus.

UNIT I: INTRODUCTION 12

Conventional design procedures – Limitations – Need for field analysis based design – Review of Basic principles of energy conversion – Development of Torque/Force.

UNIT II: MATHEMATICAL FORMULATION OF FIELD PROBLEMS 12

Electromagnetic Field Equations – Magnetic Vector/Scalar potential – Electrical vector /Scalar potential – Stored energy in Electric and Magnetic fields – Capacitance - Inductance- Laplace and Poisson's Equations – Energy functional.

UNIT III: PHILOSOPHY OF FEM 12

Mathematical models – Differential/Integral equations – Finite Difference method – Finite element method – Energy minimization – Variation method- 2D field problems – Discretisation – Shape functions – Stiffness matrix – Solution techniques.

UNIT IV: CAD PACKAGES 12

Elements of a CAD System –Pre-processing – Modeling – Meshing – Material properties- Boundary Conditions – Setting up solution – Post processing.

UNIT V: DESIGN APPLICATIONS 12

Voltage Stress in Insulators – Capacitance calculation - Design of Solenoid Actuator – Inductance and force calculation – Torque calculation in Switched Reluctance Motor.

COURSE OUTCOMES

- The students will obtain the knowledge of basic electric and magnetic materials and design of rotating electrical Machines and Transformers.
- The students will be able to overall design the machines and transformers.

- The students will gain knowledge about the various types of electrical machines and design of both ac & dc Machines and many application.

TEXT BOOKS

1. S.J Salon, ‘Finite Element Analysis of Electrical Machines’, Kluwer Academic Publishers, London, 1995.
2. Nicola Bianchi, ‘Electrical Machine Analysis using Finite Elements’, CRC Taylor& Francis, 2005.

REFERENCES

1. Joao Pedro, A. Bastos and Nelson Sadowski, ‘Electromagnetic Modeling by Finite Element Methods’, Marcell Dekker Inc., 2003.
2. P.P.Silvester and Ferrari, ‘Finite Elements for Electrical Engineers’, Cambridge University Press, 1983.
3. D.A.Lowther and P.P Silvester, ‘Computer Aided Design in Magnetics’, Springer Verlag, New York, 1986.
4. S.R.H.Hoole, ‘Computer Aided Analysis and Design of Electromagnetic Devices’, Elsevier, New York, 1989.
5. User Manuals of MAGNET, MAXWELL & ANSYS Softwares.

22153E64EP ADVANCED DC-AC POWER CONVERSION 2 0 2 4

AIM

To study advanced DC-AC power conversion technologies

OBJECTIVE

To provide conceptual knowledge in modern power electronic converters and its applications in electric power utility.

UNIT-I TWO-LEVEL VOLTAGE SOURCE INVERTER 9

Introduction **- Sinusoidal PWM** - Modulation Scheme - Harmonic Content – Over-modulation – Third Harmonic Injection PWM - **Space Vector Modulation** - Switching States - Space Vectors - Dwell Time Calculation - Modulation Index - Switching Sequence - Spectrum Analysis - Even-Order Harmonic Elimination - Discontinuous Space Vector Modulation

UNIT-II CASCADED H-BRIDGE (CHB) MULTILEVEL INVERTERS 9

Introduction **- H-Bridge Inverter** - Bipolar Pulse-Width Modulation - Unipolar Pulse-Width Modulation –**Multilevel Inverter Topologies -** CHB Inverter with Equal dc Voltage - H-Bridges with Unequal dc Voltages.

Carrier Based PWM Schemes - Phase-Shifted Multicarrier Modulation - Level-Shifted Multicarrier Modulation - Comparison Between Phase- and Level-Shifted PWM Schemes - Staircase Modulation.

UNIT-III DIODE-CLAMPED MULTILEVEL INVERTERS 9

Introduction **-Three-Level Inverter -** Converter Configuration - Switching State - Commutation - Space Vector Modulation - Stationary Space Vectors - Dwell Time Calculation - Relationship Between *Vref* Location and Dwell Times - Switching Sequence Design -Inverter Output Waveforms and Harmonic Content - Even-Order Harmonic Elimination - **Neutral-Point Voltage Control** - Causes of Neutral-Point Voltage Deviation – Effect of Motoring and Regenerative Operation - Feedback Control of Neutral-Point Voltage

UNIT-IV 9

Other Space Vector Modulation Algorithms - Discontinuous Space Vector Modulation - SVM Based on Two-level Algorithm **High-Level Diode-Clamped Inverters** - Four- and Five-Level Diode-Clamped Inverters - Carrier-Based PWM– **Other Multilevel Voltage Source Inverters – Introduction - NPC/H-Bridge Inverter - Inverter** Topology - Modulation Scheme - Waveforms and Harmonic Content - **Multilevel Flying-Capacitor Inverters** – Inverter Configuration - Modulation Schemes

UNIT-V PWM CURRENT SOURCE INVERTERS 9

Introduction **-** PWM Current Source Inverter - Trapezoidal Modulation - Selective Harmonic Elimination -**Space Vector Modulation** - Switching States - Space Vectors - Dwell Time Calculation - Switching Sequence -Harmonic Content - SVM Versus TPWM and SHE - **Parallel Current Source Inverters** - Inverter Topology -Space Vector Modulation for Parallel Inverters - Effect of Medium Vectors on dc Currents - dc Current Balance Control - Load-Commutated Inverter (LCI) **Total: 45**

TEXT/REFERENCE BOOKS:

1. B. Woo, “High Power Converters and AC Drives”, John Wiley & Sons, 2006
2. Ned Mohan et.al , “Power Electronics” ,John Wiley and Sons,2006
3. Rashid, “Power Electronics, Circuits Devices and Applications”, Pearson Education, 3rd edition, 2004.
4. G.K.Dubey, Thyristorised Power Controllers, Wiley Eastern Ltd, 1993.
5. Dewan & Straughen, Power Semiconductor Circuits, John Wiley & Sons, 1975.
6. Cyril W Lander, Power Electronics, Mc Graw Hill, 3rd edition, 1993.

ELECTIVES-IV
SEMESTER-VII

22153E74AP - POWER SYSTEM TRANSIENTS

3 0 0 3
Semester VII

AIM
To understand generation of switching and lighting transients, their propagation, reflection and refraction a on the grid ad their impact on the grid equipment.

OBJECTIVES
i. To study the generation of switching transients and their control using circuit – theoretical concept.
ii. To study the mechanism of lighting strokes and the production of lighting surges.
iii. To study the propagation, reflection and refraction of travelling waves.
iv. To study the impact of voltage transients caused by faults, circuit breaker action, load rejection on integrated power system.

UNIT I INTRODUCTION AND SURVEY 7
Various types of power system transients - effects of transients on power systems.

UNIT II LIGHTNING AND SWITCHING SURGES 19
Electrification of thunder clouds – lightning current surges, parameters – closing and reclosing of lines – load rejection – fault clearing – short line faults – ferro-resonance – temporary over voltages – harmonics.

UNIT III MODELLING OF POWER SYSTEM EQUIPMENT 14
Surge parameters of power systems equipment, equivalent circuit representation, lumped and distributed circuit transients.

UNIT IV COMPUTATION OF TRANSIENT OVERVOLTAGES 14
Computation of transients – traveling wave method, Bewley's lattice diagram – analysis in time and frequency domain, EMTP for transient computation.

UNIT V INSULATION COORDINATION 12
Insulation co-ordination – over voltage protective devises principles of recent co-ordination and design of EHV lines. **Total = 60**

COURSE OUTCOMES

- Ability to understand and analyze power system transients and types of switching transients.
- To get knowledge about lightening transients and high voltage transient behavior travelling on line.
- To get knowledge about transients in integrated power systems.

TEXT BOOKS

1. Allan Greenwood, 'Electrical Transients in Power Systems', Wiley Inter science, New York, 2nd edition 1991**.**

2. R.D Begamudre, 'Extra High Voltage AC Transmission Engineering', Wiley Eastern Limited, 1986.

REFERENCES

1. Klaus Ragaller, 'Surges in High Voltage Networks', Plenum Press, New York, 1980.

2. Diesengrof, W., 'Overvoltages on High Voltage Systems', Rensealer Bookstore, Troy, New York, 1971.

22153E74BP -EHV AC and DC TRANSMISSION SYSTEMS

3 0 0 3

UNIT I TRANSMISSION ENGINEERING 9

Transmission line trends – Standard transmission voltages – Power handling capacity and line losses Cost of transmission lines and equipment – Mechanical consideration – Transmission Engineering principles.

UNIT II LINE PARAMETER 9

Calculation of line and ground parameters - Resistance, capacitance and Inductance calculation – Bundle conductors – modes propagation – Effect of earth.

UNIT III POWER CONTROL 9

Power frequency and voltage control – voltage control – Over voltages – Power circle diagram – Voltage control using shunt and series compensation – Static VAR compensation – Higher Phase order system – FACTs.

UNIT IV EHV AC Transmission 9

Design of EHV lines based in steady state limits and transient over voltages – Design of extra HV cable transmission – XLPE cables – Gas insulated cable – Corona and RIV.

UNIT V HVDC TRANSMISSION 9

HVDC Transmission principles – Comparison of HVAC and HVDC transmission – Economics – types of Converters – HVDC links – HVDC control – Harmonics – Filters – Multi terminal DC System – HVDC cables and HVDC circuit breakers.

Total=45

<u>COURSE OUTCOMES</u>

- Basic knowledge of HVDC Transmission, its components, types and applications
- Ability to analyze and design the Converter circuits, System Control Techniques
- Ability to design filters for harmonic control and perform power flow analysis using Per unit system for DC Quantities.

Reference Books:

1. Rakosh Das Begamudre, ‘Extra HVDC Transmission Engineering’, Wiley Eastern Ltd, 1990.
2. Padiyar K.R., ‘HVDC Power Transmission systems’, Wiley Eastern Ltd, 1993.
3. Allan Greenwood, ‘Electrical transients in power Systems’, John Eastern Ltd, New York, 1992.
4. Arrilaga J., ‘HVDC transmission’, Peter Perengrinus Ltd, London, 1983.

ELECTIVES-IV
SEMESTER-VII

22153E74CP - **Fundamentals of Nanoscience** **3 0 0 3**

OBJECTIVES:
To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION 9
Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thin films multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic,

UNIT II GENERAL METHODS OF PREPARATION 9
Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS 9
Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO_2,MgO, ZrO_2, NiO, nano alumina, CaO, $AgTiO_2$, Ferrites, Nano clays functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications..

UNIT IV CHARACTERIZATION TECHNIQUES 9
X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nano indentation.

UNIT V APPLICATIONS 9
NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery.

L= 45 Total = 45

COURSE OUTCOMES

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS

1. A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.

2. N John Dinardo, “Nanoscale charecterisation of surfaces & Interfaces”, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

REFERENCE BOOKS

1. G Timp, “Nanotechnology”, AIP press/Springer, 1999.
2. Akhlesh Lakhtakia,“The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations”. Prentice-Hall of India (P) Ltd, New Delhi, 2007.

22153E74DP - ADVANCED CONTROL SYSTEMS 3 0 0 3

AIM

To gain knowledge in analysis of non-linear system and digital control of linear system.

OBJECTIVES

i. To study the description and stability of non-linear system.
ii. To study the conventional technique of non-linear system analysis.
iii. To study the analysis discrete time systems using conventional techniques.
iv. To study the analysis of digital control system using state-space formulation.
v. To study the formulation and analysis of multi input multi output (MIMO) system.

UNIT I NON-LINEAR SYSTEM – DESCRIPTION & STABILITY **9**

Linear vs non-linear – Examples – Incidental and Intentional – Mathematical description - Equilibria and linearisation - Stability – Lyapunov function – Construction of Lyapunov function.

UNIT II PHASE PLANE AND DESCRIBING FUNCTION ANALYSIS **9**

Construction of phase trajectory – Isocline method – Direct or numerical integration – Describing function definition – Computation of amplitude and frequency of oscillation.

UNIT III Z-TRANSFORM AND DIGITAL CONTROL SYSTEM **9**

Z transfer function – Block diagram – Signal flow graph – Discrete root locus – Bode plot. Design of Discrete PID controller – discrete state feedback controller and discrete compensator.

UNIT IV STATE-SPACE DESIGN OF DIGITAL CONTROL SYSTEM **9**

State equation – Solutions – Realization – Controllability – Observability – Stability Jury's test.

UNIT V MUTLI INPUT MULTI OUTPUT (MIMO) SYSTEM: 9

Models of MIMO system – Matrix representation – Transfer function representation – Poles and Zeros – Decoupling – Introduction to multivariable Nyquist plot and singular values analysis – Model predictive control. **L = 45 Total = 45**

COURSE OUTCOMES

- Develop mathematical models and understand the mathematical relationships between
- the sensitivity functions and how they govern the fundamentals in control systems.
- Design and fine tune PID controllers and understand the roles of P, I and D in feedback control and develop state-space models

- Advanced filters design for various control applications with proper error estimation techniques.

TEXT BOOKS

1. Benjamin C. Kuo, ‘Digital Control Systems’, Oxford University Press, 1992.
2. George J. Thaler, ‘Automatic Control Systems’, Jaico Publishers, 1993.

REFERENCE BOOKS

1. I.J. Nagrath and M. Gopal, ‘Control Systems Engineering’, New Age International Publishers, 2003.
2. Raymond T. Stefani & Co., ‘Design of feed back Control systems’, Oxford University, 2002.
3. William L. Luyben and Michael L. Luyben, ‘Essentials of Process Control’, McGraw Hill International Editions, Chemical Engineering Series, 1997.

Reference from Reputed University
Percentage of syllabus revised 10%
Syllabus focus on Employability and Innovation

22153E74EP SWITCHED MODE POWER SUPPLIES 2 0 2 4

AIM
To study low power SMPS and UPS technologies

OBJECTIVE
To provide conceptual knowledge in modern power electronic converters and its applications in electric power utility.

UNIT-I Introduction 9
Linear regulator Vs. Switching regulator – Topologies of SMPS – isolated and non isolated topologies – Buck – Boost – Buck boost – Cuk – Polarity inverting topologies – Push pull and forward converters half bridge and full bridge – Fly back converters Voltage fed and current fed topologies. EMI issues.

UNIT-II Design Concepts 9
Magnetic Circuits and design – Transformer design - core selection – winding wire selection – temperature rise calculations - Inductor design. Core loss – copper loss – skin effect - proximity effect. Power semiconductor selection and its drive circuit design – snubber circuits. Closing the feedback loop – Control design – stability considerations

UNIT-III Control Modes 9
Voltage Mode Control of SMPS.. Transfer Function and Frequency response of Error Amp. Transconductance Error Amps. PWM Control ICs (SG 3525,TL 494,MC34060 etc.) Current Mode Control and its advantages. Current Mode Vs Voltage Mode. Current Mode PWM Control IC(eg.UC3842).

UNIT-IV Applications of SMPS 9
Active front end – power factor correction – High frequency power source for fluorescent lamps - power supplies for portable electronic gadgets.

UNIT-V Resonant converters 9
Principle of operation – modes of operation – quasi resonant operation- advantages.

Total : 45

Text/Reference Books:

1. Abraham I Pressman - Switching power supply design – 2nd edition 1998 Mc-Graw hill Publishing Company.
2. Keith H Billings - Switch mode power supply handbook – 1st edition 1989 Mc-Graw hill Publishing Company.
3. Sanjaya Maniktala - Switching power supplies A to Z. – 1st edition 2006, Elsevier Inc.
4. Daniel M Mitchell : DC-DC Switching Regulator Analysis. McGraw Hill Publishing Company
5. Ned Mohan et.al : Power Electronics. John Wiley and Sons.
6. Otmar Kilgenstein : Switched Mode Power Supplies in Practice. John Wiley and Sons.
7. Mark J Nave : Power Line Filter Design for Switched-Mode Power Supplies. Van Nostrand Reinhold, New York.

22153P75P Project Work

- The student will use their ability to design electrical, electronic systems and signals through modeling, simulation, experimentation, interpretation and analysis to build, test, and debug prototype circuits and systems and analyze results using the principles of design to solve open-ended engineering problems.
- The students will be able to take professional decisions based on the impact of socio- economic issues by their self-confidence, a high degree of personal integrity, and the belief that they can each make a difference by developing persuasive communication skills in a variety of media by engaging them in team-based activities, and by strengthening their interpersonal skills. This will lead to develop the leadership qualities by making the students to identify their personal values and demonstrate the practice of ethical leadership.
- The students will be able to appreciate the importance of optimization, commercialization, and innovation as the desired features of the designed system

PONNAIYAH RAMAJAYAM INSTITUTE OF SCIENCE & TECHNOLOGY (PRIST)

Declared as DEEMED-TO-BE-UNIVERSITY
U/s 3 of UGC Act, 1956

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

PROGRAM COURSE STRUCTURE
R-2022

M.TECH-POWER SYSTEMS (FULL TIME)
[Regulation 2022]

[for candidates admitted to M. Tech Power System program from June 2022 onwards]

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

PROGRAMME: M.TECH-POWER SYSTEMS (FULL TIME)

CURRICULUM -REGULATION 2022

SEMESTER – I

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1.	22248S11D	Applied Mathematics for Power System Engineering	3	1	0	4
2	22272C12	System Theory	3	1	0	4
3	22272C13	Advanced Power System Analysis	3	1	0	4
4	22272C14	Economic Operations of Power Systems	3	1	0	4
5	22272C15	HVDC and FACTS	3	1	0	4
6	22272E16_	Elective-I	3	0	0	3
7	22272L17	Power System Simulation Laboratory	0	0	3	3
		TOTAL				**26**

SEMESTER – II

SL. NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272C21	EHV power transmission	3	1	0	4
2	22272C22	Power System Control	3	1	0	4
3	22272C23	Advanced Power System Protection	3	1	0	4
4	22272E24_	Elective –II	3	0	0	3
5	22272E25_	Elective –III	3	0	0	3
6	22272L26	Advanced Power System Simulation Laboratory	0	0	3	3
7	222TECWR	Technical Writing/Seminars	0	0	3	3
		TOTAL				**24**

SEMESTER – III

SL. NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272C31	Electrical Transients in power systems	3	1	0	4
2	22272E32_	Elective –IV	3	0	0	3
3	22272E33_	Elective –V	3	0	0	3
4	22272E34_	Elective –VI	3	0	0	3
5	22272P35	Project work Phase-I	0	0	10	10
		TOTAL				**23**

SEMESTER – IV

SL. NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272P41	Project work Phase-II	0	0	15	15

Elective –I

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E16A	Analysis of Inverters	3	0	0	3
2.	22272E16B	Modeling and Analysis of Electrical Machines	3	0	0	3
3.	22272E16C	Advanced Power System Dynamics	3	0	0	3
4.	22272E16D	Analysis and Computation of Electromagnetic Transients in Power Systems	3	0	0	3

Elective –II

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E24A	Smart Grid	3	0	0	3
2.	22272E24B	Solar and Energy Storage Systems	3	0	0	3
3.	22272E24C	Power System Reliability	3	0	0	3
4.	22272E24D	Distributed Generation and Microgrid	3	0	0	3

Elective –III

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E25A	Wind Energy conversion systems	3	0	0	3
2.	22272E25B	AI Techniques to Power Systems	3	0	0	3
3.	22272E25C	Electrical Distribution	3	0	0	3
4.	22272E25D	Energy Management and Auditing	3	0	0	3

Elective –IV

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E32A	Power Electronics applications in Power systems	3	0	0	3
2.	22272E32B	Power system Dynamics	3	0	0	3
3.	22272E32C	Electric Vehicles and Power Management	3	0	0	3
4.	22272E32D	Electromagnetic Interference and Compatibility	3	0	0	3

Elective –V

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E33A	Power Conditioning	3	0	0	3
2.	22272E33B	Deregulated Power System	3	0	0	3
3.	22272E33C	Control System Design for Power Electronics	3	0	0	3
4.	22272E33D	Principles of EHV Transmission	3	0	0	3

Elective –VI

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E34A	Software for Control system Design	3	0	0	3
2.	22272E34B	Industrial Power system analysis and design	3	0	0	3
3.	22272E34C	Soft Computing Techniques	3	0	0	3
4.	22272E34D	Restructured Power System	3	0	0	3

Total Credits = 88

Credit Distribution

Sem.	Core Courses				Elective Courses		Total Credits
	Theory Courses		Practical Courses				
	Nos.	Credits	Nos.	Credits	Nos.	Credits	
I	04	16	01	03	01	03	26
II	03	12	02	06	02	06	24
III	01	04	-	-	03	09	23
IV	-	-	-	-	-	-	15
						Total Credits	**88**

HOD **DEAN**

DEAN ACADEMIC AFFAIRS

22248S11D - APPLIED MATHEMATICS for POWER SYSTEM ENGINEERING

ENGINEERING **3 1 0 4**

1. ADVANCED MATRIX THEORY 9

Matrix norms – Jordan canonical form – Generalized eigenvectors – Singular value decomposition – Pseudo inverse – Least square approximations.

2. RANDOM PROCESSES 9

Random variable, discrete, continuous types - Binomial, Poisson, normal and exponential distributions density & distribution Functions- Moments Moment Generating Functions – Notion of stochastic processes - Auto-correlation – Cross correlation .

3. LINEAR PROGRAMMING 9

Basic concepts – Graphical and Simplex methods –Transportation problem – Assignment problem.

4. DYNAMIC PROGRAMMING 9

Elements of the dynamic programming model – optimality principle – Examples of dynamic programming models and their solutions.

5. INTEGRAL TRANSFORMS 9

Finite Fourier transform - Fourier series - Finite sine Transform - Cosine transform - finite Hankel transform - definition, Transform of df/dx where p is a root of Jn(p) = 0, Transform of

$$\frac{d^2f}{dx^2} + \frac{1}{x}\frac{df}{dx}, \text{ and Transform of } \frac{d^2f}{dx^2} + \frac{1}{x}\frac{df}{dx} - \frac{n^2f}{x^2}$$

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Lewis.D.W., Matrix Theory ,Allied Publishers, Chennai 1995.
2. Bronson, R, Matrix Operations, Schaums outline Series, McGraw Hill, New York. 1989.
3. Andrews, L.A., and Shivamoggi B.K., “Integral Transforms for Engineers and Applied Mathematicians”, Macmillan , New York ,1988.
4. Taha, H.A., " Operations research - An Introduction ", Mac Millan publishing Co., (1982).
5. Gupta, P.K.and Hira, D.S., " Operations Research ", S.Chand & Co., New Delhi, (1999).6..
6. Ochi, M.K. " Applied Probability and Stochastic Processes ", John Wiley & Sons (1992).
7. Peebles Jr., P.Z., " Probability Random Variables and Random Signal Principles, McGraw Hill Inc., (1993).

22272C12- SYSTEM THEORY

3 1 0 4

1. PHYSICAL SYSTEMS AND STATE ASSIGNMENT 9

Systems - electrical - mechanical - hydraulic - pneumatic - thermal systems - modelling of some typical systems like D.C. Machines - inverted pendulum.

2. STATE SPACE ANALYSIS 9

Realisation of state models - non-uniqueness - minimal realisation - balanced realisation - solution of state equations - state transition matrix and its properties - free and forced responses - properties - controllability and observability - stabilisability and detectability - Kalman decomposition.

3. MIMO SYSTEMS - FREQUENCY DOMAIN DESCRIPTIONS 9

Properties of transfer functions - impulse response matrices - poles and zeros of transfer function matrices - critical frequencies - resonance - steady state and dynamic response - bandwidth - Nyquist plots - singular value analysis.

4. NON-LINEAR SYSTEMS 9

Types of non-linearity - typical examples - equivalent linearization - phase plane analysis - limit cycles - describing functions - analysis using describing functions - jump resonance.

5. STABILITY 9

Stability concepts - equilibrium points - BIBO and asymptotic stability - direct method of Liapunov - application to non-linear problems - frequency domain stability criteria - Popov's method and its extensions.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. M. Gopal, 'Modern Control Engineering', Wiley, 1996.
2. J.S. Bay, 'Linear State Space Systems', McGraw-Hill, 1999.
3. Eroni-Umez and Eroni, 'System dynamics & Control', Thomson Brooks / Cole, 1998.
4. K. Ogatta, 'Modern Control Engineering', Pearson Education, Low Priced Edition, 1997.
5. G.J. Thaler, 'Automatic control systems', Jaico publishers, 1993.
6. John S. Bay, 'Linear State Space Systems', McGraw-Hill International Edition, 1999.

22272C13 - ADVANCED POWER SYSTEM ANALYSIS

3 1 0 4

OBJECTIVES:

- To introduce different techniques of dealing with sparse matrix for large scale power systems.
- To impart in-depth knowledge on different methods of power flow solutions.
- To perform optimal power flow solutions in detail.
- To perform short circuit fault analysis and understand the consequence of different type of faults.
- To Illustrate different numeric al integration methods and factors influencing transient stability

UNIT I SOLUTION TECHNIQUE 9

Sparse Matrix techniques for large scale power systems: Optimal ordering schemes forpreserving sparsity. Flexible packed storage scheme for storing matrix as compact arrays –Factorization by Bifactorization and Gauss elimination methods; Repeat solution using Left and Right factors and L and U matrices.

UNIT II POWER FLOW ANALYSIS 9

Power flow equation in real and polar forms; Review of Newton's method for solution; Adjustment of P-V buses; Review of Fast Decoupled Power Flow method; Sensitivity factors for P-V bus adjustment..

UNIT III OPTIMAL POWER FLOW 9

Problem statement; Solution of Optimal Power Flow (OPF) – The gradient method, Newton's method, Linear Sensitivity Analysis; LP methods – With real power variables only – LP method with AC power flow variables and detailed cost functions; Security constrained Optimal Power Flow; Interior point algorithm; Bus Incremental costs.

UNIT IV SHORT CIRCUIT ANALYSIS 9

Formation of bus impedance matrix with mutual coupling (single phase basis and three phase basis)- Computer method for fault analysis using ZBUS and sequence components. Derivation of equations for bus voltages, fault current and line currents, both in sequence and phase – symmetrical and unsymmetrical faults.

UNIT V TRANSIENT STABILITY ANALYSIS 9

Introduction, Numerical Integration Methods: Euler and Fourth Order Runge-Kutta methods, Algorithm for simulation of SMIB and multi-machine system with classical synchronous machine model; Factors influencing transient stability, Numerical stability and implicit Integration methods.

L = 45 T = 15 P = 0 C =4

OUTCOMES:

- Ability to apply the concepts of sparse matrix for large scale power system analysis
- Ability to analyze power system studies that needed for the transmission system planning.

REFERENCES:

1. A.J.Wood and B.F.Wollenberg, "Power Generation Operation and Control", John Wiley and sons, New York, 1996.
2. W.F.Tinney and W.S.Meyer, "Solution of Large Sparse System by Ordered Triangular Factorization" IEEE Trans. on Automatic Control, Vol : AC-18, pp:333346 Aug 1973.
3.K.Zollenkopf, "Bi-Factorization: Basic Computational Algorithm and Programming Techniques ; pp:75-96 ; Book on "Large Sparse Set of Linear Systems" Editor: J.K.Rerd,Academic Press, 1971.
4. M.A.Pai," Computer Techniques in Power System Analysis",Tata McGraw-Hill Publishing Company Limited, New Delhi, 2006.
5. G W Stagg , A.H El. Abiad, "Computer Methods in Power System Analysis", McGraw Hill, 1968.
6. P.Kundur, "Power System Stability and Control", McGraw Hill, 1994.

22272C14- ECONOMIC OPERATIONS OF POWER SYSTEMS

3 1 0 4

1. INTRODUCTION **9**

Planning and operational problems of power systems – review of economic dispatch and calculation using B matrix loss formula – use of participation factors in on line economic dispatch.

2. OPTIMAL POWER FLOW PROBLEM **9**

Real and reactive power control variables – operation and security constraints and their limits – general OPF problem with different objective functions – formulation – cost loss minimization using Dommel and Tinney's method and SLP – development of model and algorithm – MVAR planning – optimal sitting and sizing of capacitors using SLR method – interchange evaluation using SLP.

3. HYDRO THERMAL SCHEDULING **9**

Problems definition and mathematical model of long and short term problems – discretization – dynamic and incremental dynamic programming – methods of local variation – hydro thermal system with pumped hydro units – solution by local variation treating pumped hydro unit for load management and spinning reserve.

4. UNIT COMMITMENT **9**

Constraints in unit commitment – solution by priority list method – dynamic programming method – backward and forward – restricted search range.

5. MAINTENANCE SCHEDULING **9**

Factors considered in maintenance scheduling for generating units – turbines – boilers – introduction to maintenance scheduling using mathematical programming.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Allen J.Wood and Bruce F.Wollenberg, "Power generation and control", John Wiley & Sons, New York, 1984.
2. Krichmayer L., "Economic operation of power systems", John Wiley and sons Inc, New York, 1958.
3. Krichmayer L.K, "Economic control of Interconnected systems", Jhon Wiley and sons Inc, New York, 1959.
4. Elgerd O.I., "Electric energy systems theory – an introduction", McGraw Hill, New Delhi, 1971.

22272C15- HVDC AND FACTS

3 1 0 4

OBJECTIVES:

- To emphasis the need for FACTS controllers.
- To learn the characteristics, applications and modeling of series and controllers.
- To analyze the interaction of different FACTS controller and coordination
- To impart knowledge on operation, modelling and control of HVDC link.
- To perform steady state analysis of AC/DC system.

UNIT I INTRODUCTION 9

Review of basics of power transmission networks-control of power flow in AC transmission line- Analysis of uncompensated AC Transmission line- Passive reactive power compensation: Effect of series and shunt compensation at the mid-point of the line on power transfer- Need for FACTS controllers- types of FACTS controllers. Comparison of AC & DC Transmission, Applications of DC Transmission Topologies.

UNIT II SVC & STATCOM 9

Configuration of SVC- voltage regulation by SVC- Modelling of SVC for load flow analysisDesign of SVC to regulate the mid-point voltage of a SMIB system- Applications Static synchronous compensator (STATCOM)- Operation of STATCOM – Voltage regulation – Power flow control with STATCOM.

UNIT III TCSC and SSSC 9

Concepts of Controlled Series Compensation- Operation of TCSC - Analysis of TCSC operation - Modelling of TCSC for load flow studies - Static synchronous series compensator (SSSC)- Operation of SSSC - Modelling of SSSC for power flow – operation of Unified power flow controllers(UPFC).

UNIT IV ANALYSIS OF HVDC LINK 9

Simplified analysis of six pulse Graetz bridge – Charecteristics - Analysis of converter operations – Commutation overlap – Equivalence circuit of bipolar DC transmission link – Modes of operation – Mode ambiguity – Different firing angle controllers – Power flow control.

UNIT V POWER FLOW ANALYSIS IN AC/DC SYSTEMS 9

Per unit system for DC Quantities - Modelling of DC links - Solution of DC load flow - Solution of AC-DC power flow – Unified and Sequential methods.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will be able to refresh on basics of power transmission networks and need for FACTS controllers
- Learners will understand the significance about different voltage source converter based FACTS controllers
- Learners will understand the significance of HVDC converters and HVDC system control
- Learners will attain knowledge on AC/DC power flow analysis

REFERENCES

1. Mohan Mathur, R., Rajiv. K. Varma, “Thyristor – Based Facts Controllers for Electrical Transmission Systems”, IEEE press and John Wiley & Sons, Inc.

2. K.R.Padiyar, “FACTS Controllers in Power Transmission and Distribution”, New Age International (P) Ltd., Publishers, New Delhi, Reprint 2008.
3. K.R.Padiyar, “HVDC Power Transmission Systems”, New Age International (P) Ltd., New Delhi, 2002.
4. J.Arrillaga, “High Voltage Direct Current Transmission”, Peter Pregrinus, London, 1983.
5. V.K.Sood, “HVDC and FACTS controllers- Applications of Static Converters in Power System”, Kluwer Academic Publishers 2004

22272L17- POWER SYSTEM SIMULATION LABORATORY 0 0 3 3

OBJECTIVES:

- To have hands on experience on various system studies and different techniques used
- for system planning using Software packages
- To perform the dynamic analysis of power system
-

LIST OF EXPERIMENTS

1. Power flow analysis by Newton-Raphson method and Fast decoupled method

2. Transient stability analysis of single machine-infinite bus system using classical machine model

3. Contingency analysis: Generator shift factors and line outage distribution factors

4. Economic dispatch using lambda-iteration method

5. Unit commitment: Priority-list schemes and dynamic programming

6. State Estimation (DC)

7. Analysis of switching surge using EMTP: Energisation of a long distributed- parameter line

8. Analysis of switching surge using EMTP : Computation of transient recovery voltage

9. Simulation and Implementation of Voltage Source Inverter

10. Digital Over Current Relay Setting and Relay Coordination using Suitable software packages

11 Co-ordination of over-current and distance relays for radial line protection

TOTAL: 60 PERIODS

OUTCOMES:

- Upon Completion of the course, the students will be able to:
- Analyze the power flow using Newton-Raphson method and Fast decoupled method.
- Perform contingency analysis & economic dispatch
- Set Digital Over Current Relay and Coordinate Relay

22272C21- EHV POWER TRANSMISSION

3 1 0 4

1. INTRODUCTION 9

Standard transmission voltages – different configurations of EHV and UHV lines – average values of line parameters – power handling capacity and line loss – costs of transmission lines and equipment – mechanical considerations in line performance.

2. CALCULATION OF LINE PARAMETERS 9

Calculation of resistance, inductance and capacitance for multi-conductor lines – calculation of sequence inductances and capacitances – line parameters for different modes of propagation – resistance and inductance of ground return, numerical example involving a typical 400/220kV line using line constant program.

3. VOLTAGE GRADIENTS OF CONDUCTORS 9

Charge-potential relations for multi-conductor lines – surface voltage gradient on conductors – gradient factors and their use – distribution of voltage gradient on sub conductors of bundle - voltage gradients on conductors in the presence of ground wires on towers.

4. CORONA EFFECTS 9

Power losses and audible losses: I R loss and corona loss - audible noise generation and characteristics - limits for audible noise - Day-Night equivalent noise level- radio interference: corona pulse generation and properties - limits for radio interference fields

5. ELECTROSTATIC FIELD OF EHV LINES 9

Effect of EHV line on heavy vehicles - calculation of electrostatic field of AC lines- effect of high field on humans, animals, and plants - measurement of electrostatic fields - electrostatic Induction in unenergised circuit of a D/C line - induced voltages in insulated ground wires - electromagnetic interference

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Rakosh Das Begamudre, "Extra High Voltage AC Transmission Engineering", Second Edition, New Age International Pvt. Ltd., 1990.
2. Power Engineer's Handbook, Revised and Enlarged 6th Edition, TNEB Engineers' Association, October 2002.
3. Microtran Power System Analysis Corporation, Microtran Reference Manual, Vancouver Canada. (Website: www.microtran.com).

22272C22 **POWER SYSTEM CONTROL** **3 1 0 4**

1. AUTOMATIC GENERATION CONTROL 9

Plant and system level control problem – ALFC of single area system modeling state and transient response – EDC control loop – ALFC of multi area system – modeling – static and transient response of two area system development of state variable model – two area system – AGC system design Kalman's method.

2. AUTOMATIC VOLTAGE CONTROL 9

Modeling of AVR loop – components – dynamic and static analysis – stability compensation – system level voltage control using OLTC, capacitor and generator voltages – expert system application for system voltage control.

3. SECURITY CONTROL CONCEPT 9

System operating states by security control functions – monitoring evaluation of system state by contingency analysis – corrective controls (preventive, emergency and restorative) – islanding scheme.

4. STATE ESTIMATION 9

Least square estimation – basic solution – sequential form of solution – static state estimation of power system by different algorithms – tracking state estimation of power system-computation consideration – external equivalency. Treatment of bad data and on line load flow analysis.

5. COMPUTER CONTROL OF POWER SYSTEM 9

Energy control center – various levels – national – regional and state level SCADA system – computer configuration – functions, monitoring, data acquisition and controls – EMS system – software in EMS system. Expert system applications for power system operation.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Kundur.P., "power system stability and control", McGraw Hill, 1994.
2. Anderson P.M., and Fouad A.A, "power system control and stability", Galgotia publication, New Delhi, 1981.
3. Taylor C.W., "power systems voltage stability", McGraw Hill, New Delhi, 1993.
4. IEEE recommended practice for excitation system models for power system stability studies, IEEE standard 421.5, 1992.
5. Kimbark E.W., "power system stability", Vol.3., Synchronous machines, John Wiley and sons, 1956.
6. T.V Custem, C.Vournas, "voltage stability of power system", Kluwer Acadamic Publishers, 1998.
7. Elgerd O.L., "Elctric energy systems theory – an introduction", McGraw Hill, New Delhi, 1971.

22272C23- ADVANCED POWER SYSTEM PROTECTION

3 1 0 4

OBJECTIVES:

- To illustrate concepts of transformer protection
- To describe about the various schemes of Over current protection
- To analyze distance and carrier protection
- To familiarize the concepts of Generator protection and Numerical protection

UNIT I OVER CURRENT & EARTH FAULT PROTECTION 9

Zones of protection – Primary and Backup protection – operating principles and Relay Construction - Time – Current characteristics-Current setting – Time setting-Over current protective schemes –Concept of Coordination - Protection of parallel / ring feeders – Reverse power or directional relay –Polarisation Techniques – Cross Polarisation – Quadrature Connection -Earth fault and phase fault protection - Combined Earth fault and phase fault protection scheme - Phase fault protective - scheme directional earth fault relay - Static over current relays – Numerical over – current protection; numerical coordination example for a radial feeder

UNIT II TRANSFORMER & BUSBAR PROTECTION 9

Types of transformers –Types of faults in transformers- Types of Differential Protection – High Impedance – External fault with one CT saturation – Actual behaviors of a protective CT – Circuit model of a saturated CT - Need for high impedance – Disadvantages - Percentage Differential Bias Characteristics – Vector group & its impact on differential protection - Inrush phenomenon – Zero Sequence filtering – High resistance Ground Faults in Transformers – Restricted Earth fault Protection - Inter-turn faults in transformers – Incipient faults in transformers - Phenomenon of overfluxing in transformers – Transformer protection application chart. Differential protection of busbars external and internal fault - Supervisory relay-protection of three – Phase busbars – Numerical examples on design of high impedance busbar differential scheme –Biased Differential Characteristics – Comparison between Transformer differential & Busbar differential.

UNIT III DISTANCE AND CARRIER PROTECTION OF TRANSMISSION LINES 9

Drawback of over – Current protection – Introduction to distance relay – Simple impedance relay – Reactance relay – mho relays comparison of distance relay – Distance protection of a three – Phase line-reasons for inaccuracy of distance relay reach - Three stepped distance protection Trip contact configuration for the three - Stepped distance protection - Three-stepped protection f three-phase line against all ten shunt faults - Impedance seen from relay side - Three-stepped protection of double end fed lines-need for carrier – Aided protection – Various options for a carrier –Coupling and trapping the carrier into the desired line section - Unit type carrier aided directional comparison relaying – Carrier aided distance schemes for acceleration of zone II; numerical example for a typical distance protection scheme for a transmission line.

UNIT IV GENERATOR PROTECTION 9

Electrical circuit of the generator –Various faults and abnormal operating conditions – Stator Winding Faults – Protection against Stator (earth) faults – third harmonic voltage protection – Rotor fault – Abnormal operating conditions - Protection against Rotor faults – Potentiometer Method – injection method – Pole slipping – Loss of excitation – Protection against Mechanical faults; Numerical examples for typical generator protection schemes

UNIT V NUMERICAL PROTECTION

Introduction–Block diagram of numerical relay - Sampling theorem- Correlation with a reference (LES) technique-Digital filtering-numerical over - Current protection– Numerical transformer differential protection-Numerical distance protection of transmission line

L = 45 T = 15 P = 0 C =4

OUTCOMES:

- Learners will be able to understand the various schemes available in Transformer
- protection
- Learners will have knowledge on Overcurrent protection.
- Learners will attain knowledge about Distance and Carrier protection in transmission lines.
- Learners will understand the concepts of Generator protection.
- Learners will attain basic knowledge on substation automation.

REFERENCES

1 Y.G. Paithankar and S.R Bhide, "Fundamentals of Power System Protection", Prentice-Hall of India, 2003

2 Badri Ram and D.N. Vishwakarma, "Power System Protection and Switchgear", Tata McGraw- Hill Publishing Company, 2002.

3 T.S.M. Rao, "Digital Relay / Numerical relays", Tata McGraw Hill, New Delhi, 1989.

4 P.Kundur, "Power System Stability and Control", McGraw-Hill, 1993.

22272L26 ADVANCED POWER SYSTEM SIMULATION LABORATORY

LT P C

0 0 4 2

OBJECTIVES:

- To analyze the effect of FACTS controllers by performing steady state analysis.
- To have hands on experience on different wind energy conversion technologies

LIST OF EXPERIMENTS

1. Small-signal stability analysis of single machine-infinite bus system using classical machine model
2. Small-signal stability analysis of multi-machine configuration with classical machine model
3. Induction motor starting analysis
4. Load flow analysis of two-bus system with STATCOM
5. Transient analysis of two-bus system with STATCOM
6. Available Transfer Capability calculation using an existing load flow program
7. Study of variable speed wind energy conversion system- DFIG
8. Study of variable speed wind energy conversion system- PMSG
9. Computation of harmonic indices generated by a rectifier feeding a R-L load
10. Design of active filter for mitigating harmonics

22272C31- ELECTRICAL TRANSIENTS IN POWER SYSTEMS

3 1 0 4

1. TRAVELLING WAVES ON TRANSMISSION LINE 9

Lumped and Distributed Parameters – Wave Equation – Reflection, Refraction, Behavior of Travelling waves at the line terminations – Lattice Diagrams – Attenuation and Distortion – Multi-conductor system and Velocity wave.

2. COMPUTATION OF POWER SYSTEM TRANSIENTS 9

Principle of digital computation – Matrix method of solution, Modal analysis, Z transforms, Computation using EMTP – Simulation of switches and non-linear elements.

3. LIGHTNING, SWITCHING AND TEMPORARY OVERVOLTAGES 9

Lightning: Physical phenomena of lightning – Interaction between lightning and power system – Factors contributing to line design – Switching: Short line or kilometric fault – Energizing transients - closing and re-closing of lines - line dropping, load rejection - Voltage induced by fault – Very Fast Transient Overvoltage (VFTO)

4. BEHAVIOUR OF WINDING UNDER TRANSIENT CONDITION 9

Initial and Final voltage distribution - Winding oscillation - traveling wave solution - Behavior of the transformer core under surge condition – Rotating machine – Surge in generator and motor

5. INSULATION CO-ORDINATION 9

Principle of insulation co-ordination in Air Insulated substation (AIS) and Gas Insulated Substation (GIS), insulation level, statistical approach, co-ordination between insulation and protection level –overvoltage protective devices – lightning arresters, substation earthing.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Pritindra Chowdhari, "Electromagnetic transients in Power System", John Wiley and Sons Inc., 1996.
2. Allan Greenwood, "Electrical Transients in Power System", Wiley & Sons Inc. New York, 1991.
3. Klaus Ragaller, "Surges in High Voltage Networks", Plenum Press, New York, 1980.
4. Rakosh Das Begamudre, "Extra High Voltage AC Transmission Engineering", (Second edition) Newage International (P) Ltd., New Delhi, 1990.
5. Naidu M S and Kamaraju V, "High Voltage Engineering", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.
6. IEEE Guide for safety in AC substation grounding IEEE Standard 80-2000.
7. Working Group 33/13-09 (1988), 'Very fast transient phenomena associated with Gas Insulated System', CIGRE, 33-13, pp. 1-2

22272E16A – ANALYSIS of INVERTERS **L T P C**
3 0 0 3

OBJECTIVES:

- To determine the operationand characteristics of controlled rectifiers.
- To apply switching techniques and basic topologies of DC-DC switching regulators.
- To introduce the design of power converter components.
- To provide an in depth knowledge about resonant converters.
- To comprehend the conceptsof AC-AC power converters and their applications.

UNIT I SINGLE PHASE & THREE PHASE CONVERTERS 9

Principle of phase controlled converter operation – single-phase full converter and semi-converter (RL,RLE load)- single phase dual converter – Three phase operation full converter and semi-converter (R,RL,RLE load) – reactive power – power factor improvement techniques – PWM rectifiers.

UNIT II DC-DC CONVERTERS 9

Limitations of linear power supplies, switched mode power conversion, Non-isolated DC-DC converters: operation and analysis of Buck, Boost, Buck-Boost, Cuk& SEPIC – under continuous and discontinuous operation – Isolated converters: basic operation of Flyback, Forward and Push-pull topologies.

UNIT III DESIGN OF POWER CONVERTER COMPONENTS 9

Introduction to magnetic materials- hard and soft magnetic materials –types of cores , copper windings – Design of transformer –Inductor design equations –Examples of inductor design for buck/flyback converter-selection of output filter capacitors – selection of ratings for devices – input filter design.

UNIT IV RESONANT DC-DC CONVERTERS 9

Switching loss, hard switching, and basic principles of soft switching- classification of resonant converters- load resonant converters – series and parallel – resonant switch converters – operation and analysis of ZVS, ZCS converters comparison of ZCS/ZVS-Introduction to ZVT/ZCT PWM converters.

UNIT V AC-AC CONVERTERS 9

Principle of on-off and phase angle control – single phase ac voltage controller – analysis with R & RL load – Three phase ac voltage controller – principle of operation of cyclo converter – single phase and three phase cyclo converters – Introduction to matrix converters.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course the student will be able to:

- Analyze various single phase and three phase power converters
- Select and design dc-dc converter topologies for a broad range of power conversion applications.
- Develop improved power converters for any stringent application requirements.
- Design ac-ac converters for variable frequency applications.

TEXT BOOKS:

1 Ned Mohan,T.MUndeland and W.P Robbin, “Power Electronics: converters, Application and design” John Wiley and sons.Wiley India edition, 2006.

2 Rashid M.H., “Power Electronics Circuits, Devices and Applications ", Prentice Hall India, Third Edition, New Delhi, 2004.

3 P.C. Sen, “Modern Power Electronics”, Wheeler Publishing Co, First Edition, New Delhi, 1998.

4 P.S.Bimbra, “Power Electronics”, Khanna Publishers, Eleventh Edition, 2003

5 Simon Ang, Alejandro Oliva, “Power-Switching Converters, Second Edition, CRC Press, Taylor & Francis Group, 2010

6 V.Ramanarayanan, “Course material on Switched mode power conversion”, 2007

7 Alex Van den Bossche and VencislavCekovValchev, “Inductors and TransformersforPowerElectronics”, CRC Press, Taylor & Francis Group, 2005

8 W. G. Hurley and W. H.Wolfle, “Transformers and Inductors for Power Electronics Theory, Design and Applications”, 2013 John Wiley & Sons Ltd.

9 Marian.K.Kazimierczuk and DariuszCzarkowski, “Resonant Power Converters”, John Wiley & Sons limited, 2011

22272E16B - MODELLING AND ANALYSIS OF ELECTRICAL MACHINES

3 1 0 4

UNIT I PRINCIPLES OF ELECTROMAGNETIC ENERGY CONVERSION

General expression of stored magnetic energy - co-energy and force/torque - example using single and doubly excited system.

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UNIT II BASIC CONCEPTS OF ROTATING MACHINES

Calculation of air gap M.M.F. - per phase machine inductance using physical machine data - voltage and torque equation of D.C. machine - three phase symmetrical induction machine and salient pole synchronous machines in phase variable form.

UNIT III INTRODUCTION TO REFERENCE FRAME THEORY

Static and rotating reference frames - transformation relationships - examples using static symmetrical three phase R, R-L, R-L-M and R-L-C circuits - application of reference frame theory to three phase symmetrical induction and synchronous machines - dynamic direct and quadrature axis model in arbitrarily rotating reference frames - voltage and torque equations - derivation of steady state phasor relationship from dynamic model - generalized theory of rotating electrical machine and Kron's primitive machine.

UNIT IVD ETERMINATIONOF SYNCHRONOUS MACHINE DYNAMIC EQUIVALENT CIRCUIT PARAMETERS

Standard and derived machine time constants - frequency response test - analysis and dynamic modeling of two phase asymmetrical induction machine and single phase induction machine.

UNIT V SPECIAL MACHINES

Permanent magnet synchronous machine - surface permanent magnet (square and sinusoidal back E.M.F. type) and interior permanent magnet machines - construction and operating principle - dynamic modeling and self controlled operation - analysis of switch reluctance motors.

L = 45 T = 15 P = 0 C =4

TEXT BOOKS

1. Charles Kingsley, A.E. Fitzgerald Jr. and Stephen D. Umans, 'Electric Machinery', Tata McGraw-Hill, Fifth Edition, 1992.
2. R. Krishnan, 'Electric Motor & Drives: Modelling, Analysis and Control', Prentice Hall of India, 2001.

REFERENCES

1. C.V. Jones, 'The Unified Theory of Electrical Machines', Butterworth, 1967.
2. T.J.E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives' Clarendon Press, 1989.

22272E16C ADVANCED POWER SYSTEM DYNAMICS **L T P C**

OBJECTIVES: **3 0 0 3**

- To perform transient stability analysis using unified algorithm.
- To impart knowledge on sub-synchronous resonance and oscillations
- To analyze voltage stability problem in power system.
- To familiarize the methods of transient stability enhancement

UNIT ITRANSIENT STABILITY ANALYSIS 9

Review of numerical integration methods: Euler and Fourth Order Runge-Kutta methods, Numerical stability and implicit methods, Interfacing of Synchronous machine (variable voltage) model to the transient stability algorithm (TSA) with partitioned – explicit and implicit approaches – Interfacing SVC with TSA-methods to enhance transient stability

UNIT II UNIFIED ALGORITHM FOR DYNAMIC ANALYSIS OF POWER SYSTEMS 9

Need for unified algorithm- numerical integration algorithmic steps-truncation error-variable step size – handling the discontinuities- numerical stability- application of the algorithm for transient. Mid-term and long-term stability simulations

UNIT III SUBSYSNCHRONOUS RESONANCE (SSR) AND OSCILLATIONS 9

Sub synchronous Resonance (SSR) – Types of SSR - Characteristics of series –Compensated transmission systems –Modeling of turbine-generator-transmission network- Self-excitation due to induction generator effect – Torsional interaction resulting in SSR – Methods of analyzing SSR – Numerical examples illustrating instability of subsynchronous oscillations – time-domain simulation of subsynchronous resonance – EMTP with detailed synchronous machine model- Turbine Generator Torsional Characteristics: Shaft system model – Examples of torsional characteristics – Torsional Interaction with Power System Controls: Interaction with generator excitation controls – Interaction with speed governors – Interaction with nearby DC converters

UNIT IV TRANSMISSION, GENERATION AND LOAD ASPECTS OF VOLTAGE STABILITY ANALYSIS 9

Review of transmission aspects – Generation Aspects: Review of synchronous machine theory – Voltage and frequency controllers – Limiting devices affecting voltage stability – Voltage-reactive power characteristics of synchronous generators – Capability curves – Effect of machine limitation on deliverable power – Load Aspects – Voltage dependence of loads – Load restoration dynamics – Induction motors – Load tap changers – Thermostatic load recovery – General aggregate load models.

UNIT V ENHANCEMENT OF TRANSIENT STABILITY AND COUNTER MEASURES FOR SUB SYNCHRONOUS RESONANCE 9

Principle behind transient stability enhancement methods: high-speed fault clearing, reduction of transmission system reactance, regulated shunt compensation, dynamic braking, reactor switching, independent pole-operation of circuit-breakers, single-pole switching, fast-valving, high-speed excitation systems; NGH damper scheme.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will be able to understand the various schemes available in Transformer protection
- Learners will have knowledge on Over current protection.
- Learners will attain knowledge about Distance and Carrier protection in transmission lines.
- Learners will understand the concepts of Busbar protection.
- Learners will attain basic knowledge on numerical protection techniques

REFERENCES

1 R.Ramnujam,” Power System Dynamics Analysis and Simulation”, PHI Learning Private Limited, New Delhi, 2009

2 T.V. Cutsem and C.Vournas, “Voltage Stability of Electric Power Systems”, Kluwer publishers,1998

3 P. Kundur, “Power System Stability and Control”, McGraw-Hill, 1993.

4 H.W. Dommel and N.Sato, "Fast Transient Stability Solutions," IEEE Trans., Vol. PAS-91, pp, 1643-1650, July/August 1972.

5 Roderick J . Frowd and J. C. Giri, “Transient stability and Long term dynamics unified”, IEEE Trans., Vol 101, No. 10, October 1982.

6 M.Stubbe, A.Bihain,J.Deuse, J.C.Baader, “A New Unified software program for the study of the dynamic behaviour of electrical power system” IEEE Transaction, Power Systems, Vol.4.No.1,Feb:1989 Pg.129 to 138

22272E16D **ANALYSIS AND COMPUTATION OF ELECTROMAGNETIC TRANSIENTS IN POWER SYSTEMS**

L T P C

OBJECTIVES: **3 0 0 3**

- To understand the various types of transients and its analysis in power system.
- To learn about modeling and computational aspects transients computation

UNIT I REVIEW OF TRAVELLING WAVE PHENOMENA 9

Lumped and Distributed Parameters – Wave Equation – Reflection, Refraction, Behaviour of Travelling waves at the line terminations – Lattice Diagrams – Attenuation and Distortion.

UNIT II LIGHTNING, SWITCHING AND TEMPORARY OVERVOLTAGES 9

Lightning overvoltages: interaction between lightning and power system- ground wire voltage and voltage across insulator; switching overvoltage: Short line or kilometric fault, energizing transients - closing and re-closing of lines, methods of control; temporary overvoltages: line dropping, load rejection; voltage induced by fault; very fast transient overvoltage (VFTO).

UNIT III PARAMETERS AND MODELING OF OVERHEAD LINES 9

Review of line parameters for simple configurations: series resistance, inductance and shunt capacitance; bundle conductors : equivalent GMR and equivalent radius; modal propagation in transmission lines: modes on multi-phase transposed transmission lines, α-β-0 transformation and symmetrical components transformation, modal impedances; analysis of modes on untransposed lines; effect of ground return and skin effect; transposition schemes;

UNIT V FAST TRANSIENTS PHENOMENON IN AIS AND GIS 9

Digital computation of line parameters: why line parameter evaluation programs? Salient features of a typical line parameter evaluation program; constructional features of that affect transmission line parameters; line parameters for physical and equivalent phase conductors elimination of ground wires bundling of conductors; principle of digital computation of transients: features and capabilities of electromagnetic transients program; steady state and time step solution modules: basic solution methods; case studies on simulation of various types of transients.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will be able to model over head lines, cables and transformers.
- Learners will be able to analyze power system transients.

REFERENCES

1 Allan Greenwood, "Electrical Transients in Power System", Wiley & Sons Inc. New York, 1991.

2 R. Ramanujam, "Computational Electromagnetic Transients: Modeling, Solution Methods and Simulation", I.K. International Publishing House Pvt. Ltd, New Delhi, 2014.

3 Naidu M S and Kamaraju V, "High Voltage Engineering", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.

22272E24A **SMART GRID** **LTPC**

3003

OBJECTIVES:

- To Study about Smart Grid technologies, different smart meters and advanced metering infrastructure.
- To familiarize the power quality management issues in Smart Grid.
- To familiarize the high performance computing for Smart Grid applications

UNIT IINTRODUCTION TO SMART GRID 9

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, National and International Initiatives in Smart Grid.

UNIT II SMART GRID TECHNOLOGIES 9

Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/Var control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV).

UNIT III SMART METERS AND ADVANCED METERING INFRASTRUCTURE 9

Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU), Intelligent Electronic Devices (IED) & their application for monitoring & protection.

UNIT IV POWER QUALITY MANAGEMENT IN SMART GRID 9

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

UNIT V HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS 9

Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will develop more understanding on the concepts of Smart Grid and its present developments.
- Learners will study about different Smart Grid technologies.
- Learners will acquire knowledge about different smart meters and advanced metering infrastructure.
- Learners will have knowledge on power quality management in Smart Grids
- Learners will develop more understanding on LAN, WAN and Cloud Computing for Smart Grid application

REFERENCES

1 Stuart Borlase "Smart Grid :Infrastructure, Technology and Solutions", CRC Press 2012.

2 Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley 2012.

3 Vehbi C. Güngör, DilanSahin, TaskinKocak, Salih Ergüt, Concettina Buccella, Carlo Cecati, and Gerhard P. Hancke, "Smart Grid Technologies: Communication Technologies and Standards" IEEE Transactions On Industrial Informatics, Vol. 7, No. 4, November 2011.

4 Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang "Smart Grid – The New and Improved Power Grid: A Survey" , IEEE Transaction on Smart Grids, vol. 14, 2012.

22272E24B SOLAR AND ENERGY STORAGE SYSTEMS **LTPC**

3003

OBJECTIVES:

- To Study about solar modules and PV system design and their applications
- To Deal with grid connected PV systems
- To Discuss about different energy storage systems

UNIT IINTRODUCTION 9

Characteristics of sunlight – semiconductors and P-N junctions –behavior of solar cells – cell properties – PV cell interconnection

UNIT II STAND ALONE PV SYSTEM 9

Solar modules – storage systems – power conditioning and regulation - MPPT- protection – stand alone PV systems design – sizing

UNIT III GRID CONNECTED PV SYSTEMS 9

PV systems in buildings – design issues for central power stations – safety – Economic aspect – Efficiency and performance - International PV programs

UNIT IV ENERGY STORAGE SYSTEMS 9

Impact of intermittent generation – Battery energy storage – solar thermal energy storage – pumped hydroelectric energy storage

UNIT V APPLICATIONS 9

Water pumping – battery chargers – solar car – direct-drive applications –Space – Telecommunications.

TOTAL : 45 PERIODS

OUTCOMES:

- Students will develop more understanding on solar energy storage systems
- Students will develop basic knowledge on standalone PV system
- Students will understand the issues in grid connected PV systems
- Students will study about the modeling of different energy storage systems and their performances
- Students will attain more on different applications of solar energy

REFERENCES

1 Solanki C.S., "Solar Photovoltaics: Fundamentals, Technologies And Applications", PHI Learning Pvt. Ltd.,2015.

2 Stuart R.Wenham, Martin A.Green, Muriel E. Watt and Richard Corkish, "Applied Photovoltaics", 2007,Earthscan, UK. Eduardo Lorenzo G. Araujo, "Solar electricity engineering of photovoltaic systems", Progensa,1994.

3 Frank S. Barnes & Jonah G. Levine, "Large Energy storage Systems Handbook", CRC Press, 2011.

4 McNeils, Frenkel, Desai, "Solar & Wind Energy Technologies", Wiley Eastern, 1990

5 S.P. Sukhatme , "Solar Energy", Tata McGraw Hill,1987.

22272E24C **POWER SYSTEM RELIABILITY** **L T P C**

OBJECTIVES: **3 0 0 3**

- To introduces the objectives of Load forecasting.
- To study the fundamentals of Generation system, transmission system and Distribution system reliability analysis
- To illustrate the basic concepts of Expansion planning

UNIT I LOAD FORECASTING 9

Objectives of forecasting - Load growth patterns and their importance in planning - Load forecasting Based on discounted multiple regression technique-Weather sensitive load forecasting-Determination of annual forecasting-Use of AI in load forecasting.

UNIT II GENERATION SYSTEM RELIABILITY ANALYSIS 9

Probabilistic generation and load models- Determination of LOLP and expected value of demand not served –Determination of reliability of ISO and interconnected generation systems

UNIT III TRANSMISSION SYSTEM RELIABILITY ANALYSIS 9

Deterministic contingency analysis-probabilistic load flow-Fuzzy load flow probabilistic transmission system reliability analysis-Determination of reliability indices like LOLP and expected value of demand not served

UNIT IV EXPANSION PLANNING 9

Basic concepts on expansion planning-procedure followed for integrate transmission system planning, current practice in India-Capacitor placer problem in transmission system and radial distributions system.

UNIT V DISTRIBUTION SYSTEM PLANNING OVERVIEW 9

Introduction, sub transmission lines and distribution substations-Design primary and secondary systems-distribution system protection and coordination of protective devices.

TOTAL: 45 PERIODS

OUTCOMES:

- Students will develop the ability to learn about load forecasting.
- Students will learn about reliability analysis of ISO and interconnected systems.
- Students will understand the concepts ot Contingency analysis and Probabilistic Load flow Analysis
- Students will be able to understand the concepts of Expansion planning
- Students will have knowledge on the fundamental concepts of the Distribution system planning

REFERENCES

1 Roy Billinton & Ronald N. Allan, “Reliability Evaluation of Power Systems” Springer Publication,

2 R.L. Sullivan, “Power System Planning”, Tata McGraw Hill Publishing Company Ltd 1977.

3 X. Wang & J.R. McDonald, “Modern Power System Planning”, McGraw Hill Book Company 1994.

4 T. Gonen, “Electrical Power Distribution Engineering”, McGraw Hill Book Company 1986.

5 B.R. Gupta, “Generation of Electrical Energy”,S.Chand Publications 1983.

22272E24D DISTRIBUTED GENERATION AND MICROGRID **L T P C**

OBJECTIVES: **3 0 0 3**

- To illustrate the concept of distributed generation
- To analyze the impact of grid integration.
- To study concept of Microgrid and its configuration

UNIT I INTRODUCTION 9

Conventional power generation: advantages and disadvantages, Energy crises, Non-conventional energy (NCE) resources: review of Solar PV, Wind Energy systems, Fuel Cells, micro-turbines, biomass, and tidal sources.

UNIT II DISTRIBUTED GENERATIONS (DG) 9

Concept of distributed generations, topologies, selection of sources, regulatory standards/ framework, Standards for interconnecting Distributed resources to electric power systems: IEEE 1547. DG installation classes, security issues in DG implementations. Energy storage elements: Batteries, ultra-capacitors, flywheels. Captive power plants

UNIT III IMPACT OF GRID INTEGRATION 9

Requirements for grid interconnection, limits on operational parameters,: voltage, frequency, THD, response to grid abnormal operating conditions, islanding issues. Impact of grid integration with NCE sources on existing power system: reliability, stability and power quality issues.

UNIT IV BASICS OF A MICROGRID 9

Concept and definition of microgrid, microgrid drivers and benefits, review of sources of microgrids, typical structure and configuration of a microgrid, AC and DC microgrids, Power Electronics interfaces in DC and AC microgrids

UNIT V CONTROL AND OPERATION OF MICROGRID 9

Modes of operation and control of microgrid: grid connected and islanded mode, Active and reactive power control, protection issues, anti-islanding schemes: passive, active and communication based techniques, microgrid communication infrastructure, Power quality issues in microgrids, regulatory standards, Microgrid economics, Introduction to smart microgrids.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will attain knowledge on the various schemes of conventional and nonconventional power generation.

- Learners will have knowledge on the topologies and energy sources of distributed generation.
- Learners will learn about the requirements for grid interconnection and its impact with NCE sources
- Learners will understand the fundamental concept of Microgrid.

REFERENCES

1 Amirnaser Yezdani, and Reza Iravani, “Voltage Source Converters in Power Systems: Modeling, Control and Applications”, IEEE John Wiley Publications, 2010.

2 DorinNeacsu, “Power Switching Converters: Medium and High Power”, CRC Press, Taylor & Francis, 2006

3 Chetan Singh Solanki, “Solar Photo Voltaics”, PHI learning Pvt. Ltd., New Delhi,2009

4 J.F. Manwell, J.G. McGowan “Wind Energy Explained, theory design and applications”, Wiley publication 2010.

5 D. D. Hall and R. P. Grover, “Biomass Regenerable Energy”, John Wiley, New York, 1987.

6 John Twidell and Tony Weir, “Renewable Energy Resources” Tyalor and Francis Publications, Second edition 2006.

22272E25A - WIND ENERGY CONVERSION SYSTEMS

3 1 0 4

UNIT-I INTRODUCTION: **9**

History of wind Electric generation - Darrieus wind - Horizontal and vertical axis-Wind turbine - other modern developments - Future possibilities.

UNIT-II WIND RESOURCE AND ITS POTENTIAL FOR ELECVTRIC POWER GENERATION: 9

Power Extracted By A Wind Driven Machine - Nature and occurrence of wind characteristics and power production - variation of mean wind speed with time.

UNIT-III WIND POWER SITES AND WIND MEASUREMENTS: **9**

Average wind speed and other factors affecting choice of the site - Effect of wind direction - Measurement of wind velocity - Personal estimation without instruments- anemometers - Measurement of wind direction.

UNIT-IV WIND TURBINES WITH ASYNCHRONOUS GENERATORS AND CONTROL ASPECTS: 9

Asynchronous systems - Ac Generators - Self excitation of Induction Generator - Single Phase operation of Induction Generator - Permanenet magnet Generators - Basic control aspects - fixed speed ratio control scheme - fixed vs variable speed operation of WECS.

UNIT-V GENERATION OF ELECTRICITY 9

Active and reactive power - P and Q transfer in power systems - Power converters - Characteristics of Generators - Variable Speed options - Economics.

L = 45 T = 15 P = 0 C =4

REFERENCES:

1. N.G.Calvert, 'Wind Power Principles: Their Application on small scale', Charles Friffin& co. Ltd, London, 1979.
2. Gerald W.Koeppel, "Pirnam's and Power from the wind", Van Nastran Reinhold Co., London, 1979.
3. Gary L. Johnson, "Wind Energy System", Prentice hall Inc., Englewood Cliffs, New Jersey, 1985.
4. Wind energy conversion system by L. Lfreris, Prentice hall (U.K) Ltd., 1990.

22272E25B - AI TECHNIQUES TO POWER SYSTEMS

3 1 0 4

1. INTRODUCTION TO NEURAL NETWORKS 9

Basics of ANN - perceptron - delta learning rule - back propagation algorithm - multilayer feed forward network - memory models - bi-directional associative memory - Hopfield network.

2. APPLICATIONS TO POWER SYSTEM PROBLEMS 9

Application of neural networks to load forecasting - contingency analysis - VAR control - economic load dispatch.

3. INTRODUCTION TO FUZZY LOGIC 9

Crispness - vagueness - fuzziness - uncertainty - fuzzy set theory fuzzy sets - fuzzy set operations - fuzzy measures - fuzzy relations - fuzzy function - structure of fuzzy logic controller – fuzzification models - data base - rule base - inference engine defuzzification module.

4. APPLICATIONS TO POWER SYSTEMS 9

Decision making in power system control through fuzzy set theory - use of fuzzy set models of LP in power systems scheduling problems - fuzzy logic based power system stabilizer.

5. GENETIC ALGORITHM AND ITS APPLICATIONS TO POWER SYSTEMS 9

Introduction - simple genetic algorithm - reproduction - crossover - mutation – advanced operators in genetic search - applications to voltage control and stability studies.

L = 45 T = 15 P = 0 C =4

REFERENCES:

1. James A. Freeman and Skapura.B.M „Neural Networks - Algorithms Applications and Programming Techniques‟, Addison Wesley, 1990.
2. George Klir and Tina Folger.A, „Fuzzy sets, Uncertainty and Information‟, Prentice Hall of India, 1993.
3. Zimmerman.H.J„„Fuzzy Set Theory and its Applications‟, Kluwer Academic Publishers 1994.
4. IEEE tutorial on „Application of Neural Network to Power Systems‟, 1996.
5. Loi Lei Lai, „Intelligent System Applications in Power Engineering‟, John Wiley & SonsLtd.,1998.

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22272E25C ELECTRICAL DISTRIBUTION SYSTEM **L T P C**

OBJECTIVES: **3 0 0 3**

- To provide knowledge about the distribution system electrical characteristics
- To gain knowledge about planning and designing of distribution system
- To analyze power quality in distribution system
- To analyze the power flow in balanced and unbalanced system

UNIT I INTRODUCTION 9

Distribution System-Distribution Feeder Electrical Characteristics-Nature of Loads : Individual Customer Load, Distribution Transformer Loading and Feeder Load -Approximate Method of Analysis: Voltage Drop, Line Impedance, “K” Factors, Uniformly Distributed Loads and Lumping Loads in Geometric Configurations.

UNIT II DISTRIBUTION SYSTEM PLANNING 9

Factors effecting planning, present techniques, planning models(Short term planning, long term planning and dynamic planning), planning in the future, future nature of distribution planning, Role of computer in Distribution planning. Load forecast, Load characteristics and Load models.

UNIT III DISTRIBUTION SYSTEM LINE MODEL 9

Exact Line Segment Model-Modified Line Model- Approximate Line Segment Model-Modified “Ladder” Iterative Technique-General Matrices for Parallel Lines.

UNIT IV VOLTAGE REGULATION 9

Standard Voltage Ratings-Two-Winding Transformer Theory-Two-Winding Autotransformer-Step-Voltage Regulators: Single-Phase Step-Voltage Regulators-Three-Phase Step-Voltage Regulators- Application of capacitors in Distribution system.

UNIT V DISTRIBUTION FEEDER ANALYSIS 9

Power-Flow Analysis- Ladder Iterative Technique -Unbalanced Three-Phase Distribution Feeder- Modified Ladder Iterative Technique- Load Allocation- Short-Circuit Studies.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to apply the concepts of planning and design of distribution system for utility systems
- Ability to implement the concepts of volatage control in distribution system.
- Ability to analyze the power flow in balanced and unbalanced system

REFERENCES

1. William H. Kersting," Distribution System Modeling and Analysis " CRC press 3rd edition,2012.

2. Turan Gonen, “Electric Power Distribution System Engineering”, McGraw Hill Company. 1986
3. James Northcote – Green, Robert Wilson, “Control and Automation of Electrical Power Distribution Systems”, CRC Press, New York, 2007.
4. Pabla H S, “Electrical Power Distribution Systems”, Tata McGraw Hill. 2004

22272E25D ENERGY MANAGEMENT AND AUDITING L T P C

OBJECTIVES: **3 0 0 3**

- To study the concepts behind economic analysis and Load management.
- To emphasize the energy management on various electrical equipments and metering.
- To illustrate the concept of lighting systems and cogeneration.

UNIT I INTRODUCTION 9

Need for energy management - energy basics- designing and starting an energy management program – energy accounting -energy monitoring, targeting and reporting-energy audit process.

UNIT II ENERGY COST AND LOAD MANAGEMENT 9

Important concepts in an economic analysis - Economic models-Time value of money-Utility rate structures- cost of electricity-Loss evaluation- Load management: Demand control techniques-Utility monitoring and control system-HVAC and energy management-Economic justification.

UNIT III ENERGY MANAGEMENT FOR MOTORS, SYSTEMS, AND ELECTRICAL EQUIPMENT 9

Systems and equipment- Electric motors-Transformers and reactors-Capacitors and synchronous machines.

UNIT IV METERING FOR ENERGY MANAGEMENT 9

Relationships between parameters-Units of measure-Typical cost factors- Utility meters - Timing of meter disc for kilowatt measurement - Demand meters - Paralleling of current transformers - Instrument transformer burdens-Multitasking solid-state meters - Metering location vs. requirements- Metering techniques and practical examples.

UNIT V LIGHTING SYSTEMS & COGENERATION 9

Concept of lighting systems - The task and the working space -Light sources - Ballasts - Luminaries - Lighting controls-Optimizing lighting energy - Power factor and effect of harmonics on power quality - Cost analysis techniques-Lighting and energy standards Cogeneration: Forms of cogeneration - feasibility of cogeneration- Electrical interconnection.

TOTAL : 45 PERIODS

OUTCOMES:

- Students will develop the ability to learn about the need for energy management and auditing process
- Learners will learn about basic concepts of economic analysis and load management.
- Students will understand the energy management on various electrical equipments.
- Students will have knowledge on the concepts of metering and factors influencing cost function

- Students will be able to learn about the concept of lighting systems, light sources and various forms of cogeneration

REFERENCES

1 Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, “Guide to Energy Management”, Fifth Edition, The Fairmont Press, Inc., 2006
2 Eastop T.D & Croft D.R, “Energy Efficiency for Engineers and Technologists”, Logman Scientific & Technical, 1990.
3 Reay D.A, “Industrial Energy Conservation”, 1st edition, Pergamon Press, 1977.
4 “IEEE Recommended Practice for Energy Management in Industrial and Commercial Facilities”, IEEE, 1996
5 Amit K. Tyagi, “Handbook on Energy Audits and Management”, TERI, 2003.

22272E32A - POWER ELECTRONICS APPLICATIONS IN POWER SYSTEMS

3 1 0 4

UNIT: I STATIC COMPENSATOR CONTROL 9

Theory of load compensation - voltage regulation and power factor correction - phase balance and PF correction of unsymmetrical loads - Property of static compensator - Thyristor controlled rectifier (TCR) - Thyristor Controlled Capacitor (TSC) -Saturable core reactor - Control Strategies.

UNIT: II HARMONIC CONTROL AND POWER FACTOR IMPROVEMENT 9

Input power factor for different types of converters - power factor improvement using Load and forced commutated converters.

UNIT: III VOLTAGE CONTROL USING STATIC TAP-CHANGERS 9

Conventional tap changing methods, static tap changers using Thyristor, different schemes - comparison.

UNIT: IV STATIC EXCITATION CONTROL 9

Solid state excitation of synchronous generators - Different schemes - Generex excitation systems.

UNIT: V UNINTERRUPTABLE POWER SUPPLY SYSTEM 9

Parallel, Redundant and non- redundant UPS - Ups using resonant power converters - Switch mode power supplies.

L = 45 T = 15 P = 0 C =4

TEXT BOOK

Miller. T.J.E, “Reactive power control in Electric systems”. Wiley inter science, New York, 1982.

REFRENCES

1. “Static Compensator for AC power systems”, Proc. IEE vol.128 Nov. 1981. pp 362-406.
2 “A Static alternative to the transformer on load tap changing”, IEEE Trans. On Pas, Vol.PAS-99, Jan. /Feb. 1980, pp86-89.
3. “Improvements in Thyristor controlled static on- load tap controllers for transformers”, IEEE Trans. on PAS, Vol.PAS-101, Sept.1982, pp3091-3095.
4. “Shunt Thyristor rectifiers for the Generex Excitation systems”, IEEE Trans. On PAS. PAS -96, July/August, 1977, pp1219-1325.

22272E32B- POWER SYSTEM DYNAMICS

3 1 0 4

1. SYNCHRONOUS MACHINE MODELLING 9

Schematic Diagram, Physical Description: armature and field structure, machines with multiple pole pairs, mmf waveforms, direct and quadrature axes, Mathematical Description of a Synchronous Machine: Basic equations of a synchronous machine: stator circuit equations, stator self, stator mutual and stator to rotor mutual inductances, dq0 Transformation: flux linkage and voltage equations for stator and rotor in dq0 coordinates, electrical power and torque, physical interpretation of dq0 transformation, Per Unit Representations: L_{ad}-reciprocal per unit system and that from power-invariant form of Park's transformation; Equivalent Circuits for direct and quadrature axes, Steady-state Analysis: Voltage, current and flux-linkage relationships, Phasor representation, Rotor angle, Steady-state equivalent circuit, Computation of steady-state values, Equations of Motion: Swing Equation, calculation of inertia constant, Representation in system studies, Synchronous Machine Representation in Stability Studies: Simplifications for large-scale studies : Neglect of stator $p\Psi$ terms and speed variations, Simplified model with amortisseurs neglected: two-axis model with amortisseur windings neglected, classical model.

2. MODELLING OF EXCITATION AND SPEED GOVERNING SYSTEMS 9

Excitation System Requirements; Elements of an Excitation System; Types of Excitation System;Control and protective functions;IEEE (1992) block diagram for simulation of excitation systems. Turbine and Governing System Modelling: Functional Block Diagram of Power Generation and Control, Schematic of a hydroelectric plant, classical transfer function of a hydraulic turbine (no derivation), special characteristic of hydraulic turbine, electrical analogue of hydraulic turbine, Governor for Hydraulic Turbine: Requirement for a transient droop, Block diagram of governor with transient droop compensation, Steam turbine modelling: Single reheat tandem compounded type only and IEEE block diagram for dynamic simulation; generic speed-governing system model for normal speed/load control function.

3. SMALL-SIGNAL STABILITY ANALYSIS WITHOUT CONTROLLERS 9

Classification of Stability, Basic Concepts and Definitions: Rotor angle stability, The Stability Phenomena. Fundamental Concepts of Stability of Dynamic Systems: State-space representation, stability of dynamic system, Linearisation, Eigen properties of the state matrix: Eigen values and eigenvectors, modal matrices, eigen value and stability, mode shape and participation factor. Single-Machine Infinite Bus (SMIB) Configuration: Classical Machine Model stability analysis with numerical example, Effects of Field Circuit Dynamics: synchronous machine, network and linearised system equations, block diagram representation with K-constants; expression for K-constants (no derivation), effect of field flux variation on system stability: analysis with numerical example,

4. SMALL-SIGNAL STABILITY ANALYSIS WITH CONTROLLERS 9

Effects Of Excitation System: Equations with definitions of appropriate K-constants and simple thyristor excitation system and AVR, block diagram with the excitation system, analysis of effect of AVR on synchronizing and damping components using a numerical example, Power System Stabiliser: Block diagram with AVR and PSS, Illustration of principle of PSS application with numerical example, Block diagram of PSS with description, system state matrix including PSS, analysis of stability with numerical a example. Multi-Machine Configuration: Equations in a common reference frame, equations in individual machine rotor coordinates, illustration of formation of system state matrix for a two-machine system with classical models for synchronous machines, illustration of stability analysis using a numerical example. Principle behind small-signal stability improvement methods: delta-omega and delta P-omega stabilizers.

5. ENHANCEMENT OF SMALL SIGNAL STABILITY 9

Power System Stabilizer – Stabilizer based on shaft speed signal (delta omega) – Delta –P-Omega stabilizer-Frequency-based stabilizers – Digital Stabilizer – Excitation control design – Exciter gain – Phase lead compensation – Stabilizing signal washout stabilizer gain – Stabilizer limits

L = 45 T = 15 P = 0 C =4

REFERENCES

1. P. Kundur, "Power System Stability and Control", McGraw-Hill, 1993.
2. IEEE Committee Report, "Dynamic Models for Steam and Hydro Turbines in Power System Studies", IEEE Trans., Vol.PAS-92, pp 1904-1915, November/December, 1973. on Turbine-Governor Model.
3. P.M Anderson and A.A Fouad, "Power System Control and Stability", Iowa State University Press, Ames, Iowa, 1978.

22272E32C **ELECTRIC VEHICLES AND POWER MANAGEMENTL** **T P C**
3 0 0 3

OBJECTIVES:

- To understand the concept of electrical vehicles and its operations
- To understand the need for energy storage in hybrid vehicles
- To provide knowledge about various possible energy storage technologies that can be used in electric vehicles

UNIT I ELECTRIC VEHICLES AND VEHICLE MECHANICS 9

Electric Vehicles (EV), Hybrid Electric Vehicles (HEV), Engine ratings, Comparisons of EV with internal combustion Engine vehicles, Fundamentals of vehicle mechanics

UNIT II ARCHITECTURE OF EV's AND POWER TRAIN COMPONENTS 9

Architecture of EV's and HEV's – Plug-n Hybrid Electric Vehicles (PHEV)- Power train components and sizing, Gears, Clutches, Transmission and Brakes

UNIT III CONTROL OF DC AND AC DRIVES 9

DC/DC chopper based four quadrant operations of DC drives – Inverter based V/f Operation (motoring and braking) of induction motor drive system – Induction motor and permanent motor based vector control operation – Switched reluctance motor (SRM) drives

UNIT IV BATTERY ENERGY STORAGE SYSTEM 9

Battery Basics, Different types, Battery Parameters, Battery modeling, Traction Batteries

UNIT V ALTERNATIVE ENERGY STORAGE SYSTEMS 9

Fuel cell – Characteristics- Types – hydrogen Storage Systems and Fuel cell EV – Ultra capacitors

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will understand the operation of Electric vehicles and various energy storage technologies for electrical vehicles

REFERENCES

1 Iqbal Hussain, "**Electric and Hybrid Vehicles: Design Fundamentals, Second Edition"** CRC Press, Taylor & Francis Group, Second Edition (2011).

2 Ali Emadi, Mehrdad Ehsani, John M.Miller, "Vehicular Electric Power Systems", Special Indian Edition, Marcel dekker, Inc 2010.

22272E32D	ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide fundamental knowledge on electromagnetic interference and electromagnetic compatibility.
- To study the important techniques to control EMI and EMC.
- To expose the knowledge on testing techniques as per Indian and international standards in EMI measurement.

UNIT I INTRODUCTION 9

Definitions of EMI/EMC -Sources of EMI- Intersystems and Intrasystem- Conducted and radiated interference- Characteristics - Designing for electromagnetic compatibility (EMC)- EMC regulation typical noise path- EMI predictions and modeling, Cross talk - Methods of eliminating interferences.

UNIT II GROUNDING AND CABLING 9

Cabling- types of cables, mechanism of EMI emission / coupling in cables –capacitive coupling inductive coupling- shielding to prevent magnetic radiation- shield transfer impedance, Grounding – safety grounds – signal grounds- single point and multipoint ground systems hybrid grounds- functional ground layout –grounding of cable shields- -guard shields- isolation, neutralizing transformers, shield grounding at high frequencies, digital grounding- Earth measurement Methods

UNIT III BALANCING, FILTERING AND SHIELDING 9

Power supply decoupling- decoupling filters-amplifier filtering –high frequency filtering- EMI filters characteristics of LPF, HPF, BPF, BEF and power line filter design -Choice of capacitors, inductors, transformers and resistors, EMC design components -shielding – near and far fields shielding effectiveness - absorption and reflection loss- magnetic materials as a shield, shield discontinuities, slots and holes, seams and joints, conductive gaskets-windows and coatings - grounding of shields

UNIT IVEMI IN ELEMENTS AND CIRCUITS 9

Electromagnetic emissions, noise from relays and switches, non- linearities in circuits, passive inter modulation, transients in power supply lines, EMI from power electronic equipment, EMI as combination of radiation and conduction

UNIT V ELECTROSTATIC DISCHARGE, STANDARDS AND TESTING TECHNIQUES 9

Static Generation- human body model- static discharges- ESD versus EMC, ESD protection in equipment's- standards – FCC requirements – EMI measurements – Open area test site measurements and precautions- Radiated and conducted interference measurements, Control requirements and testing methods

TOTAL: 45 PERIODS

OUTCOMES:

- Recognize the sources of Conducted and radiated EMI in Power Electronic Converters and consumer appliances and suggest remedial measures to mitigate the problems
- Assess the insertion loss and design EMI filters to reduce the loss
- Design EMI filters, common-mode chokes and RC-snubber circuits measures to keep the interference within tolerable limits

REFERENCES

1. V.P. Kodali, “Engineering Electromagnetic Compatibility”, S. Chand, 1996
2. Henry W.Ott, “ Noise reduction techniques in electronic systems”, John Wiley & Sons, 1989
3. Bernhard Keiser, “Principles of Electro-magnetic Compatibility”, Artech House, Inc. (685 canton street, Norwood, MA 020062 USA) 1987
4. Bridges, J.E Milleta J. and Ricketts.L.W., “EMP Radiation and Protective techniques”, John Wiley and sons, USA 1976
5. William Duff G., & Donald White R. J, “Series on Electromagnetic Interference and Compatibility”, Vol.
6. Weston David A., “Electromagnetic Compatibility, Principles and Applications”, 1991.

ELECTIVES – V (semester-III)

22272E33A - POWER CONDITIONING

3 1 0 4

1. INTRODUCTION 9

Introduction – Characterization of Electric Power Quality: Transients, short duration and long duration voltage variations, Voltage imbalance, waveform distortion, Voltage fluctuations, Power frequency variation, Power acceptability curves – power quality problems: poor load power factor, Non linear and unbalanced loads, DC offset in loads, Notching in load voltage, Disturbance in supply voltage – Power quality standards.

2. NON-LINEAR LOADS 9

Single phase static and rotating AC/DC converters, Three phase static AC/DC converters, Battery chargers, Arc furnaces, Fluorescent lighting, pulse modulated devices, Adjustable speed drives.

3. MEASUREMENT AND ANALYSIS METHODS 9

Voltage, Current, Power and Energy measurements, power factor measurements and definitions, event recorders, Measurement Error – Analysis: Analysis in the periodic steady state, Time domain methods, Frequency domain methods: Laplace's, Fourier and Hartley transform – The Walsh Transform – Wavelet Transform.

4. ANALYSIS AND CONVENTIONAL MITIGATION METHODS 9

Analysis of power outages, Analysis of unbalance: Symmetrical components of phasor quantities, Instantaneous symmetrical components, Instantaneous real and reactive powers, Analysis of distortion: On–line extraction of fundamental sequence components from measured samples – Harmonic indices – Analysis of voltage sag: Detorit Edison sag score, Voltage sag energy, Voltage Sag Lost Energy Index (VSLEI)- Analysis of voltage flicker, Reduced duration and customer impact of outages, Classical load balancing problem: Open loop balancing, Closed loop balancing, current balancing, Harmonic reduction, Voltage sag reduction.

5. POWER QUALITY IMPROVEMENT 9

Utility-Customer interface –Harmonic filters: passive, Active and hybrid filters –Custom power devices: Network reconfiguring Devices, Load compensation using DSTATCOM, Voltage regulation using DSTATCOM, protecting sensitive loads using DVR, UPQC –control strategies: P- Q theory, Synchronous detection method – Custom power park –Status of application of custom power devices

L = 45 T = 15 P = 0 C =4

REFERENCES:

1. Arindam Ghosh "Power Quality Enhancement Using Custom Power Devices", Kluwer Academic Publishers, 2002.
2. Heydt.G.T, "Electric Power Quality", Stars in a Circle Publications, 1994(2nd edition)
3. Dugan.R.C, " Electrical Power System Quality",TMH,2008.
4. Arrillga.A.J and Neville R.Watson, Power System Harmonics, John Wiley second Edition,2003.
5. Derek A. Paice, "Power electronic converter harmonics",John Wiley & sons, 1999.

ELECTIVES – V (semester-III)

22272E33B – DEREGULATED POWER SYSTEM

3 1 0 4

1. FUNDAMENTALS AND ARCHITECTURE OF POWERMARKETS 9

Deregulation of Electric utilities: Introduction-Unbundling-Wheeling- Reform motivations- Fundamentals of Deregulated Markets – Types (Future, Day-ahead and Spot) – Participating in Markets (Consumer and Producer Perspective) – bilateral markets – pool markets. Independent System Operator (ISO)-components-types of ISO - role of ISO - Lessons and Operating Experiences of Deregulated Electricity Markets in various Countries (UK, Australia, Europe, US, Asia).

2. TECHNICAL CHALLENGES 9

Total Transfer Capability – Limitations - Margins – Available transfer capability (ATC) – Procedure - Methods to compute ATC – Static and Dynamic ATC – Effect of contingency analysis – Case Study. Concept of Congestion Management – Bid, Zonal and Node Congestion Principles – Inter and Intra zonal congestion – Generation Rescheduling - Transmission congestion contracts – Case Study.

3. TRANSMISSION NETWORKS AND SYSTEM SECURITY SERVICES 9

Transmission expansion in the New Environment – Introduction – Role of transmission planning – Physical Transmission Rights – Limitations – Flow gate - Financial Transmission Rights – Losses – Managing Transmission Risks – Hedging – Investment. Ancillary Services – Introduction – Describing Needs – Compulsory and Demand-side provision – Buying and Selling Ancillary Services – Standards.

4. MARKET PRICING 9

Transmission pricing in open access system – Introduction – Spot Pricing – Uniform Pricing – Zonal Pricing – Locational Marginal Pricing – Congestion Pricing – Ramping and Opportunity Costs. Embedded cost based transmission pricing methods (Postage stamp, Contract path and MW-mile) – Incremental cost based transmission pricing methods (Short run marginal cost, Long run marginal cost) - Pricing of Losses on Lines and Nodes.

5. INDIAN POWER MARKET 9

Current Scenario – Regions – Restructuring Choices – Statewise Operating Strategies – Salient features of Indian Electricity Act 2003 – Transmission System Operator – Regulatory and Policy development in Indian power Sector – Opportunities for IPP and Capacity Power Producer. Availability based tariff – Necessity – Working Mechanism – Beneficiaries – Day Scheduling Process – Deviation from Schedule – Unscheduled Interchange Rate – System Marginal Rate – Trading Surplus Generation – Applications.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Kankar Bhattacharya, Math H.J. Bollen and Jaap E. Daalder, “Operation of Restructured Power Systems”, Kluwer Academic Publishers, 2001

2. Loi Lei Lai, “Power system Restructuring and Regulation”, John Wiley sons, 2001.
3. Shahidehpour.M and Alomoush.M, “Restructuring Electrical Power Systems”, Marcel Decker Inc., 2001.
4. Steven Stoft, “ Power System Economics”, Wiley – IEEE Press, 2002
5. Daniel S. Kirschen and Goran Strbac, “ Fundamentals of Power System Economics”, John Wiley & Sons Ltd., 2004.
6. Scholarly Transaction Papers and Utility web sites

22272E33C	CONTROL SYSTEM DESIGN FOR POWER ELECTRONICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explore conceptual bridges between the fields of Control Systems and Power Electronics
- To Study Control theories and techniques relevant to the design of feedback controllers in Power Electronics.

UNIT I MODELLING OF DC-TO-DC POWER CONVERTERS 9

Modelling of Buck Converter , Boost Converter ,Buck- Boost Converter, Cuk Converter ,Sepic Converter, Zeta Converter, Quadratic Buck Converter ,Double Buck-Boost Converter, Boost-Boost Converter General Mathematical Model for Power Electronics Devices.

UNIT II SLIDING MODE CONTROLLER DESIGN 9

Variable Structure Systems. Single Switch Regulated Systems Sliding Surfaces, Accessibility of the Sliding Surface Sliding Mode Control Implementation of Boost Converter ,Buck-Boost Converter, Cuk Converter ,Sepic Converter, Zeta Converter, Quadratic Buck Converter ,Double Buck-Boost Converter, Boost-Boost Converter.

UNIT III APPROXIMATE LINEARIZATION CONTROLLER DESIGN 9

Linear Feedback Control, Pole Placement by Full State Feedback , Pole Placement Based on Observer Design ,Reduced Order Observers , Generalized Proportional Integral Controllers, Passivity Based Control , Sliding Mode Control Implementation of Buck Converter , Boost Converter ,Buck-Boost Converter.

UNIT IV NONLINEAR CONTROLLER DESIGN 9

Feedback Linearization Isidori's Canonical Form, Input-Output Feedback Linearization, State Feedback Linearization, Passivity Based Control , Full Order Observers , Reduced Order Observers.

UNIT V PREDICTIVE CONTROL OF POWER CONVERTERS 9

Basic Concepts, Theory, and Methods, Application of Predictive Control in Power Electronics, AC-DC-AC Converter System, Faults and Diagnosis Systems in Power Converters.

TOTAL:45 PERIODS

OUTCOMES:

- Ability to understand an overview on modern linear and nonlinear control strategies for power electronics devices
- Ability to model modern power electronic converters for industrial applications
- Ability to design appropriate controllers for modern power electronics devices.

REFERENCES

1. Hebertt Sira-Ramírez, Ramón Silva-Ortigoza, "Control Design Techniques in Power Electronics Devices", Springer 2012

2. Mahesh Patil, Pankaj Rodey, "Control Systems for Power Electronics: A Practical Guide", Springer India, 2015.

3. Blaabjerg José Rodríguez, "Advanced and Intelligent Control in Power Electronics and Drives" , Springer, 2014

4. Enrique Acha, Vassilios Agelidis, Olimpo Anaya, TJE Miller, "Power Electronic Control in Electrical Systems", Newnes, 2002

5. Marija D. Aranya Chakrabortty, Marija , "Control and Optimization Methods for Electric Smart Grids", Springer, 2012.

22272E33D PRINCIPLES OF EHV TRANSMISSION **L T P C 3 0 0 3**

OBJECTIVES:

To impart knowledge on,
- Types of power transmission and configurations various parameters and voltage gradients of transmission line conductors.
- The design requirements of EHV AC and DC lines.

UNIT I INTRODUCTION 9

Standard transmission voltages-AC and DC – different line configurations– average values of line parameters – power handling capacity and line loss – costs of transmission lines and equipment – mechanical considerations in line performance.

UNIT II CALCULATION OF LINE PARAMETERS 9

Calculation of resistance, inductance and capacitance for multi-conductor lines – calculation of sequence inductances and capacitances – line parameters for different modes of propagation – effect of ground return.

UNIT III VOLTAGE GRADIENTS OF CONDUCTORS 9

Charge-potential relations for multi-conductor lines – surface voltage gradient on conductors – gradient factors and their use – distribution of voltage gradient on sub conductors of bundle - voltage gradients on conductors in the presence of ground wires on towers-I2R loss and corona loss-RIV.

UNIT IV ELECTROSTATIC FIELD AND DESIGN OF EHV LINES 9

Effect of EHV line on heavy vehicles - calculation of electrostatic field of AC lines- effect of high field on humans, animals, and plants - measurement of electrostatic fields – electrostatic Induction in unenergised circuit of a D/C line - induced voltages in insulated ground wires - electromagnetic interference, Design of EHV lines.

UNIT V HVDC LINES

Introduction- Reliability and failure issues-Design-tower, ROW, clearances, insulators, electrical and mechanical protection-Maintenance-Control and protection-D.C Electric field band Magnetic field -Regulations and guide lines-underground line design.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to model the transmission lines and estimate the voltage gradients and losses
- Ability to design EHV AC and DC transmission lines

REFERENCES

1 Rakosh Das Begamudre, “Extra High Voltage AC Transmission Engineering”, Second Edition, New Age International Pvt. Ltd., 2006.
2 Pritindra Chowdhari, “Electromagnetic transients in Power System”, John Wiley and Sons Inc., 2009.
3 Sunil S.Rao, “EHV-AC, HVDC Transmission & Distribution Engineering”, Third Edition, Khanna Publishers, 2008.
4 William H. Bailey, Deborah E. Weil and James R. Stewart, “A Review on HVDC Power Transmission Environmental Issues”, Oak Ridge National Laboratory.
5 J.C Molburg, J.A. Kavicky, and K.C. Picel ,”A report on The design, Construction and operation of Long-distance High-Voltage Electricity Transmission Technologies” Argonne (National Laboratory) 2007.
6 “Power Engineer’s Handbook”, Revised and Enlarged 6th Edition, TNEB Engineers’ Association, October 2002.

22272E34A - SOFTWARE FOR CONTROL SYSTEM DESIGN

3 1 0 4

1. INTRODUCTION TO DESIGN AND CLASSICAL PID CONTROL

Systems performance and specifications –Proportional, Integral and Derivative Controllers – Structure – Empirical tuning- Zeigler Nichols-Cohen Coon – Root Locus method – Open loop inversion-– Tuning using ISE, IAE and other performance indices.

2. COMPENSATOR DESIGN

Design of lag, lead, lead-lag compensators – Design using bode plots – Polar plots – Nichols charts – root locus and Routh Hurwitz criterion.

3. MATLAB

Introduction – function description – Data types – Tool boxes – Graphical Displays – Programs for solution of state equations – Controller design – Limitations.- simulink-Introduction – Graphical user interface – Starting – Selection of objects – Blocks – Lines - simulation – Application programs – Limitations.

4. MAPLE

Introduction – symbolic programming – Programming constructs – Data structure computation with formulae – Procedures – Numerical Programming.

5. MATLAB

Programs using MATLAB software

L = 45 T = 15 P = 0 C =4

REFERENCES

1. MAPLE V Programming guide.
2. MATLAB user manual.
3. SIMULINK user manual.
4. K.Ogatta ,"Modern Control Engineering",PHI,1997.
5. Dorf and Bishop,"Modern control Engineering', Addison Wesley, 1998.

ELECTIVES – VI (semester-III)

22272E34B - INDUSTRIAL POWER SYSTEM ANALYSIS AND DESIGN

3 1 0 4

1. MOTOR STARTING STUDIES 9

Introduction-Evaluation Criteria-Starting Methods-System Data-Voltage Drop Calculations-Calculation of Acceleration time-Motor Starting with Limited-Capacity Generators-Computer-Aided Analysis-Conclusions.

2. POWER FACTOR CORRECTION STUDIES 9

Introduction-System Description and Modeling-Acceptance Criteria-Frequency Scan Analysis-Voltage Magnification Analysis-Sustained Overvoltages-Switching Surge Analysis-Back-to-Back Switching-Summary and Conclusions.

3. HARMONIC ANALYSIS 9

Harmonic Sources-System Response to Harmonics-System Model for Computer-Aided Analysis-Acceptance Criteria-Harmonic Filters-Harmonic Evaluation-Case Study-Summary and Conclusions.

4. FLICKER ANALYSIS 9

Sources of Flicker-Flicker Analysis-Flicker Criteria-Data for Flicker analysis- Case Study-Arc Furnace Load-Minimizing the Flicker Effects-Summary.

5. GROUND GRID ANALYSIS 9

Introduction-Acceptance Criteria-Ground Grid Calculations-Computer-Aided Analysis - Improving the Performance of the Grounding Grids-Conclusions.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Ramasamy Natarajan, "Computer-Aided Power System Analysis", Marcel Dekker Inc., 2002.

22272E34C SOFT COMPUTING TECHNIQUES **L T P C**

OBJECTIVES: **3 0 0 3**

- To expose the concepts of feed forward neural networks.
- To provide adequate knowledge about feed back neural networks.
- To teach about the concept of fuzziness involved in various systems.
- To expose the ideas about genetic algorithm
- To provide adequate knowledge about of FLC and NN toolbox

UNIT I INTRODUCTION AND ARTIFICIAL NEURAL NETWORKS 9

Introduction to intelligent systems- Soft computing techniques- Conventional Computing versus Swarm Computing - Classification of meta-heuristic techniques - Properties of Swarm intelligent Systems - Application domain - Discrete and continuous problems - Single objective and multi-objective problems -Neuron- Nerve structure and synapse- Artificial Neuron and its model- activation functions- Neural network architecture- single layer and multilayer feed forward networks- Mc Culloch Pitts neuron model- perceptron model- Adaline and Madaline- multilayer perception model- back propogation learning methods- effect of learning rule coefficient -back propagation algorithm- factors affecting back propagation training- applications.

UNIT II ARTIFICIAL NEURAL NETWORKS AND ASSOCIATIVE MEMORY 9

Counter propagation network- architecture- functioning & characteristics of counter Propagation network- Hopfield/ Recurrent network configuration - stability constraints associative memory and characteristics- limitations and applications- Hopfield v/s Boltzman machine- Adaptive Resonance Theory- Architecture- classifications- Implementation and training - Associative Memory.

UNIT III FUZZY LOGIC SYSTEM 9

Introduction to crisp sets and fuzzy sets- basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modeling and control- Fuzzification inferencing and defuzzification-Fuzzy knowledge and rule bases- Fuzzy modeling and control schemes for nonlinear systems. Self organizing fuzzy logic control- Fuzzy logic control for nonlinear time delay system.

UNIT IV GENETIC ALGORITHM 9

Evolutionary programs – Genetic algorithms, genetic programming and evolutionary programming - Genetic Algorithm versus Conventional Optimization Techniques - Genetic representations and selection mechanisms; Genetic operators- different types of crossover and mutation operators - Optimization problems using GA-discrete and continuous - Single objective and multi-objective problems - Procedures in evolutionary programming.

UNIT V HYBRID CONTROL SCHEMES 9

Fuzzification and rule base using ANN–Neuro fuzzy systems-ANFIS – Fuzzy Neuron - Optimization of membership function and rule base using Genetic

Algorithm –Introduction to Support Vector Machine - Evolutionary Programming-Particle Swarm Optimization - Case study – Familiarization of NN, FLC and ANFIS Tool Box.

TOTAL : 45 PERIODS

OUTCOMES:

- Will be able to know the basic ANN architectures, algorithms and their limitations.
- Also will be able to know the different operations on the fuzzy sets.
- Will be capable of developing ANN based models and control schemes for non-linear system.
- Will get expertise in the use of different ANN structures and online training algorithm.
- Will be knowledgeable to use Fuzzy logic for modeling and control of non-linear systems.
- Will be competent to use hybrid control schemes and P.S.O and support vector Regressive.

TEXT BOOKS:

1. Laurene V. Fausett, “Fundamentals of Neural Networks: Architectures, Algorithms And Applications”, Pearson Education.
2. Timothy J. Ross, “Fuzzy Logic with Engineering Applications” Wiley India, 2008.
3. Zimmermann H.J. "Fuzzy set theory and its Applications" Springer international edition, 2011.
4. David E.Goldberg, “Genetic Algorithms in Search, Optimization, and Machine Learning”, Pearson Education, 2009.
5. W.T.Miller, R.S.Sutton and P.J.Webrose, “Neural Networks for Control” MIT Press”, 1996.
6. T. Ross, “Fuzzy Logic with Engineering Applications”, Tata McGraw Hill, New Delhi, 1995.
7. Ethem Alpaydin, “Introduction to Machine Learning (Adaptive Computation and Machine Learning Series)”, MIT Press, 2004.
8. Corinna Cortes and V. Vapnik, " Support - Vector Networks, Machine Learning ” 1995.

22272E34D **RESTRUCTURED POWER SYSTEM** **LTPC**
OBJECTIVES: **3003**

- To introduce the restructuring of power industry and market models.
- To impart knowledge on fundamental concepts of congestion management.
- To analyze the concepts of locational marginal pricing and financial transmission rights.
- To Illustrate about various power sectors in India

UNIT I INTRODUCTION TO RESTRUCTURING OF POWER INDUSTRY 9

Introduction: Deregulation of power industry, Restructuring process, Issues involved in deregulation, Deregulation of various power systems – Fundamentals of Economics: Consumer behavior, Supplier behavior, Market equilibrium, Short and long run costs, Various costs of production – Market models: Market models based on Contractual arrangements, Comparison of various market models, Electricity vis – a – vis other commodities, Market architecture, Case study.

UNIT II TRANSMISSION CONGESTION MANAGEMENT 9

Introduction: Definition of Congestion, reasons for transfer capability limitation, Importance of congestion management, Features of congestion management – Classification of congestion management methods – Calculation of ATC - Non – market methods – Market methods – Nodal pricing – Inter zonal and Intra zonal congestion management – Price area congestion management – Capacity alleviation method.

UNIT III LOCATIONAL MARGINAL PRICES AND FINANCIAL TRANSMISSION RIGHTS 9

Mathematical preliminaries: - Locational marginal pricing– Lossless DCOPF model for LMP calculation – Loss compensated DCOPF model for LMP calculation – ACOPF model for LMP calculation – Financial Transmission rights – Risk hedging functionality -Simultaneous feasibility test and revenue adequency – FTR issuance process: FTR auction, FTR allocation – Treatment of revenue shortfall – Secondary trading of FTRs – Flow gate rights – FTR and market power - FTR and merchant transmission investment.

UNIT IV ANCILLARY SERVICE MANAGEMENT AND PRICING OF TRANSMISSION NETWORK 9

Introduction of ancillary services – Types of Ancillary services – Classification of Ancillary services – Load generation balancing related services – Voltage control and reactive power support devices – Black start capability service - How to obtain ancillary service –Co-optimization of energy and reserve services - Transmission pricing – Principles – Classification – Rolled in transmission pricing methods – Marginal transmission pricing paradigm – Composite pricing paradigm – Merits and demerits of different paradigm.

UNIT V REFORMS IN INDIAN POWER SECTOR 9

Introduction – Framework of Indian power sector – Reform initiatives - Availability based tariff – Electricity act 2003 – Open access issues – Power exchange – Reforms in the near future

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will have knowledge on restructuring of power industry
- Learners will understand basics of congestion management
- Learners will attain knowledge about locational margin prices and financial transmission rights
- Learners will understand the significance ancillary services and pricing of transmission network
- Learners will have knowledge on the various power sectors in India

REFERENCES

1. Mohammad Shahidehpour, Muwaffaq Alomoush, Marcel Dekker, “Restructured electrical power systems: operation, trading and volatility” Pub., 2001.
2. Kankar Bhattacharya, Jaap E. Daadler, Math H.J. Boolen, “Operation of restructured power systems”, Kluwer Academic Pub., 2001.
3. Paranjothi, S.R. , “Modern Power Systems” Paranjothi, S.R. , New Age International, 2017.
4. Sally Hunt,” Making competition work in electricity”, John Willey and Sons Inc. 2002.
5. Steven Stoft, “Power system economics: designing markets for electricity”, John Wiley & Sons, 2002.

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PONNAIYAH RAMAJAYAM INSTITUTE OF SCIENCE & TECHNOLOGY (PRIST)

Declared as DEEMED-TO-BE-UNIVERSITY
U/s 3 of UGC Act, 1956

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

COURSE STRUCTURE

M.TECH-POWER SYSTEMS (PART TIME) [Regulation2022]

[for candidates admitted to M.Tech Power System program from June2022 onwards]

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

PRIST UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

PROGRAMME: M.TECH-POWER SYSTEMS (PART TIME)

CURRICULUM -REGULATION 2022

SEMESTER – I

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1.	22248S11DP	Applied Mathematics for Power System Engineering	3	1	0	4
2.	22272C12P	System Theory	3	1	0	4
3.	22272C13P	Advanced Power System Analysis	3	1	0	4
4.	22272L14P	Power System Simulation Laboratory	0	0	3	3
		TOTAL				**15**

SEMESTER – II

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272C21P	EHV power transmission.	3	1	0	4
2	22272C22P	Advanced Power System Protection	3	1	0	4
3	22272E23_P	Elective-I	3	0	0	3
4	222TECWRP	Technical Writing/Seminars	0	0	3	3
		TOTAL				**14**

SEMESTER – III

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272C31P	Economic Operations of Power Systems	3	1	0	4
2	22272C32P	HVDC and FACTS	3	1	0	4
3	22272E33_P	Elective –II	3	0	0	3
4	22272L34P	Advanced Power System Simulation Laboratory	0	0	3	3
		TOTAL				**14**

SEMESTER – IV

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272C41P	Power System Control	3	1	0	4
2	22272C42P	Electrical Transients in power systems	3	1	0	4
3	22272E43_P	Elective –III	3	0	0	3
4	22272P44P	Project work Phase –I	0	0	10	10
		TOTAL				**21**

SEMESTER – V

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1.	22272E51_P	Elective –IV	3	0	0	3
2.	22272E52_P	Elective –V	3	0	0	3
3.	22272E53_P	Elective –VI	3	0	0	3
		TOTAL				**9**

SEMESTER – VI

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1.	22272P61P	Project work Phase -II	0	0	15	**15**

Total Credits = 88

Elective –I

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E23AP	Analysis and Design of Power Converters	3	0	0	3
2.	22272E23BP	Modeling and Analysis of Electrical Machines	3	0	0	3
3.	22272E23CP	Advanced Power System Dynamics	3	0	0	3
4.	22272E23DP	Analysis and computation of Electromagnetic Transients in Power Systems	3	0	0	3

Elective –II

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E33AP	Smart Grid	3	0	0	3
2.	22272E33BP	Solar and Energy Storage Systems	3	0	0	3
3.	22272E33CP	Power System Reliability	3	0	0	3
4.	22272E33DP	Design and analysis of VLSI subsystems	3	0	0	3

Elective –III

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E43AP	Wind Energy conversion systems	3	0	0	3
2.	22272E43BP	AI Techniques to Power Systems	3	0	0	3
3.	22272E43CP	VLSI physical design with timing analysis	3	0	0	3
4.	22272E43DP	Facts devices	3	0	0	3

Elective –IV

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E51AP	Power Electronics applications in Power systems	3	0	0	3
2.	22272E51BP	Power system Dynamics	3	0	0	3
3.	22272E51CP	IC design for wireless system	3	0	0	3
4.	22272E51DP	Introduction to information theory	3	0	0	3

Elective –V

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22275E52AP	Power Conditioning	3	0	0	3
2.	22275E52BP	Deregulated Power System	3	0	0	3
3.	22275E52CP	Physics of nanoscale devices	3	0	0	3
4.	22275E52DP	Principles of EHV Transmission	3	0	0	3

Elective –VI

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E53AP	Software for Control system Design	3	0	0	3
2.	22272E53BP	Industrial Power system analysis and design	3	0	0	3
3.	22272E53CP	Optical wireless communication	3	0	0	3
4.	22272E53DP	Medical image analysis	3	0	0	3

Credit Distribution

Sem.	Core Courses				Elective Courses		Total Credits
	Theory Courses		Practical Courses				
	Nos.	Credits	Nos.	Credits	Nos.	Credits	
I	02	08	01	03	-	-	15
II	02	08	01	03	01	03	14
III	02	08	01	03	01	03	14
IV	02	08	01	10	01	03	21
V	-	-	-	-	03	09	09
VI	-	-	01	15	-	-	15
Total Credits							**88**

HOD **DEAN**

DEAN ACADEMIC AFFAIRS

SYLLABUS

22248S11DP -APPLIED MATHEMATICS FOR POWER SYSTEM ENGINEERING

3 1 0 4

1. ADVANCED MATRIX THEORY 9

Matrix norms – Jordan canonical form – Generalized eigenvectors – Singular value decomposition – Pseudo inverse – Least square approximations.

2. RANDOM PROCESSES 9

Random variable, discrete, continuous types - Binomial, Poisson, normal and exponential distributions density & distribution Functions- Moments Moment Generating Functions – Notion of stochastic processes - Auto-correlation – Cross correlation .

3. LINEAR PROGRAMMING 9

Basic concepts – Graphical and Simplex methods –Transportation problem– Assignment problem.

4. DYNAMIC PROGRAMMING 9

Elements of the dynamic programming model – optimality principle – Examples of dynamic programming models and their solutions.

5. INTEGRAL TRANSFORMS 9

Finite Fourier transform - Fourier series - Finite sine Transform - Cosine transform - finite Hankel transform - definition, Transform of df/dx where p is a root of Jn(p) = 0, Transform of

$\frac{d^2f}{dx^2} + \frac{1}{x}\frac{df}{dx}$, and Transform of $\frac{d^2f}{dx^2} + \frac{1}{x}\frac{df}{dx} - \frac{n^2f}{x^2}$

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Lewis.D.W., Matrix Theory ,Allied Publishers, Chennai 1995.
2. Bronson, R, Matrix Operations, Schaums outline Series, McGraw Hill, New York. 1989.
3. Andrews, L.A., and Shivamoggi B.K., “Integral Transforms for Engineers and Applied Mathematicians”, Macmillan , New York ,1988.
4. Taha, H.A., " Operations research - An Introduction ", Mac Millan publishing Co., (1982).
5. Gupta, P.K.and Hira, D.S., " Operations Research ", S.Chand & Co., New Delhi, (1999).6..
6. Ochi, M.K. " Applied Probability and Stochastic Processes ", John Wiley & Sons (1992).
7. Peebles Jr., P.Z., " Probability Random Variables and Random Signal Principles, McGraw Hill Inc., (1993).

22272C12P - SYSTEM THEORY

3 1 0 4

1. PHYSICAL SYSTEMS AND STATE ASSIGNMENT 9

Systems - electrical - mechanical - hydraulic - pneumatic - thermal systems - modelling of some typical systems like D.C. Machines - inverted pendulum.

2. STATE SPACE ANALYSIS 9

Realisation of state models - non-uniqueness - minimal realisation - balanced realisation - solution of state equations - state transition matrix and its properties - free and forced responses - properties - controllability and observability - stabilisability and detectability - Kalman decomposition.

3. MIMO SYSTEMS - FREQUENCY DOMAIN DESCRIPTIONS 9

Properties of transfer functions - impulse response matrices - poles and zeros of transfer function matrices - critical frequencies - resonance - steady state and dynamic response - bandwidth - Nyquist plots - singular value analysis.

4. NON-LINEAR SYSTEMS 9

Types of non-linearity - typical examples - equivalent linearization - phase plane analysis - limit cycles - describing functions - analysis using describing functions - jump resonance.

5. STABILITY 9

Stability concepts - equilibrium points - BIBO and asymptotic stability - direct method of Liapunov - application to non-linear problems - frequency domain stability criteria - Popov's method and its extensions.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. M. Gopal, 'Modern Control Engineering', Wiley, 1996.
2. J.S. Bay, 'Linear State Space Systems', McGraw-Hill, 1999.
3. Eroni-Umez and Eroni, 'System dynamics & Control', Thomson Brooks / Cole, 1998.
4. K. Ogatta, 'Modern Control Engineering', Pearson Education, Low Priced Edition, 1997.
5. G.J. Thaler, 'Automatic control systems', Jaico publishers, 1993.
6. John S. Bay, 'Linear State Space Systems', McGraw-Hill International Edition, 1999.

22272C13P - ADVANCED POWER SYSTEM ANALYSIS

3 1 0 4

OBJECTIVES:

- To introduce different techniques of dealing with sparse matrix for large scale power systems.
- To impart in-depth knowledge on different methods of power flow solutions.
- To perform optimal power flow solutions in detail.
- To perform short circuit fault analysis and understand the consequence of different type of faults.
- To Illustrate different numeric al integration methods and factors influencing transient stability

UNIT I SOLUTION TECHNIQUE 9

Sparse Matrix techniques for large scale power systems: Optimal ordering schemes forpreserving sparsity. Flexible packed storage scheme for storing matrix as compact arrays –Factorization by Bifactorization and Gauss elimination methods; Repeat solution using Left and Right factors and L and U matrices.

UNIT II POWER FLOW ANALYSIS 9

Power flow equation in real and polar forms; Review of Newton's method for solution; Adjustment of P-V buses; Review of Fast Decoupled Power Flow method; Sensitivity factors for P-V bus adjustment..

UNIT III OPTIMAL POWER FLOW 9

Problem statement; Solution of Optimal Power Flow (OPF) – The gradient method, Newton's method, Linear Sensitivity Analysis; LP methods – With real power variables only – LP method with AC power flow variables and detailed cost functions; Security constrained Optimal Power Flow; Interior point algorithm; Bus Incremental costs.

UNIT IV SHORT CIRCUIT ANALYSIS 9

Formation of bus impedance matrix with mutual coupling (single phase basis and three phase basis)-Computer method for fault analysis using ZBUS and sequence components. Derivation of equations for bus voltages, fault current and line currents, both in sequence and phase – symmetrical and unsymmetrical faults.

UNIT V TRANSIENT STABILITY ANALYSIS 9

Introduction, Numerical Integration Methods: Euler and Fourth Order Runge-Kutta methods, Algorithm for simulation of SMIB and multi-machine system with classical synchronous machine model; Factors influencing transient stability, Numerical stability and implicit Integration methods.

L = 45 T = 15 P = 0 C =4

OUTCOMES:

- Ability to apply the concepts of sparse matrix for large scale power system analysis
- Ability to analyze power system studies that needed for the transmission system planning.

REFERENCES:

1. A.J.Wood and B.F.Wollenberg, "Power Generation Operation and Control", John Wiley and sons, New York, 1996.
2. W.F.Tinney and W.S.Meyer, "Solution of Large Sparse System by Ordered Triangular Factorization" IEEE Trans. on Automatic Control, Vol : AC-18, pp:333346 Aug 1973.
3.K.Zollenkopf, "Bi-Factorization: Basic Computational Algorithm and Programming Techniques ; pp:75-96 ; Book on "Large Sparse Set of Linear Systems" Editor: J.K.Rerd,Academic Press, 1971.
4. M.A.Pai," Computer Techniques in Power System Analysis",Tata McGraw-Hill Publishing Company Limited, New Delhi, 2006.
5. G W Stagg , A.H El. Abiad, "Computer Methods in Power System Analysis", McGraw Hill, 1968.
6. P.Kundur, "Power System Stability and Control", McGraw Hill, 1994.

22272L14P- POWER SYSTEM SIMULATION LABORATORY 0 0 3 3

OBJECTIVES:

- To have hands on experience on various system studies and different techniques used
- for system planning using Software packages
- To perform the dynamic analysis of power system
-

LIST OF EXPERIMENTS

1. Power flow analysis by Newton-Raphson method and Fast decoupled method
2. Transient stability analysis of single machine-infinite bus system using classical machine model
3. Contingency analysis: Generator shift factors and line outage distribution factors
4. Economic dispatch using lambda-iteration method
5. Unit commitment: Priority-list schemes and dynamic programming
6. State Estimation (DC)
7. Analysis of switching surge using EMTP: Energisation of a long distributed- parameter line
8. Analysis of switching surge using EMTP : Computation of transient recovery voltage
9. Simulation and Implementation of Voltage Source Inverter
10. Digital Over Current Relay Setting and Relay Coordination using Suitable software packages 11 Co-ordination of over-current and distance relays for radial line protection
11. TOTAL: 60 PERIODS

OUTCOMES:

- Upon Completion of the course, the students will be able to:
- Analyze the power flow using Newton-Raphson method and Fast decoupled method.
- Perform contingency analysis & economic dispatch
- Set Digital Over Current Relay and Coordinate Relay

P=3 C=3

SEMESTER -II

22272C21P- EHV POWER TRANSMISSION

3 1 0 4

1. INTRODUCTION **9**

Standard transmission voltages – different configurations of EHV and UHV lines – average values of line parameters – power handling capacity and line loss – costs of transmission lines and equipment – mechanical considerations in line performance.

2. CALCULATION OF LINE PARAMETERS **9**

Calculation of resistance, inductance and capacitance for multi-conductor lines – calculation of sequence inductances and capacitances – line parameters for different modes of propagation – resistance and inductance of ground return, numerical example involving a typical 400/220kV line using line constant program.

3. VOLTAGE GRADIENTS OF CONDUCTORS **9**

Charge-potential relations for multi-conductor lines – surface voltage gradient on conductors – gradient factors and their use – distribution of voltage gradient on sub conductors of bundle - voltage gradients on conductors in the presence of ground wires on towers.

4. CORONA EFFECTS **9**

Power losses and audible losses: I R loss and corona loss - audible noise generation and characteristics - limits for audible noise - Day-Night equivalent noise level- radio interference: corona pulse generation and properties - limits for radio interference fields

5. ELECTROSTATIC FIELD OF EHV LINES **9**

Effect of EHV line on heavy vehicles - calculation of electrostatic field of AC lines- effect of high field on humans, animals, and plants - measurement of electrostatic fields - electrostatic Induction in unenergised circuit of a D/C line - induced voltages in insulated ground wires - electromagnetic interference

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Rakosh Das Begamudre, "Extra High Voltage AC Transmission Engineering", Second Edition, New Age International Pvt. Ltd., 1990.
2. Power Engineer's Handbook, Revised and Enlarged 6th Edition, TNEB Engineers' Association, October 2002.
3. Microtran Power System Analysis Corporation, Microtran Reference Manual, Vancouver Canada. (Website: www.microtran.com).

22272C22P - ADVANCED POWER SYSTEM PROTECTION **3 1 0 4**

OBJECTIVES:

- To illustrate concepts of transformer protection
- To describe about the various schemes of Over current protection
- To analyze distance and carrier protection
- To familiarize the concepts of Generator protection and Numerical protection

UNIT I OVER CURRENT & EARTH FAULT PROTECTION 9

Zones of protection – Primary and Backup protection – operating principles and Relay Construction - Time – Current characteristics-Current setting – Time setting-Over current protective schemes –Concept of Coordination - Protection of parallel / ring feeders – Reverse power or directional relay –Polarisation Techniques – Cross Polarisation – Quadrature Connection -Earth fault and phase fault protection - Combined Earth fault and phase fault protection scheme - Phase fault protective - scheme directional earth fault relay - Static over current relays – Numerical over – current protection; numerical coordination example for a radial feeder

UNIT II TRANSFORMER & BUSBAR PROTECTION 9

Types of transformers –Types of faults in transformers- Types of Differential Protection – High Impedance – External fault with one CT saturation – Actual behaviors of a protective CT – Circuit model of a saturated CT - Need for high impedance – Disadvantages - Percentage Differential Bias Characteristics – Vector group & its impact on differential protection - Inrush phenomenon – Zero Sequence filtering – High resistance Ground Faults in Transformers – Restricted Earth fault Protection - Inter-turn faults in transformers – Incipient faults in transformers - Phenomenon of overfluxing in transformers – Transformer protection application chart. Differential protection of busbars external and internal fault - Supervisory relay-protection of three – Phase busbars – Numerical examples on design of high impedance busbar differential scheme –Biased Differential Characteristics – Comparison between Transformer differential & Busbar differential.

UNIT III DISTANCE AND CARRIER PROTECTION OF TRANSMISSION LINES **9**

Drawback of over – Current protection – Introduction to distance relay – Simple impedance relay– Reactance relay – mho relays comparison of distance relay – Distance protection of a three – Phase line-reasons for inaccuracy of distance relay reach - Three stepped distance protection Trip contact configuration for the three - Stepped distance protection - Three-stepped protection f three-phase line against all ten shunt faults - Impedance seen from relay side - Three-stepped protection of double end fed lines-need for carrier – Aided protection – Various options for a carrier –Coupling and trapping the carrier into the desired line section - Unit type carrier aided directional comparison relaying – Carrier aided distance schemes for acceleration of zone II; numerical example for a typical distance protection scheme for a transmission line.

UNIT IV GENERATOR PROTECTION **9**

Electrical circuit of the generator –Various faults and abnormal operating conditions – Stator Winding Faults – Protection against Stator (earth) faults – third harmonic voltage protection – Rotor fault – Abnormal operating conditions - Protection against Rotor faults – Potentiometer Method – injection method – Pole slipping – Loss of excitation – Protection against Mechanical faults; Numerical examples for typical generator protection schemes

UNIT V NUMERICAL PROTECTION

Introduction–Block diagram of numerical relay - Sampling theorem- Correlation with a reference (LES) technique-Digital filtering-numerical over - Current protection– Numerical transformer differential protection-Numerical distance protection of transmission line

L = 45 T = 15 P = 0 C =4

OUTCOMES:

- Learners will be able to understand the various schemes available in Transformer
- protection
- Learners will have knowledge on Overcurrent protection.
- Learners will attain knowledge about Distance and Carrier protection in transmission lines.
- Learners will understand the concepts of Generator protection.
- Learners will attain basic knowledge on substation automation.

REFERENCES

1 Y.G. Paithankar and S.R Bhide, "Fundamentals of Power System Protection", Prentice-Hall of India, 2003

2 Badri Ram and D.N. Vishwakarma, "Power System Protection and Switchgear", Tata McGraw- Hill Publishing Company, 2002.

3 T.S.M. Rao, "Digital Relay / Numerical relays", Tata McGraw Hill, New Delhi, 1989.

4 P.Kundur, "Power System Stability and Control", McGraw-Hill, 1993.

22272C31P - ECONOMIC OPERATIONS OF POWER SYSTEMS

3 1 0 4

1. INTRODUCTION **9**

Planning and operational problems of power systems – review of economic dispatch and calculation using B matrix loss formula – use of participation factors in on line economic dispatch.

2. OPTIMAL POWER FLOW PROBLEM **9**

Real and reactive power control variables – operation and security constraints and their limits – general OPF problem with different objective functions – formulation – cost loss minimization using Dommel and Tinney's method and SLP – development of model and algorithm – MVAR planning – optimal sitting and sizing of capacitors using SLR method – interchange evaluation using SLP.

3. HYDRO THERMAL SCHEDULING **9**

Problems definition and mathematical model of long and short term problems – discretization – dynamic and incremental dynamic programming – methods of local variation – hydro thermal system with pumped hydro units – solution by local variation treating pumped hydro unit for load management and spinning reserve.

4. UNIT COMMITMENT **9**

Constraints in unit commitment – solution by priority list method – dynamic programming method– backward and forward – restricted search range.

5. MAINTENANCE SCHEDULING **9**

Factors considered in maintenance scheduling for generating units – turbines – boilers – introduction to maintenance scheduling using mathematical programming.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Allen J.Wood and Bruce F.Wollenberg, "Power generation and control", John Wiley & Sons, New York, 1984.
2. Krichmayer L., "Economic operation of power systems", John Wiley and sons Inc, New York, 1958.
3. Krichmayer L.K, "Economic control of Interconnected systems", Jhon Wiley and sons Inc, New York, 1959.
4. Elgerd O.I., "Electric energy systems theory – an introduction", McGraw Hill, New Delhi, 1971.

SEMESTER – III

22272C32P - HVDC and FACTS

3 1 0 4

OBJECTIVES:

- To emphasis the need for FACTS controllers.
- To learn the characteristics, applications and modeling of series and controllers.
- To analyze the interaction of different FACTS controller and coordination
- To impart knowledge on operation, modelling and control of HVDC link.
- To perform steady state analysis of AC/DC system.

UNIT I INTRODUCTION 9

Review of basics of power transmission networks-control of power flow in AC transmission line- Analysis of uncompensated AC Transmission line- Passive reactive power compensation: Effect of series and shunt compensation at the mid-point of the line on power transfer- Need for FACTS controllers- types of FACTS controllers. Comparison of AC & DC Transmission, Applications of DC Transmission Topologies.

UNIT II SVC & STATCOM **9**

Configuration of SVC- voltage regulation by SVC- Modelling of SVC for load flow analysisDesign of SVC to regulate the mid-point voltage of a SMIB system- Applications Static synchronous compensator (STATCOM)- Operation of STATCOM – Voltage regulation – Power flow control with STATCOM.

UNIT III TCSC and SSSC **9**

Concepts of Controlled Series Compensation- Operation of TCSC - Analysis of TCSC operation - Modelling of TCSC for load flow studies - Static synchronous series compensator (SSSC)- Operation of SSSC - Modelling of SSSC for power flow – operation of Unified power flow controllers(UPFC).

UNIT IV ANALYSIS OF HVDC LINK **9**

Simplified analysis of six pulse Graetz bridge – Charecteristics - Analysis of converter operations – Commutation overlap – Equivalence circuit of bipolar DC transmission link – Modes of operation – Mode ambiguity – Different firing angle controllers – Power flow control.

UNIT V POWER FLOW ANALYSIS IN AC/DC SYSTEMS 9

Per unit system for DC Quantities - Modelling of DC links - Solution of DC load flow - Solution of AC-DC power flow – Unified and Sequential methods.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will be able to refresh on basics of power transmission networks and need for FACTS controllers
- Learners will understand the significance about different voltage source converter based FACTS controllers
- Learners will understand the significance of HVDC converters and HVDC system control
- Learners will attain knowledge on AC/DC power flow analysis

REFERENCES

1. Mohan Mathur, R., Rajiv. K. Varma, “Thyristor – Based Facts Controllers for Electrical Transmission Systems”, IEEE press and John Wiley & Sons, Inc.
2. K.R.Padiyar, “FACTS Controllers in Power Transmission and Distribution”, New Age International (P) Ltd., Publishers, New Delhi, Reprint 2008.
3. K.R.Padiyar, “HVDC Power Transmission Systems”, New Age International (P) Ltd., New Delhi, 2002.
4. J.Arrillaga, “High Voltage Direct Current Transmission”, Peter Pregrinus, London, 1983.
5. V.K.Sood, “HVDC and FACTS controllers- Applications of Static Converters in Power System”, Kluwer Academic Publishers 2004

22272L34P- ADVANCED POWER SYSTEM SIMULATION LABORATORY

LT P C

0 0 4 2

OBJECTIVES:

- To analyze the effect of FACTS controllers by performing steady state analysis.
- To have hands on experience on different wind energy conversion technologies

LIST OF EXPERIMENTS

1. Small-signal stability analysis of single machine-infinite bus system using classical machine model
2. Small-signal stability analysis of multi-machine configuration with classical machine model
3. Induction motor starting analysis
4. Load flow analysis of two-bus system with STATCOM
5. Transient analysis of two-bus system with STATCOM
6. Available Transfer Capability calculation using an existing load flow program
7. Study of variable speed wind energy conversion system- DFIG
8. Study of variable speed wind energy conversion system- PMSG
9. Computation of harmonic indices generated by a rectifier feeding a R-L load
10. Design of active filter for mitigating harmonics

SEMESTER – IV

22272C41P - POWER SYSTEM CONTROL **3 1 0 4**

1. AUTOMATIC GENERATION CONTROL 9

Plant and system level control problem – ALFC of single area system modeling state and transient response – EDC control loop – ALFC of multi area system – modeling – static and transient response of two area system development of state variable model – two area system – AGC system design Kalman's method.

2. AUTOMATIC VOLTAGE CONTROL **9**

Modeling of AVR loop – components – dynamic and static analysis – stability compensation – system level voltage control using OLTC, capacitor and generator voltages – expert system application for system voltage control.

3. SECURITY CONTROL CONCEPT **9**

System operating states by security control functions – monitoring evaluation of system state by contingency analysis – corrective controls (preventive, emergency and restorative) – islanding scheme.

4. STATE ESTIMATION **9**

Least square estimation – basic solution – sequential form of solution – static state estimation of power system by different algorithms – tracking state estimation of power system- computation consideration – external equivalency. Treatment of bad data and on line load flow analysis.

5. COMPUTER CONTROL OF POWER SYSTEM **9**

Energy control center – various levels – national – regional and state level SCADA system – computer configuration – functions, monitoring, data acquisition and controls – EMS system – software in EMS system. Expert system applications for power system operation.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Kundur.P., "power system stability and control", McGraw Hill, 1994.
2. Anderson P.M., and Fouad A.A, "power system control and stability", Galgotia publication, New Delhi, 1981.
3. Taylor C.W., "power systems voltage stability", McGraw Hill, New Delhi, 1993.
4. IEEE recommended practice for excitation system models for power system stability studies, IEEE standard 421.5, 1992.
5. Kimbark E.W., "power system stability", Vol.3., Synchronous machines, John Wiley and sons, 1956.
6. T.V Custem, C.Vournas, "voltage stability of power system", Kluwer Acadamic Publishers, 1998.
7. Elgerd O.L., "Elctric energy systems theory – an introduction", McGraw Hill, New Delhi, 1971.

22272C42P- ELECTRICAL TRANSIENTS IN POWER SYSTEMS

3 1 0 4

1. TRAVELLING WAVES ON TRANSMISSION LINE **9**

Lumped and Distributed Parameters – Wave Equation – Reflection, Refraction, Behavior of Travelling waves at the line terminations – Lattice Diagrams – Attenuation and Distortion – Multi-conductor system and Velocity wave.

2. COMPUTATION OF POWER SYSTEM TRANSIENTS **9**

Principle of digital computation – Matrix method of solution, Modal analysis, Z transforms, Computation using EMTP – Simulation of switches and non-linear elements.

3. LIGHTNING, SWITCHING AND TEMPORARY OVERVOLTAGES **9**

Lightning: Physical phenomena of lightning – Interaction between lightning and power system – Factors contributing to line design – Switching: Short line or kilometric fault – Energizing transients - closing and re-closing of lines - line dropping, load rejection - Voltage induced by fault – Very Fast Transient Overvoltage (VFTO)

4. BEHAVIOUR OF WINDING UNDER TRANSIENT CONDITION **9**

Initial and Final voltage distribution - Winding oscillation - traveling wave solution - Behavior of the transformer core under surge condition – Rotating machine – Surge in generator and motor

5. INSULATION CO-ORDINATION **9**

Principle of insulation co-ordination in Air Insulated substation (AIS) and Gas Insulated Substation (GIS), insulation level, statistical approach, co-ordination between insulation and protection level –overvoltage protective devices – lightning arresters, substation earthing.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Pritindra Chowdhari, “Electromagnetic transients in Power System”, John Wiley and Sons Inc., 1996.
2. Allan Greenwood, “Electrical Transients in Power System”, Wiley & Sons Inc. New York, 1991.
3. Klaus Ragaller, “Surges in High Voltage Networks”, Plenum Press, New York, 1980.
4. Rakosh Das Begamudre, “Extra High Voltage AC Transmission Engineering”, (Second edition) Newage International (P) Ltd., New Delhi, 1990.
5. Naidu M S and Kamaraju V, “High Voltage Engineering”, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.
6. IEEE Guide for safety in AC substation grounding IEEE Standard 80-2000.
7. Working Group 33/13-09 (1988), ‘Very fast transient phenomena associated with Gas Insulated System’, CIGRE, 33-13, pp. 1-2

22272E23AP – ANALYSIS AND DESIGN OF POWER CONVERTERS L T P C

3 0 0 3

OBJECTIVES:

- To determine the operation and characteristics of controlled rectifiers.
- To apply switching techniques and basic topologies of DC-DC switching regulators.
- To introduce the design of power converter components.
- To provide an in depth knowledge about resonant converters.
- To comprehend the concepts of AC-AC power converters and their applications.

UNIT I SINGLE PHASE & THREE PHASE CONVERTERS **9**

Principle of phase controlled converter operation – single-phase full converter and semi-converter (RL,RLE load)- single phase dual converter – Three phase operation full converter and semi-converter (R,RL,RLE load) – reactive power – power factor improvement techniques – PWM rectifiers.

UNIT II DC-DC CONVERTERS **9**

Limitations of linear power supplies, switched mode power conversion, Non-isolated DC-DC converters: operation and analysis of Buck, Boost, Buck-Boost, Cuk& SEPIC – under continuous and discontinuous operation – Isolated converters: basic operation of Flyback, Forward and Push-pull topologies.

UNIT III DESIGN OF POWER CONVERTER COMPONENTS **9**

Introduction to magnetic materials- hard and soft magnetic materials –types of cores , copper windings – Design of transformer –Inductor design equations –Examples of inductor design for buck/flyback converter-selection of output filter capacitors – selection of ratings for devices – input filter design.

UNIT IV RESONANT DC-DC CONVERTERS **9**

Switching loss, hard switching, and basic principles of soft switching- classification of resonant converters- load resonant converters – series and parallel – resonant switch converters – operation and analysis of ZVS, ZCS converters comparison of ZCS/ZVS-Introduction to ZVT/ZCT PWM converters.

UNIT V AC-AC CONVERTERS **9**

Principle of on-off and phase angle control – single phase ac voltage controller – analysis with R & RL load – Three phase ac voltage controller – principle of operation of cyclo converter – single phase and three phase cyclo converters – Introduction to matrix converters.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course the student will be able to:

- Analyze various single phase and three phase power converters
- Select and design dc-dc converter topologies for a broad range of power conversion applications.
- Develop improved power converters for any stringent application requirements.
- Design ac-ac converters for variable frequency applications.

TEXT BOOKS:

1 Ned Mohan,T.MUndeland and W.P Robbin, “Power Electronics: converters, Application and design” John Wiley and sons.Wiley India edition, 2006.

2 Rashid M.H., “Power Electronics Circuits, Devices and Applications ", Prentice Hall India, Third Edition, New Delhi, 2004.

3 P.C. Sen, “Modern Power Electronics”, Wheeler Publishing Co, First Edition, New Delhi, 1998.

4 P.S.Bimbra, “Power Electronics”, Khanna Publishers, Eleventh Edition, 2003

5 Simon Ang, Alejandro Oliva, “Power-Switching Converters, Second Edition, CRC Press, Taylor & Francis Group, 2010

6 V.Ramanarayanan, “Course material on Switched mode power conversion”, 2007

7 Alex Van den Bossche and VencislavCekovValchev, “Inductors and TransformersforPowerElectronics”, CRC Press, Taylor & Francis Group, 2005

8 W. G. Hurley and W. H.Wolfle, “Transformers and Inductors for Power Electronics Theory, Design and Applications”, 2013 John Wiley & Sons Ltd.

9 Marian.K.Kazimierczuk and DariuszCzarkowski, “Resonant Power Converters”, John Wiley & Sons limited, 2011

22272E23BP - MODELING AND ANALYSIS OF ELECTRICAL MACHINES

3 1 0 4

UNIT I PRINCIPLES OF ELECTROMAGNETIC ENERGY CONVERSION
General expression of stored magnetic energy - co-energy and force/torque - example using single and doubly excited system.
.

UNIT II BASIC CONCEPTS OF ROTATING MACHINES
Calculation of air gap M.M.F. - per phase machine inductance using physical machine data - voltage and torque equation of D.C. machine - three phase symmetrical induction machine and salient pole synchronous machines in phase variable form.

UNIT III INTRODUCTION TO REFERENCE FRAME THEORY
Static and rotating reference frames - transformation relationships - examples using static symmetrical three phase R, R-L, R-L-M and R-L-C circuits - application of reference frame theory to three phase symmetrical induction and synchronous machines - dynamic direct and quadrature axis model in arbitrarily rotating reference frames - voltage and torque equations - derivation of steady state phasor relationship from dynamic model - generalized theory of rotating electrical machine and Kron's primitive machine.

UNIT IV DETERMINATIONOF SYNCHRONOUS MACHINE DYNAMIC EQUIVALENT CIRCUIT PARAMETERS
Standard and derived machine time constants - frequency response test - analysis and dynamic modeling of two phase asymmetrical induction machine and single phase induction machine.

UNIT V SPECIAL MACHINES
Permanent magnet synchronous machine - surface permanent magnet (square and sinusoidal back E.M.F. type) and interior permanent magnet machines - construction and operating principle - dynamic modeling and self controlled operation - analysis of switch reluctance motors.

L = 45 T = 15 P = 0 C =4

TEXT BOOKS

1. Charles Kingsley, A.E. Fitzgerald Jr. and Stephen D. Umans, 'Electric Machinery', Tata McGraw-Hill, Fifth Edition, 1992.
2. R. Krishnan, 'Electric Motor & Drives: Modelling, Analysis and Control', Prentice Hall of India, 2001.

REFERENCES

1. C.V. Jones, 'The Unified Theory of Electrical Machines', Butterworth, 1967.
2. T.J.E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives' Clarendon Press, 1989.

22272E51BP ADVANCED POWER SYSTEM DYNAMICS **L T P C**

OBJECTIVES: **3 0 0 3**

- To perform transient stability analysis using unified algorithm.
- To impart knowledge on sub-synchronous resonance and oscillations
- To analyze voltage stability problem in power system.
- To familiarize the methods of transient stability enhancement

UNIT ITRANSIENT STABILITY ANALYSIS 9

Review of numerical integration methods: Euler and Fourth Order Runge-Kutta methods, Numerical stability and implicit methods, Interfacing of Synchronous machine (variable voltage) model to the transient stability algorithm (TSA) with partitioned – explicit and implicit approaches – Interfacing SVC with TSA-methods to enhance transient stability

UNIT IIUNIFIED ALGORITHM FOR DYNAMIC ANALYSIS OF POWER SYSTEMS9

Need for unified algorithm- numerical integration algorithmic steps-truncation error- variable step size – handling the discontinuities- numerical stability- application of the algorithm for transient. Mid-term and long-term stability simulations

UNIT III SUBSYSNCHRONOUS RESONANCE (SSR) AND OSCILLATIONS 9

Subsynchronous Resonance (SSR) – Types of SSR - Characteristics of series –Compensated transmission systems –Modeling of turbine-generator-transmission network- Self-excitation due to induction generator effect – Torsional interaction resulting in SSR – Methods of analyzing SSR – Numerical examples illustrating instability of subsynchronous oscillations – time-domain simulation of subsynchronous resonance – EMTP with detailed synchronous machine model- Turbine Generator Torsional Characteristics: Shaft system model – Examples of torsional characteristics – Torsional Interaction with Power System Controls: Interaction with generator excitation controls – Interaction with speed governors – Interaction with nearby DC converters

UNIT IV TRANSMISSION, GENERATION AND LOAD ASPECTS OF VOLTAGE STABILITY ANALYSIS **9**

Review of transmission aspects – Generation Aspects: Review of synchronous machine theory – Voltage and frequency controllers – Limiting devices affecting voltage stability – Voltage-reactive power characteristics of synchronous generators – Capability curves – Effect of machine limitation on deliverable power – Load Aspects – Voltage dependence of loads – Load restoration dynamics – Induction motors – Load tap changers – Thermostatic load recovery – General aggregate load models.

UNIT V ENHANCEMENT OF TRANSIENT STABILITY AND COUNTER MEASURES FOR SUB SYNCHRONOUS RESONANCE 9

Principle behind transient stability enhancement methods: high-speed fault clearing, reduction of transmission system reactance, regulated shunt compensation, dynamic braking, reactor switching, independent pole-operation of circuit-breakers, single-pole switching, fast-valving, high-speed excitation systems; NGH damper scheme.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will be able to understand the various schemes available in Transformer protection
- Learners will have knowledge on Over current protection.
- Learners will attain knowledge about Distance and Carrier protection in transmission lines.
- Learners will understand the concepts of Busbar protection.
- Learners will attain basic knowledge on numerical protection techniques

REFERENCES

1 R.Ramnujam," Power System Dynamics Analysis and Simulation", PHI Learning Private Limited, New Delhi, 2009

2 T.V. Cutsem and C.Vournas, "Voltage Stability of Electric Power Systems", Kluwer publishers,1998

3 P. Kundur, "Power System Stability and Control", McGraw-Hill, 1993.

4 H.W. Dommel and N.Sato, "Fast Transient Stability Solutions," IEEE Trans., Vol. PAS-91, pp, 1643-1650, July/August 1972.

5 Roderick J . Frowd and J. C. Giri, "Transient stability and Long term dynamics unified", IEEE Trans., Vol 101, No. 10, October 1982.

6 M.Stubbe, A.Bihain,J.Deuse, J.C.Baader, "A New Unified software program for the study of the dynamic behaviour of electrical power system" IEEE Transaction, Power Systems, Vol.4.No.1,Feb:1989 Pg.129 to 138

22272E23DP ANALYSIS AND COMPUTATION OF ELECTROMAGNETIC TRANSIENTS IN POWER SYSTEMS

L T P C
3 0 0 3

OBJECTIVES:

- To understand the various types of transients and its analysis in power system.
- To learn about modeling and computational aspects transients computation

UNIT I REVIEW OF TRAVELLING WAVE PHENOMENA 9

Lumped and Distributed Parameters – Wave Equation – Reflection, Refraction, Behaviour of Travelling waves at the line terminations – Lattice Diagrams – Attenuation and Distortion.

UNIT II LIGHTNING, SWITCHING AND TEMPORARY OVERVOLTAGES **9**

Lightning overvoltages: interaction between lightning and power system- ground wire voltage and voltage across insulator; switching overvoltage: Short line or kilometric fault, energizing transients - closing and re-closing of lines, methods of control; temporary overvoltages: line dropping, load rejection; voltage induced by fault; very fast transient overvoltage (VFTO).

UNIT III PARAMETERS AND MODELING OF OVERHEAD LINES **9**

Review of line parameters for simple configurations: series resistance, inductance and shunt capacitance; bundle conductors : equivalent GMR and equivalent radius; modal propagation in transmission lines: modes on multi-phase transposed transmission lines, α-β-0 transformation and symmetrical components transformation, modal impedances; analysis of modes on untransposed lines; effect of ground return and skin effect; transposition schemes;

UNIT V FAST TRANSIENTS PHENOMENON IN AIS AND GIS **9**

Digital computation of line parameters: why line parameter evaluation programs? Salient features of a typical line parameter evaluation program; constructional features of that affect transmission line parameters; line parameters for physical and equivalent phase conductors elimination of ground wires bundling of conductors; principle of digital computation of transients: features and capabilities of electromagnetic transients program; steady state and time step solution modules: basic solution methods; case studies on simulation of various types of transients

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will be able to model over head lines, cables and transformers.
- Learners will be able to analyze power system transients.

REFERENCES

1 Allan Greenwood, "Electrical Transients in Power System", Wiley & Sons Inc. New York, 1991.

2 R. Ramanujam, "Computational Electromagnetic Transients: Modeling, Solution Methods and Simulation", I.K. International Publishing House Pvt. Ltd, New Delhi, 2014.

3 Naidu M S and Kamaraju V, "High Voltage Engineering", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.

22272E33AP SMART GRID **LTPC**

3003

OBJECTIVES:

- To Study about Smart Grid technologies, different smart meters and advanced metering infrastructure.
- To familiarize the power quality management issues in Smart Grid.
- To familiarize the high performance computing for Smart Grid applications

UNIT IINTRODUCTION TO SMART GRID **9**

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, National and International Initiatives in Smart Grid.

UNIT II SMART GRID TECHNOLOGIES **9**

Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/Var control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV).

UNIT III SMART METERS AND ADVANCED METERING INFRASTRUCTURE **9**

Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU), Intelligent Electronic Devices (IED) & their application for monitoring & protection.

UNIT IV POWER QUALITY MANAGEMENT IN SMART GRID **9**

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

UNIT V HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS 9

Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will develop more understanding on the concepts of Smart Grid and its present developments.
- Learners will study about different Smart Grid technologies.
- Learners will acquire knowledge about different smart meters and advanced metering infrastructure.
- Learners will have knowledge on power quality management in Smart Grids
- Learners will develop more understanding on LAN, WAN and Cloud Computing for Smart Grid application

REFERENCES

1 Stuart Borlase "Smart Grid :Infrastructure, Technology and Solutions", CRC Press 2012.

2 Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley 2012.

3 Vehbi C. Güngör, DilanSahin, TaskinKocak, Salih Ergüt, Concettina Buccella, Carlo Cecati, and Gerhard P. Hancke, "Smart Grid Technologies: Communication Technologies and Standards" IEEE Transactions On Industrial Informatics, Vol. 7, No. 4, November 2011.

4 Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang "Smart Grid – The New and Improved Power Grid: A Survey" , IEEE Transaction on Smart Grids, vol. 14, j2012.

22272E33BP SOLAR AND ENERGY STORAGE SYSTEMS **LTPC**

3003

OBJECTIVES:

- To Study about solar modules and PV system design and their applications
- To Deal with grid connected PV systems
- To Discuss about different energy storage systems

UNIT IINTRODUCTION 9

Characteristics of sunlight – semiconductors and P-N junctions –behavior of solar cells – cell properties – PV cell interconnection

UNIT II STAND ALONE PV SYSTEM 9

Solar modules – storage systems – power conditioning and regulation - MPPT- protection – stand alone PV systems design – sizing

UNIT III GRID CONNECTED PV SYSTEMS 9

PV systems in buildings – design issues for central power stations – safety – Economic aspect – Efficiency and performance - International PV programs

UNIT IV ENERGY STORAGE SYSTEMS 9

Impact of intermittent generation – Battery energy storage – solar thermal energy storage – pumped hydroelectric energy storage

UNIT V APPLICATIONS 9

Water pumping – battery chargers – solar car – direct-drive applications –Space – Telecommunications.

TOTAL : 45 PERIODS

OUTCOMES:

- Students will develop more understanding on solar energy storage systems
- Students will develop basic knowledge on standalone PV system
- Students will understand the issues in grid connected PV systems
- Students will study about the modeling of different energy storage systems and their performances
- Students will attain more on different applications of solar energy

REFERENCES

1 Solanki C.S., "Solar Photovoltaics: Fundamentals, Technologies And Applications", PHI Learning Pvt. Ltd.,2015.

2 Stuart R.Wenham, Martin A.Green, Muriel E. Watt and Richard Corkish, "Applied Photovoltaics", 2007,Earthscan, UK. Eduardo Lorenzo G. Araujo, "Solar electricity engineering of photovoltaic systems", Progensa,1994.

3 Frank S. Barnes & Jonah G. Levine, "Large Energy storage Systems Handbook", CRC Press, 2011.

4 McNeils, Frenkel, Desai, "Solar & Wind Energy Technologies", Wiley Eastern, 1990

5 S.P. Sukhatme , "Solar Energy", Tata McGraw Hill,1987.

22272E33CP POWER SYSTEM RELIABILITY **L T P C**

OBJECTIVES: **3 0 0 3**

- To introduces the objectives of Load forecasting.
- To study the fundamentals of Generation system, transmission system and Distribution system reliability analysis
- To illustrate the basic concepts of Expansion planning

UNIT I LOAD FORECASTING 9

Objectives of forecasting - Load growth patterns and their importance in planning - Load forecasting Based on discounted multiple regression technique-Weather sensitive load forecasting-Determination of annual forecasting-Use of AI in load forecasting.

UNIT II GENERATION SYSTEM RELIABILITY ANALYSIS 9

Probabilistic generation and load models- Determination of LOLP and expected value of demand not served –Determination of reliability of ISO and interconnected generation systems

UNIT III TRANSMISSION SYSTEM RELIABILITY ANALYSIS 9

Deterministic contingency analysis-probabilistic load flow-Fuzzy load flow probabilistic transmission system reliability analysis-Determination of reliability indices like LOLP and expected value of demand not served

UNIT IV EXPANSION PLANNING 9

Basic concepts on expansion planning-procedure followed for integrate transmission system planning, current practice in India-Capacitor placer problem in transmission system and radial distributions system.

UNIT V DISTRIBUTION SYSTEM PLANNING OVERVIEW 9

Introduction, sub transmission lines and distribution substations-Design primary and secondary systems-distribution system protection and coordination of protective devices.

TOTAL: 45 PERIODS

OUTCOMES:

- Students will develop the ability to learn about load forecasting.
- Students will learn about reliability analysis of ISO and interconnected systems.
- Students will understand the concepts ot Contingency analysis and Probabilistic Load flow Analysis
- Students will be able to understand the concepts of Expansion planning

- Students will have knowledge on the fundamental concepts of the Distribution system planning

REFERENCES

1 Roy Billinton & Ronald N. Allan, "Reliability Evaluation of Power Systems" Springer Publication,

2 R.L. Sullivan, "Power System Planning", Tata McGraw Hill Publishing Company Ltd 1977.

3 X. Wang & J.R. McDonald, "Modern Power System Planning", McGraw Hill Book Company 1994.

4 T. Gonen, "Electrical Power Distribution Engineering", McGraw Hill Book Company 1986.

5 B.R. Gupta, "Generation of Electrical Energy",S.Chand Publications 1983.

22272E33DP DISTRIBUTED GENERATION AND MICROGRID **L T P C**

OBJECTIVES: **3 0 0 3**

- To illustrate the concept of distributed generation
- To analyze the impact of grid integration.
- To study concept of Microgrid and its configuration

UNIT I INTRODUCTION 9

Conventional power generation: advantages and disadvantages, Energy crises, Non-conventional energy (NCE) resources: review of Solar PV, Wind Energy systems, Fuel Cells, micro-turbines, biomass, and tidal sources.

UNIT II DISTRIBUTED GENERATIONS (DG) **9**

Concept of distributed generations, topologies, selection of sources, regulatory standards/ framework, Standards for interconnecting Distributed resources to electric power systems: IEEE 1547. DG installation classes, security issues in DG implementations. Energy storage elements: Batteries, ultra-capacitors, flywheels. Captive power plants

UNIT III IMPACT OF GRID INTEGRATION **9**

Requirements for grid interconnection, limits on operational parameters,: voltage, frequency, THD, response to grid abnormal operating conditions, islanding issues. Impact of grid integration with NCE sources on existing power system: reliability, stability and power quality issues.

UNIT IV BASICS OF A MICROGRID **9**

Concept and definition of microgrid, microgrid drivers and benefits, review of sources of microgrids, typical structure and configuration of a microgrid, AC and DC microgrids, Power Electronics interfaces in DC and AC microgrids

UNIT V CONTROL AND OPERATION OF MICROGRID 9

Modes of operation and control of microgrid: grid connected and islanded mode, Active and reactive power control, protection issues, anti-islanding schemes: passive, active and communication based techniques, microgrid communication infrastructure, Power quality issues in microgrids, regulatory standards, Microgrid economics, Introduction to smart microgrids.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will attain knowledge on the various schemes of conventional and nonconventional power generation.

- Learners will have knowledge on the topologies and energy sources of distributed generation.
- Learners will learn about the requirements for grid interconnection and its impact with NCE sources
- Learners will understand the fundamental concept of Microgrid.

REFERENCES

1 Amirnaser Yezdani, and Reza Iravani, "Voltage Source Converters in Power Systems: Modeling, Control and Applications", IEEE John Wiley Publications, 2010.

2 DorinNeacsu, "Power Switching Converters: Medium and High Power", CRC Press, Taylor & Francis, 2006

3 Chetan Singh Solanki, "Solar Photo Voltaics", PHI learning Pvt. Ltd., New Delhi,2009

4 J.F. Manwell, J.G. McGowan "Wind Energy Explained, theory design and applications", Wiley publication 2010.

5 D. D. Hall and R. P. Grover, "Biomass Regenerable Energy", John Wiley, New York, 1987.

6 John Twidell and Tony Weir, "Renewable Energy Resources" Tyalor and Francis Publications, Second edition 2006.

22272E43AP - WIND ENERGY CONVERSION SYSTEMS

3 1 0 4

UNIT-I INTRODUCTION: **9**

History of wind Electric generation - Darrieus wind - Horizontal and vertical axis-Wind turbine - other modern developments - Future possibilities.

UNIT-II WIND RESOURCE AND ITS POTENTIAL FOR ELECVTRIC POWER GENERATION: **9**

Power Extracted By A Wind Driven Machine - Nature and occurrence of wind characteristics and power production - variation of mean wind speed with time.

UNIT-III WIND POWER SITES AND WIND MEASUREMENTS: 9

Average wind speed and other factors affecting choice of the site - Effect of wind direction - Measurement of wind velocity - Personal estimation without instruments- anemometers - Measurement of wind direction.

UNIT-IV WIND TURBINES WITH ASYNCHRONOUS GENERATORS AND CONTROL ASPECTS: **9**

Asynchronous systems - Ac Generators - Self excitation of Induction Generator - Single Phase operation of Induction Generator - Permanenet magnet Generators - Basic control aspects - fixed speed ratio control scheme - fixed vs variable speed operation of WECS.

UNIT-V GENERATION OF ELECTRICITY **9**

Active and reactive power - P and Q transfer in power systems - Power converters - Characteristics of Generators - Variable Speed options - Economics.

L = 45 T = 15 P = 0 C =4

REFERENCES:

1. N.G.Calvert, 'Wind Power Principles: Their Application on small scale', Charles Friffin& co. Ltd, London, 1979.
2. Gerald W.Koeppel, "Pirnam's and Power from the wind", Van Nastran Reinhold Co., London, 1979.
3. Gary L. Johnson, "Wind Energy System", Prentice hall Inc., Englewood Cliffs, New Jersey, 1985.
4. Wind energy conversion system by L. Lfreris, Prentice hall (U.K) Ltd., 1990.

22272E43BP - AI TECHNIQUES TO POWER SYSTEMS

3 1 0 4

1. INTRODUCTION TO NEURAL NETWORKS 9

Basics of ANN - perceptron - delta learning rule - back propagation algorithm - multilayer feed forward network - memory models - bi-directional associative memory - Hopfield network.

2. APPLICATIONS TO POWER SYSTEM PROBLEMS 9

Application of neural networks to load forecasting - contingency analysis - VAR control - economic load dispatch.

3. INTRODUCTION TO FUZZY LOGIC 9

Crispness - vagueness - fuzziness - uncertainty - fuzzy set theory fuzzy sets - fuzzy set operations - fuzzy measures - fuzzy relations - fuzzy function - structure of fuzzy logic controller – fuzzification models - data base - rule base - inference engine defuzzification module.

4. APPLICATIONS TO POWER SYSTEMS 9

Decision making in power system control through fuzzy set theory - use of fuzzy set models of LP in power systems scheduling problems - fuzzy logic based power system stabilizer.

5. GENETIC ALGORITHM AND ITS APPLICATIONS TO POWER SYSTEMS 9

Introduction - simple genetic algorithm - reproduction - crossover - mutation – advanced operators in genetic search - applications to voltage control and stability studies.

L = 45 T = 15 P = 0 C =4

REFERENCES:

1. James A. Freeman and Skapura.B.M „Neural Networks - Algorithms Applications and Programming Techniques‟, Addison Wesley, 1990.
2. George Klir and Tina Folger.A, „Fuzzy sets, Uncertainty and Information‟, Prentice Hall of India, 1993.
3. Zimmerman.H.J„„Fuzzy Set Theory and its Applications‟, Kluwer Academic Publishers 1994.
4. IEEE tutorial on „Application of Neural Network to Power Systems‟, 1996.
5. Loi Lei Lai, „Intelligent System Applications in Power Engineering‟, John Wiley & SonsLtd.,1998.

22272E43CP **ELECTRICAL DISTRIBUTION SYSTEM** **L T P C**

OBJECTIVES: **3 0 0 3**

- To provide knowledge about the distribution system electrical characteristics
- To gain knowledge about planning and designing of distribution system
- To analyze power quality in distribution system
- To analyze the power flow in balanced and unbalanced system

UNIT I INTRODUCTION 9

Distribution System-Distribution Feeder Electrical Characteristics-Nature of Loads : Individual Customer Load, Distribution Transformer Loading and Feeder Load -Approximate Method of Analysis: Voltage Drop, Line Impedance, "K" Factors, Uniformly Distributed Loads and Lumping Loads in Geometric Configurations.

UNIT II DISTRIBUTION SYSTEM PLANNING 9

Factors effecting planning, present techniques, planning models(Short term planning, long term planning and dynamic planning), planning in the future, future nature of distribution planning, Role of computer in Distribution planning. Load forecast, Load characteristics and Load models.

UNIT III DISTRIBUTION SYSTEM LINE MODEL 9

Exact Line Segment Model-Modified Line Model- Approximate Line Segment Model-Modified "Ladder" Iterative Technique-General Matrices for Parallel Lines.

UNIT IV VOLTAGE REGULATION 9

Standard Voltage Ratings-Two-Winding Transformer Theory-Two-Winding Autotransformer-Step-Voltage Regulators: Single-Phase Step-Voltage Regulators-Three-Phase Step-Voltage Regulators- Application of capacitors in Distribution system.

UNIT V DISTRIBUTION FEEDER ANALYSIS 9

Power-Flow Analysis- Ladder Iterative Technique -Unbalanced Three-Phase Distribution Feeder- Modified Ladder Iterative Technique- Load Allocation- Short-Circuit Studies.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to apply the concepts of planning and design of distribution system for utility systems
- Ability to implement the concepts of volatage control in distribution system.
- Ability to analyze the power flow in balanced and unbalanced system

REFERENCES

1. William H. Kersting," Distribution System Modeling and Analysis " CRC press 3rd edition,2012.
2. Turan Gonen, “Electric Power Distribution System Engineering”, McGraw Hill Company. 1986
3. James Northcote – Green, Robert Wilson, “Control and Automation of Electrical Power Distribution Systems”, CRC Press, New York, 2007.
4. Pabla H S, “Electrical Power Distribution Systems”, Tata McGraw Hill. 2004

22272E43DP- ENERGY MANAGEMENT AND AUDITING L T P C

OBJECTIVES: 3 0 0 3

- To study the concepts behind economic analysis and Load management.
- To emphasize the energy management on various electrical equipments and metering.
- To illustrate the concept of lighting systems and cogeneration.

UNIT I INTRODUCTION 9

Need for energy management - energy basics- designing and starting an energy management program – energy accounting -energy monitoring, targeting and reporting-energy audit process.

UNIT II ENERGY COST AND LOAD MANAGEMENT 9

Important concepts in an economic analysis - Economic models-Time value of money-Utility rate structures- cost of electricity-Loss evaluation- Load management: Demand control techniques-Utility monitoring and control system-HVAC and energy management-Economic justification.

UNIT III ENERGY MANAGEMENT FOR MOTORS, SYSTEMS, AND ELECTRICAL EQUIPMENT 9

Systems and equipment- Electric motors-Transformers and reactors-Capacitors and synchronous machines.

UNIT IV METERING FOR ENERGY MANAGEMENT 9

Relationships between parameters-Units of measure-Typical cost factors- Utility meters - Timing of meter disc for kilowatt measurement - Demand meters - Paralleling of current transformers - Instrument transformer burdens-Multitasking solid-state meters - Metering location vs. requirements- Metering techniques and practical examples.

UNIT V LIGHTING SYSTEMS & COGENERATION 9

Concept of lighting systems - The task and the working space -Light sources - Ballasts - Luminaries - Lighting controls-Optimizing lighting energy - Power factor and effect of harmonics on power quality - Cost analysis techniques-Lighting and energy standards Cogeneration: Forms of cogeneration - feasibility of cogeneration- Electrical interconnection.

TOTAL : 45 PERIODS

OUTCOMES:

- Students will develop the ability to learn about the need for energy management and auditing process
- Learners will learn about basic concepts of economic analysis and load management.
- Students will understand the energy management on various electrical equipments.
- Students will have knowledge on the concepts of metering and factors influencing cost function

- Students will be able to learn about the concept of lighting systems, light sources and various forms of cogeneration

REFERENCES

1 Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, “Guide to Energy Management”, Fifth Edition, The Fairmont Press, Inc., 2006

2 Eastop T.D & Croft D.R, “Energy Efficiency for Engineers and Technologists”, Logman Scientific & Technical, 1990.

3 Reay D.A, “Industrial Energy Conservation”, 1st edition, Pergamon Press, 1977.

4 “IEEE Recommended Practice for Energy Management in Industrial and Commercial Facilities”, IEEE, 1996

5 Amit K. Tyagi, “Handbook on Energy Audits and Management”, TERI, 2003.

22272E51AP- POWER ELECTRONICS APPLICATIONS IN POWER SYSTEMS LTPC

3 1 0 4

UNIT: I STATIC COMPENSATOR CONTROL 9

Theory of load compensation - voltage regulation and power factor correction - phase balance and PF correction of unsymmetrical loads - Property of static compensator - Thyristor controlled rectifier (TCR) - Thyristor Controlled Capacitor (TSC) -Saturable core reactor - Control Strategies.

UNIT: II HARMONIC CONTROL AND POWER FACTOR IMPROVEMENT 9

Input power factor for different types of converters - power factor improvement using Load and forced commutated converters.

UNIT: III VOLTAGE CONTROL USING STATIC TAP-CHANGERS 9

Conventional tap changing methods, static tap changers using Thyristor, different schemes - comparison.

UNIT: IV STATIC EXCITATION CONTROL 9

Solid state excitation of synchronous generators - Different schemes - Generex excitation systems.

UNIT: V UNINTERRUPTABLE POWER SUPPLY SYSTEM 9

Parallel, Redundant and non- redundant UPS - Ups using resonant power converters - Switch mode power supplies.

L = 45 T = 15 P = 0 C =4

TEXT BOOK

Miller. T.J.E, “Reactive power control in Electric systems”. Wiley inter science, New York, 1982.

REFRENCES

1. “Static Compensator for AC power systems”, Proc. IEE vol.128 Nov. 1981. pp 362-406.
2 “A Static alternative to the transformer on load tap changing”, IEEE Trans. On Pas, Vol.PAS-99, Jan. /Feb. 1980, pp86-89.
3. “Improvements in Thyristor controlled static on- load tap controllers for transformers”, IEEE Trans. on PAS, Vol.PAS-101, Sept.1982, pp3091-3095.
4. “Shunt Thyristor rectifiers for the Generex Excitation systems”, IEEE Trans. On PAS. PAS -96, July/August, 1977, pp1219-1325.

22272E32B- POWER SYSTEM DYNAMICS

3 1 0 4

1. SYNCHRONOUS MACHINE MODELLING 9

Schematic Diagram, Physical Description: armature and field structure, machines with multiple pole pairs, mmf waveforms, direct and quadrature axes, Mathematical Description of a Synchronous Machine: Basic equations of a synchronous machine: stator circuit equations, stator self, stator mutual and stator to rotor mutual inductances, dq0 Transformation: flux linkage and voltage equations for stator and rotor in dq0 coordinates, electrical power and torque, physical interpretation of dq0 transformation, Per Unit Representations: L_{ad}-reciprocal per unit system and that from power-invariant form of Park's transformation; Equivalent Circuits for direct and quadrature axes, Steady-state Analysis: Voltage, current and flux-linkage relationships, Phasor representation, Rotor angle, Steady-state equivalent circuit, Computation of steady-state values, Equations of Motion: Swing Equation, calculation of inertia constant, Representation in system studies, Synchronous Machine Representation in Stability Studies: Simplifications for large-scale studies : Neglect of stator $p\Psi$ terms and speed variations, Simplified model with amortisseurs neglected: two-axis model with amortisseur windings neglected, classical model.

2. MODELLING OF EXCITATION AND SPEED GOVERNING SYSTEMS 9

Excitation System Requirements; Elements of an Excitation System; Types of Excitation System;Control and protective functions;IEEE (1992) block diagram for simulation of excitation systems. Turbine and Governing System Modelling: Functional Block Diagram of Power Generation and Control, Schematic of a hydroelectric plant, classical transfer function of a hydraulic turbine (no derivation), special characteristic of hydraulic turbine, electrical analogue of hydraulic turbine, Governor for Hydraulic Turbine: Requirement for a transient droop, Block diagram of governor with transient droop compensation, Steam turbine modelling: Single reheat tandem compounded type only and IEEE block diagram for dynamic simulation; generic speed-governing system model for normal speed/load control function.

3. SMALL-SIGNAL STABILITY ANALYSIS WITHOUT CONTROLLERS 9

Classification of Stability, Basic Concepts and Definitions: Rotor angle stability, The Stability Phenomena. Fundamental Concepts of Stability of Dynamic Systems: State-space representation, stability of dynamic system, Linearisation, Eigen properties of the state matrix: Eigen values and eigenvectors, modal matrices, eigen value and stability, mode shape and participation factor. Single-Machine Infinite Bus (SMIB) Configuration: Classical Machine Model stability analysis with numerical example, Effects of Field Circuit Dynamics: synchronous machine, network and linearised system equations, block diagram representation with K-constants; expression for K-constants (no derivation), effect of field flux variation on system stability: analysis with numerical example,

4. SMALL-SIGNAL STABILITY ANALYSIS WITH CONTROLLERS 9

Effects Of Excitation System: Equations with definitions of appropriate K-constants and simple thyristor excitation system and AVR, block diagram with the excitation system, analysis of effect of AVR on synchronizing and damping components using a numerical example, Power System Stabiliser: Block diagram with AVR and PSS, Illustration of principle of PSS application with numerical example, Block diagram of PSS with description, system state matrix including PSS, analysis of stability with numerical a example. Multi-Machine Configuration: Equations in a common reference frame, equations in individual machine rotor coordinates, illustration of formation of system state matrix for a two-machine system with classical models for synchronous machines, illustration of stability analysis using a numerical example. Principle behind small-signal stability improvement methods: delta-omega and delta P-omega stabilizers.

5. ENHANCEMENT OF SMALL SIGNAL STABILITY 9

Power System Stabilizer – Stabilizer based on shaft speed signal (delta omega) – Delta –P-Omega stabilizer-Frequency-based stabilizers – Digital Stabilizer – Excitation control design – Exciter gain – Phase lead compensation – Stabilizing signal washout stabilizer gain – Stabilizer limits

L = 45 T = 15 P = 0 C =4

REFERENCES

1. P. Kundur, “Power System Stability and Control”, McGraw-Hill, 1993.
2. IEEE Committee Report, "Dynamic Models for Steam and Hydro Turbines in Power System Studies”, IEEE Trans., Vol.PAS-92, pp 1904-1915, November/December, 1973. on Turbine-Governor Model.
3. P.M Anderson and A.A Fouad, “Power System Control and Stability”, Iowa State University Press, Ames, Iowa, 1978.

22272E51CP ELECTRIC VEHICLES AND POWER MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the concept of electrical vehicles and its operations
- To understand the need for energy storage in hybrid vehicles
- To provide knowledge about various possible energy storage technologies that can be
- used in electric vehicles

UNIT I ELECTRIC VEHICLES AND VEHICLE MECHANICS 9

Electric Vehicles (EV), Hybrid Electric Vehicles (HEV), Engine ratings, Comparisons of EV with internal combustion Engine vehicles, Fundamentals of vehicle mechanics

UNIT II ARCHITECTURE OF EV's AND POWER TRAIN COMPONENTS 9

Architecture of EV's and HEV's – Plug-n Hybrid Electric Vehicles (PHEV)- Power train components and sizing, Gears, Clutches, Transmission and Brakes

UNIT III CONTROL OF DC AND AC DRIVES 9

DC/DC chopper based four quadrant operations of DC drives – Inverter based V/f Operation (motoring and braking) of induction motor drive system – Induction motor and permanent motor based vector control operation – Switched reluctance motor (SRM) drives

UNIT IV BATTERY ENERGY STORAGE SYSTEM 9

Battery Basics, Different types, Battery Parameters, Battery modeling, Traction Batteries

UNIT V ALTERNATIVE ENERGY STORAGE SYSTEMS 9

Fuel cell – Characteristics- Types – hydrogen Storage Systems and Fuel cell EV – Ultra capacitors

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will understand the operation of Electric vehicles and various energy storage technologies for electrical vehicles

REFERENCES

1 Iqbal Hussain, "**Electric and Hybrid Vehicles: Design Fundamentals, Second Edition"** CRC Press, Taylor & Francis Group, Second Edition (2011).

2 Ali Emadi, Mehrdad Ehsani, John M.Miller, "Vehicular Electric Power Systems", Special Indian Edition, Marcel dekker, Inc 2010.

22272E51DP ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide fundamental knowledge on electromagnetic interference and electromagnetic compatibility.
- To study the important techniques to control EMI and EMC.
- To expose the knowledge on testing techniques as per Indian and international standards in EMI measurement.

UNIT I INTRODUCTION 9

Definitions of EMI/EMC -Sources of EMI- Intersystems and Intrasystem- Conducted and radiated interference- Characteristics - Designing for electromagnetic compatibility (EMC)- EMC regulationtypical noise path- EMI predictions and modeling, Cross talk - Methods of eliminating interferences.

UNIT II GROUNDING AND CABLING 9

Cabling- types of cables, mechanism of EMI emission / coupling in cables –capacitive couplinginductive coupling- shielding to prevent magnetic radiation- shield transfer impedance, Grounding – safety grounds – signal grounds- single point and multipoint ground systemshybrid grounds- functional ground layout –grounding of cable shields- -guard shields- isolation, neutralizing transformers, shield grounding at high frequencies, digital grounding- Earth measurement Methods

UNIT III BALANCING, FILTERING AND SHIELDING 9

Power supply decoupling- decoupling filters-amplifier filtering –high frequency filtering- EMI filters characteristics of LPF, HPF, BPF, BEF and power line filter design -Choice of capacitors, inductors, transformers and resistors, EMC design components -shielding – near and far fieldsshielding effectiveness - absorption and reflection loss- magnetic materials as a shield, shield discontinuities, slots and holes, seams and joints, conductive gaskets-windows and coatings - grounding of shields

UNIT IVEMI IN ELEMENTS AND CIRCUITS 9

Electromagnetic emissions, noise from relays and switches, non- linearities in circuits, passive inter modulation, transients in power supply lines, EMI from power electronic equipment, EMI as combination of radiation and conduction

UNIT V ELECTROSTATIC DISCHARGE, STANDARDS AND TESTING TECHNIQUES 9

Static Generation- human body model- static discharges- ESD versus EMC, ESD protection in equipments- standards – FCC requirements – EMI measurements – Open area test site measurements and precautions- Radiated and conducted interference measurements, Control requirements and testing methods

TOTAL: 45 PERIODS

OUTCOMES:

- Recognize the sources of Conducted and radiated EMI in Power Electronic Converters and consumer appliances and suggest remedial measures to mitigate the problems
- Assess the insertion loss and design EMI filters to reduce the loss
- Design EMI filters, common-mode chokes and RC-snubber circuits measures to keep the interference within tolerable limits

REFERENCES

1. V.P. Kodali, “Engineering Electromagnetic Compatibility”, S. Chand, 1996
2. Henry W.Ott, “ Noise reduction techniques in electronic systems”, John Wiley & Sons, 1989
3. Bernhard Keiser, “Principles of Electro-magnetic Compatibility”, Artech House, Inc. (685 canton street, Norwood, MA 020062 USA) 1987
4. Bridges, J.E Milleta J. and Ricketts.L.W., “EMP Radiation and Protective techniques”, John Wiley and sons, USA 1976
5. William Duff G., & Donald White R. J, “Series on Electromagnetic Interference and Compatibility”, Vol.
6. Weston David A., “Electromagnetic Compatibility, Principles and Applications”, 1991.

ELECTIVES – V (semester-III)

22275E52AP - POWER CONDITIONING

3 1 0 4

1. INTRODUCTION 9

Introduction – Characterization of Electric Power Quality: Transients, short duration and long duration voltage variations, Voltage imbalance, waveform distortion, Voltage fluctuations, Power frequency variation, Power acceptability curves – power quality problems: poor load power factor, Non linear and unbalanced loads, DC offset in loads, Notching in load voltage, Disturbance in supply voltage – Power quality standards.

2. NON-LINEAR LOADS 9

Single phase static and rotating AC/DC converters, Three phase static AC/DC converters, Battery chargers, Arc furnaces, Fluorescent lighting, pulse modulated devices, Adjustable speed drives.

3. MEASUREMENT AND ANALYSIS METHODS 9

Voltage, Current, Power and Energy measurements, power factor measurements and definitions, event recorders, Measurement Error – Analysis: Analysis in the periodic steady state, Time domain methods, Frequency domain methods: Laplace′s, Fourier and Hartley transform – The Walsh Transform – Wavelet Transform.

4. ANALYSIS AND CONVENTIONAL MITIGATION METHODS 9

Analysis of power outages, Analysis of unbalance: Symmetrical components of phasor quantities, Instantaneous symmetrical components, Instantaneous real and reactive powers, Analysis of distortion: On–line extraction of fundamental sequence components from measured samples – Harmonic indices – Analysis of voltage sag: Detorit Edison sag score, Voltage sag energy, Voltage Sag Lost Energy Index (VSLEI)- Analysis of voltage flicker, Reduced duration and customer impact of outages, Classical load balancing problem: Open loop balancing, Closed loop balancing, current balancing, Harmonic reduction, Voltage sag reduction.

5. POWER QUALITY IMPROVEMENT 9

Utility-Customer interface –Harmonic filters: passive, Active and hybrid filters –Custom power devices: Network reconfiguring Devices, Load compensation using DSTATCOM, Voltage regulation using DSTATCOM, protecting sensitive loads using DVR, UPQC – control strategies: P- Q theory, Synchronous detection method – Custom power park – Status of application of custom power devices

L = 45 T = 15 P = 0 C =4

REFERENCES:

1. Arindam Ghosh “Power Quality Enhancement Using Custom Power Devices”, Kluwer Academic Publishers, 2002.
2. Heydt.G.T, “Electric Power Quality”, Stars in a Circle Publications, 1994(2nd edition)
3. Dugan.R.C, “ Electrical Power System Quality”,TMH,2008.
4.Arrillga.A.J and Neville R.Watson, Power System Harmonics, John Wiley second Edition,2003.
5. Derek A. Paice, “Power electronic converter harmonics”,John Wiley & sons, 1999.

ELECTIVES – V (semester-III)

22275E52BP – DEREGULATED POWER SYSTEM

3 1 0 4

1. FUNDAMENTALS AND ARCHITECTURE OF POWERMARKETS 9

Deregulation of Electric utilities: Introduction-Unbundling-Wheeling- Reform motivations- Fundamentals of Deregulated Markets – Types (Future, Day-ahead and Spot) – Participating in Markets (Consumer and Producer Perspective) – bilateral markets – pool markets. Independent System Operator (ISO)-components-types of ISO - role of ISO - Lessons and Operating Experiences of Deregulated Electricity Markets in various Countries (UK, Australia, Europe, US, Asia).

2. TECHNICAL CHALLENGES 9

Total Transfer Capability – Limitations - Margins – Available transfer capability (ATC) – Procedure - Methods to compute ATC – Static and Dynamic ATC – Effect of contingency analysis – Case Study. Concept of Congestion Management – Bid, Zonal and Node Congestion Principles – Inter and Intra zonal congestion – Generation Rescheduling - Transmission congestion contracts – Case Study.

3. TRANSMISSION NETWORKS AND SYSTEM SECURITY SERVICES 9

Transmission expansion in the New Environment – Introduction – Role of transmission planning – Physical Transmission Rights – Limitations – Flow gate - Financial Transmission Rights – Losses – Managing Transmission Risks – Hedging – Investment. Ancillary Services – Introduction – Describing Needs – Compulsory and Demand-side provision – Buying and Selling Ancillary Services – Standards.

4. MARKET PRICING 9

Transmission pricing in open access system – Introduction – Spot Pricing – Uniform Pricing – Zonal Pricing – Locational Marginal Pricing – Congestion Pricing – Ramping and Opportunity Costs. Embedded cost based transmission pricing methods (Postage stamp, Contract path and MW-mile) – Incremental cost based transmission pricing methods (Short run marginal cost, Long run marginal cost) - Pricing of Losses on Lines and Nodes.

5. INDIAN POWER MARKET 9

Current Scenario – Regions – Restructuring Choices – Statewise Operating Strategies – Salient features of Indian Electricity Act 2003 – Transmission System Operator – Regulatory and Policy development in Indian power Sector – Opportunities for IPP and Capacity Power Producer. Availability based tariff – Necessity – Working Mechanism – Beneficiaries – Day Scheduling Process – Deviation from Schedule – Unscheduled Interchange Rate – System Marginal Rate – Trading Surplus Generation – Applications.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Kankar Bhattacharya, Math H.J. Bollen and Jaap E. Daalder, “Operation of Restructured Power Systems”, Kluwer Academic Publishers, 2001
2. Loi Lei Lai, “Power system Restructuring and Regulation”, John Wiley sons, 2001.
3. Shahidehpour.M and Alomoush.M, “Restructuring Electrical Power Systems”, Marcel Decker Inc., 2001.
4. Steven Stoft, “ Power System Economics”, Wiley – IEEE Press, 2002
5. Daniel S. Kirschen and Goran Strbac, “ Fundamentals of Power System Economics”, John Wiley & Sons Ltd., 2004.
6. Scholarly Transaction Papers and Utility web sites

		L	T	P	C
22275E52CP	**CONTROL SYSTEM DESIGN FOR POWER ELECTRONICS**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To explore conceptual bridges between the fields of Control Systems and Power Electronics
- To Study Control theories and techniques relevant to the design of feedback controllers in Power Electronics.

UNIT I MODELLING OF DC-TO-DC POWER CONVERTERS 9

Modelling of Buck Converter , Boost Converter ,Buck- Boost Converter, Cuk Converter ,Sepic Converter, Zeta Converter, Quadratic Buck Converter ,Double Buck-Boost Converter, Boost-Boost Converter General Mathematical Model for Power Electronics Devices.

UNIT II SLIDING MODE CONTROLLER DESIGN 9

Variable Structure Systems. Single Switch Regulated Systems Sliding Surfaces, Accessibility of the Sliding Surface Sliding Mode Control Implementation of Boost Converter ,Buck-Boost Converter, Cuk Converter ,Sepic Converter, Zeta Converter, Quadratic Buck Converter ,Double Buck-Boost Converter, Boost-Boost Converter.

UNIT III APPROXIMATE LINEARIZATION CONTROLLER DESIGN 9

Linear Feedback Control, Pole Placement by Full State Feedback , Pole Placement Based on Observer Design ,Reduced Order Observers , Generalized Proportional Integral Controllers, Passivity Based Control , Sliding Mode Control Implementation of Buck Converter , Boost Converter ,Buck-Boost Converter.

UNIT IV NONLINEAR CONTROLLER DESIGN 9

Feedback Linearization Isidori's Canonical Form, Input-Output Feedback Linearization, State Feedback Linearization, Passivity Based Control , Full Order Observers , Reduced Order Observers.

UNIT V PREDICTIVE CONTROL OF POWER CONVERTERS 9

Basic Concepts, Theory, and Methods, Application of Predictive Control in Power Electronics, AC-DC-AC Converter System, Faults and Diagnosis Systems in Power Converters.

TOTAL:45 PERIODS

OUTCOMES:

- Ability to understand an overview on modern linear and nonlinear control strategies for power electronics devices
- Ability to model modern power electronic converters for industrial applications
- Ability to design appropriate controllers for modern power electronics devices.

REFERENCES

1. Hebertt Sira-Ramírez, Ramón Silva-Ortigoza, "Control Design Techniques in Power Electronics Devices", Springer 2012

2. Mahesh Patil, Pankaj Rodey, "Control Systems for Power Electronics: A Practical Guide", Springer India, 2015.

3. Blaabjerg José Rodríguez, “Advanced and Intelligent Control in Power Electronics and Drives” , Springer, 2014
4. Enrique Acha, Vassilios Agelidis, Olimpo Anaya, TJE Miller, “Power Electronic Control in Electrical Systems”, Newnes, 2002
5. Marija D. Aranya Chakrabortty, Marija , “Control and Optimization Methods for Electric Smart Grids”, Springer, 2012.

22275E52DP PRINCIPLES OF EHV TRANSMISSION **L T P C**
3 0 0 3

OBJECTIVES:

To impart knowledge on,

- Types of power transmission and configurations various parameters and voltage gradients of transmission line conductors.
- The design requirements of EHV AC and DC lines.

UNIT I INTRODUCTION 9

Standard transmission voltages-AC and DC – different line configurations– average values of line parameters – power handling capacity and line loss – costs of transmission lines and equipment – mechanical considerations in line performance.

UNIT II CALCULATION OF LINE PARAMETERS 9

Calculation of resistance, inductance and capacitance for multi-conductor lines – calculation of sequence inductances and capacitances – line parameters for different modes of propagation – effect of ground return.

UNIT III VOLTAGE GRADIENTS OF CONDUCTORS 9

Charge-potential relations for multi-conductor lines – surface voltage gradient on conductors – gradient factors and their use – distribution of voltage gradient on sub conductors of bundle - voltage gradients on conductors in the presence of ground wires on towers-I2R loss and corona loss-RIV.

UNIT IV ELECTROSTATIC FIELD AND DESIGN OF EHV LINES 9

Effect of EHV line on heavy vehicles - calculation of electrostatic field of AC lines- effect of high field on humans, animals, and plants - measurement of electrostatic fields – electrostatic Induction in unenergised circuit of a D/C line - induced voltages in insulated ground wires - electromagnetic interference, Design of EHV lines.

UNIT V HVDC LINES

Introduction- Reliability and failure issues-Design-tower, ROW, clearances, insulators, electrical and mechanical protection-Maintenance-Control and protection-D.C Electric field and Magnetic field -Regulations and guide lines-underground line design.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to model the transmission lines and estimate the voltage gradients and losses
- Ability to design EHV AC and DC transmission lines

REFERENCES

1 Rakosh Das Begamudre, "Extra High Voltage AC Transmission Engineering", Second Edition, New Age International Pvt. Ltd., 2006.
2 Pritindra Chowdhari, "Electromagnetic transients in Power System", John Wiley and Sons Inc., 2009.
3 Sunil S.Rao, "EHV-AC, HVDC Transmission & Distribution Engineering", Third Edition, Khanna Publishers, 2008.
4 William H. Bailey, Deborah E. Weil and James R. Stewart, "A Review on HVDC Power Transmission Environmental Issues", Oak Ridge National Laboratory.

5 J.C Molburg, J.A. Kavicky, and K.C. Picel ,"A report on The design, Construction and operation of Long-distance High-Voltage Electricity Transmission Technologies" Argonne (National Laboratory) 2007.
6 "Power Engineer's Handbook", Revised and Enlarged 6th Edition, TNEB Engineers' Association, October 2002.

ELECTIVES – VI (semester-III)

22272E53AP- SOFTWARE FOR CONTROL SYSTEM DESIGN

3 1 0 4

1. INTRODUCTION TO DESIGN AND CLASSICAL PID CONTROL

Systems performance and specifications –Proportional, Integral and Derivative Controllers – Structure – Empirical tuning- Zeigler Nichols-Cohen Coon – Root Locus method – Open loop inversion-– Tuning using ISE, IAE and other performance indices.

2. COMPENSATOR DESIGN

Design of lag, lead, lead-lag compensators – Design using bode plots – Polar plots – Nichols charts – root locus and Routh Hurwitz criterion.

3. MATLAB

Introduction – function description – Data types – Tool boxes – Graphical Displays – Programs for solution of state equations – Controller design – Limitations.- simulink-Introduction – Graphical user interface – Starting – Selection of objects – Blocks – Lines - simulation – Application programs – Limitations.

4. MAPLE

Introduction – symbolic programming – Programming constructs – Data structure computation with formulae – Procedures – Numerical Programming.

5. MATLAB

Programs using MATLAB software

L = 45 T = 15 P = 0 C =4

REFERENCES

1. MAPLE V Programming guide.
2. MATLAB user manual.
3. SIMULINK user manual.
4. K.Ogatta ,"Modern Control Engineering",PHI,1997.
5. Dorf and Bishop,"Modern control Engineering', Addison Wesley, 1998.

ELECTIVES – VI (semester-III)

22272E53BP - INDUSTRIAL POWER SYSTEM ANALYSIS AND DESIGN

LTPC 3 1 0 4

UNIT I MOTOR STARTING STUDIES 9

Introduction-Evaluation Criteria-Starting Methods-System Data-Voltage Drop Calculations-Calculation of Acceleration time-Motor Starting with Limited-Capacity Generators-Computer-Aided Analysis-Conclusions.

UNIT II POWER FACTOR CORRECTION STUDIES 9

Introduction-System Description and Modeling-Acceptance Criteria-Frequency Scan Analysis-Voltage Magnification Analysis-Sustained Overvoltages-Switching Surge Analysis-Back-to-Back Switching-Summary and Conclusions.

UNIT III HARMONIC ANALYSIS 9

Harmonic Sources-System Response to Harmonics-System Model for Computer-Aided Analysis-Acceptance Criteria-Harmonic Filters-Harmonic Evaluation-Case Study-Summary and Conclusions.

UNIT IV FLICKER ANALYSIS 9

Sources of Flicker-Flicker Analysis-Flicker Criteria-Data for Flicker analysis- Case Study-Arc Furnace Load-Minimizing the Flicker Effects-Summary.

UNIT V GROUND GRID ANALYSIS 9

Introduction-Acceptance Criteria-Ground Grid Calculations-Computer-Aided Analysis - Improving the Performance of the Grounding Grids-Conclusions.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Ramasamy Natarajan, ”Computer-Aided Power System Analysis”, Marcel Dekker Inc., 2002.

22272E53CP- SOFT COMPUTING TECHNIQUES L T P C

OBJECTIVES: 3 0 0 3

- To expose the concepts of feed forward neural networks.
- To provide adequate knowledge about feed back neural networks.
- To teach about the concept of fuzziness involved in various systems.
- To expose the ideas about genetic algorithm
- To provide adequate knowledge about of FLC and NN toolbox

UNIT I INTRODUCTION AND ARTIFICIAL NEURAL NETWORKS 9

Introduction to intelligent systems- Soft computing techniques- Conventional Computing versus Swarm Computing - Classification of meta-heuristic techniques - Properties of Swarm intelligent Systems - Application domain - Discrete and continuous problems - Single objective and multi-objective problems -Neuron-Nerve structure and synapse- Artificial Neuron and its model- activation functions- Neural network architecture- single layer and multilayer feed forward networks- Mc Culloch Pitts neuron model- perceptron model- Adaline and Madaline- multilayer perception model- back propogation learning methods- effect of learning rule coefficient -back propagation algorithm- factors affecting back propagation training- applications.

UNIT II ARTIFICIAL NEURAL NETWORKS AND ASSOCIATIVE MEMORY 9

Counter propagation network- architecture- functioning & characteristics of counter Propagation network- Hopfield/ Recurrent network configuration - stability constraints associative memory and characteristics- limitations and applications- Hopfield v/s Boltzman machine- Adaptive Resonance Theory- Architecture- classifications- Implementation and training - Associative Memory.

UNIT III FUZZY LOGIC SYSTEM 9

Introduction to crisp sets and fuzzy sets- basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modeling and control- Fuzzification inferencing and defuzzification-Fuzzy knowledge and rule bases-Fuzzy modeling and control schemes for nonlinear systems. Self organizing fuzzy logic control- Fuzzy logic control for nonlinear time delay system.

UNIT IV GENETIC ALGORITHM 9

Evolutionary programs – Genetic algorithms, genetic programming and evolutionary programming - Genetic Algorithm versus Conventional Optimization Techniques - Genetic representations and selection mechanisms; Genetic operators- different types of crossover and mutation operators - Optimization problems using

GA-discrete and continuous - Single objective and multi-objective problems - Procedures in evolutionary programming.

UNIT V HYBRID CONTROL SCHEMES 9

Fuzzification and rule base using ANN–Neuro fuzzy systems-ANFIS – Fuzzy Neuron - Optimization of membership function and rule base using Genetic Algorithm – Introduction to Support Vector Machine - Evolutionary Programming-Particle Swarm Optimization - Case study – Familiarization of NN, FLC and ANFIS Tool Box.

TOTAL : 45 PERIODS

OUTCOMES:

- Will be able to know the basic ANN architectures, algorithms and their limitations.
- Also will be able to know the different operations on the fuzzy sets.
- Will be capable of developing ANN based models and control schemes for non-linear system.
- Will get expertise in the use of different ANN structures and online training algorithm.
- Will be knowledgeable to use Fuzzy logic for modeling and control of non-linear systems.
- Will be competent to use hybrid control schemes and P.S.O and support vector Regressive.

TEXT BOOKS:

1. Laurene V. Fausett, “Fundamentals of Neural Networks: Architectures, Algorithms And Applications”, Pearson Education.
2. Timothy J. Ross, “Fuzzy Logic with Engineering Applications” Wiley India, 2008.
3. Zimmermann H.J. "Fuzzy set theory and its Applications" Springer international edition, 2011.
4. David E.Goldberg, “Genetic Algorithms in Search, Optimization, and Machine Learning”, Pearson Education, 2009.
5. W.T.Miller, R.S.Sutton and P.J.Webrose, “Neural Networks for Control” MIT Press”, 1996.
6. T. Ross, “Fuzzy Logic with Engineering Applications”, Tata McGraw Hill, New Delhi, 1995.
7. Ethem Alpaydin, “Introduction to Machine Learning (Adaptive Computation and Machine Learning Series)”, MIT Press, 2004.
8. Corinna Cortes and V. Vapnik, " Support - Vector Networks, Machine Learning ” 1995.

22272E53DP **RESTRUCTURED POWER SYSTEM** **LTPC**
OBJECTIVES: **3003**

- To introduce the restructuring of power industry and market models.
- To impart knowledge on fundamental concepts of congestion management.
- To analyze the concepts of locational marginal pricing and financial transmission rights.
- To Illustrate about various power sectors in India

UNIT I INTRODUCTION TO RESTRUCTURING OF POWER INDUSTRY 9

Introduction: Deregulation of power industry, Restructuring process, Issues involved in deregulation, Deregulation of various power systems – Fundamentals of Economics: Consumer behavior, Supplier behavior, Market equilibrium, Short and long run costs, Various costs of production – Market models: Market models based on Contractual arrangements, Comparison of various market models, Electricity vis – a – vis other commodities, Market architecture, Case study.

UNIT II TRANSMISSION CONGESTION MANAGEMENT 9

Introduction: Definition of Congestion, reasons for transfer capability limitation, Importance of congestion management, Features of congestion management – Classification of congestion management methods – Calculation of ATC - Non – market methods – Market methods – Nodal pricing – Inter zonal and Intra zonal congestion management – Price area congestion management – Capacity alleviation method.

UNIT III LOCATIONAL MARGINAL PRICES AND FINANCIAL TRANSMISSION RIGHTS 9

Mathematical preliminaries: - Locational marginal pricing– Lossless DCOPF model for LMP calculation – Loss compensated DCOPF model for LMP calculation – ACOPF model for LMP calculation – Financial Transmission rights – Risk hedging functionality -Simultaneous feasibility test and revenue adequency – FTR issuance process: FTR auction, FTR allocation – Treatment of revenue shortfall – Secondary trading of FTRs – Flow gate rights – FTR and market power - FTR and merchant transmission investment.

UNIT IV ANCILLARY SERVICE MANAGEMENT AND PRICING OF TRANSMISSION NETWORK 9

Introduction of ancillary services – Types of Ancillary services – Classification of Ancillary services – Load generation balancing related services – Voltage control and reactive power support devices – Black start capability service - How to obtain ancillary service –Co-optimization of energy and reserve services - Transmission pricing – Principles – Classification – Rolled in transmission pricing methods –

Marginal transmission pricing paradigm – Composite pricing paradigm – Merits and demerits of different paradigm.

UNIT V REFORMS IN INDIAN POWER SECTOR 9

Introduction – Framework of Indian power sector – Reform initiatives - Availability based tariff – Electricity act 2003 – Open access issues – Power exchange – Reforms in the near future

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will have knowledge on restructuring of power industry
- Learners will understand basics of congestion management
- Learners will attain knowledge about locational margin prices and financial transmission rights
- Learners will understand the significance ancillary services and pricing of transmission network
- Learners will have knowledge on the various power sectors in India

REFERENCES

1 Mohammad Shahidehpour, Muwaffaq Alomoush, Marcel Dekker, "Restructured electrical power systems: operation, trading and volatility" Pub., 2001.

2 Kankar Bhattacharya, Jaap E. Daadler, Math H.J. Boolen, "Operation of restructured power systems", Kluwer Academic Pub., 2001.

3 Paranjothi, S.R. , "Modern Power Systems" Paranjothi, S.R. , New Age International, 2017.

4 Sally Hunt," Making competition work in electricity", John Willey and Sons Inc. 2002.

5 Steven Stoft, "Power system economics: designing markets for electricity", John Wiley & Sons, 2002.

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PRIST
DEEMED UNIVERSITY
VALLAM, THANJAVUR.

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF EEE

M.TECH-POWER SYSTEMS (FULL TIME)

COURSE STRUCTURE -R2019

PRIST

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

M.TECH - POWER ELECTRONICS AND DRIVES (FULL TIME)

CURRICULUM – REGULATION 2019

SEMESTER – I

S.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1.	19248S11D	Applied Mathematics For Electrical & Electronics Engineering	3	1	0	4
2.	19253C12	Advanced Power Semiconductor Devices And Their Applications	3	1	0	4
3.	19253C13	Analysis of Power Converters	3	1	0	4
4.	19253C14	Analysis of Inverters	3	1	0	4
5.	19253C15	Modeling And Analysis Of Electrical Machines	3	1	0	4
6.	19253E16_	Elective-I	3	0	0	3
7.	19253L17	Power Electronics Lab-I	0	0	3	3
Research Skill Development (RSD) Course						
8.	19253CRS	Research Led Seminar				1
TOTAL						**27**

SEMESTER – II

S.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1.	19253C21	Solid State Dc Drives	3	1	0	4
2.	19253C22	Solid State Ac Drives	3	1	0	4
3.	19253C23	Microprocessor and microcontroller applications in power electronics	3	1	0	4
4.	19253E24_	Elective -II	3	0	0	3
5.	19253E25_	Elective -III	3	0	0	3
6.	19253L26	Power Electronics Lab-II	0	0	3	3
7.	192TECWR	Technical Writing/Seminar	0	0	3	3
Research Skill Development (RSD) Course						
8.	19253CRM	Research Methodology	3	0	0	3
9.	19253CBR	Participation in Bounded Research	2	0	0	2
TOTAL						**29**

Skill Development Employability Entrepreneurship

SEMESTER – III

S.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1.	19253C31	Embedded Control Of Electrical Drives	3	1	0	4
2.	19253E32_	Elective –IV	3	0	0	3
3.	19253E33_	Elective –V	3	0	0	3
4.	19253E34_	Elective –VI	3	0	0	3
5.	19253P35	Project work Phase- I	0	0	10	10
Research Skill Development (RSD) Course						
6.	19253CSR	Design / Socio Technical Project	0	0	6	6
TOTAL						**29**

SEMESTER – IV

S.NO.	COURSE CODE	SUBJECT	L	T	P	C
1.	19253P41	Project work Phase - II	0	0	15	15
TOTAL						**15**

TOTAL CREDITS: 100

ELECTIVE –I

S.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1.	19253E16A	System Theory	3	0	0	3
2.	19253E16B	High Voltage Direct Current Transmission System	3	0	0	3
3.	19253E16C	Advanced Power System Dynamics	3	0	0	3
4.	19253E16D	Design of Substations	3	0	0	3

ELECTIVE –II

S.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1.	19253E24A	Flexible Ac Transmission System	3	0	0	3
2.	19253E24B	Power Conditioning	3	0	0	3
3.	19253E24C	Power System Reliability	3	0	0	3
4.	19253E24D	Distributed Generation and Microgrid	3	0	0	3

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ELECTIVE –III

S.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1.	19253E25A	Wind Energy Conversion Systems	3	0	0	3
2.	19253E25B	Computer Aided Design Of Electrical Machines	3	0	0	3
3.	19253E25C	Electrical Distribution System	3	0	0	3
4.	19253E25D	Energy Management and Auditing	3	0	0	3

ELECTIVE –IV

S.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1.	19253E32A	Power Electronics Applications In Power Systems	3	0	0	3
2.	19253E32B	POWER SYSTEM DYNAMICS	3	0	0	3
3.	19253E32C	Electric Vehicles and Power Management	3	0	0	3
4.	19253E32D	Electromagnetic Interference and Compatibility	3	0	0	3

ELECTIVE –V

S.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1.	19253E33A	Special machines and controllers	3	0	0	3
2.	19253E33B	Object oriented programming and its applications to electrical engineering	3	0	0	3
3.	19253E33C	Control System Design for Power Electronics	3	0	0	3
4.	19253E33D	Advanced Digital Signal Processing	3	0	0	3

Skill Development Employability Entrepreneurship

ELECTIVE –VI

S.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1.	19253E34A	Software for control system design	3	0	0	3
2.	19253E34B	Computer aided design of power electronic circuits	3	0	0	3
3.	19253E34C	Soft Computing Techniques	3	0	0	3
4.	19253E34D	Restructured Power System	3	0	0	3

Credit Distribution

Sem.	Core Courses						Elective Courses		Foundation Courses		Total Credits
	Theory Courses		Practical Courses		Courses on *RSD						
	Nos.	Credits	Nos.	Credits	Nos.	Credits	Nos.	Credits	Nos.	Credits	
I	04	16	01	03	01	01	01	03	01	04	27
II	03	12	02	06	02	05	02	06	-	-	29
III	01	04	-	-	02	16	03	09	-	-	29
IV	-	-	-	-	01	15	-	-	-	-	15
										Total Credits	**100**

*RSD-Research Skill Development

HOD **DEAN E&T** **DEAN ACADEMICS** **VICE CHANCELLOR**

Skill Development Employability Entrepreneurship

SYLLABUS

19248S11D - APPLIED MATHEMATICS FOR ELECTRICAL &ELECTRONICS ENGINEERING **3 1 0 4**

1. ADVANCED MATRIX THEORY 9

Matrix norms – Jordan canonical form – Generalized eigenvectors – Singular value decomposition – Pseudo inverse – Least square approximations.

2. RANDOM PROCESSES 9

Random variable, discrete, continuous types - Binomial, Poisson, normal and exponential distributions density & distribution Functions- Moments Moment Generating Functions – Notion of stochastic processes - Auto-correlation – Cross correlation .

3. LINEAR PROGRAMMING 9

Basic concepts – Graphical and Simplex methods –Transportation problem – Assignment problem.

4. DYNAMIC PROGRAMMING 9

Elements of the dynamic programming model – optimality principle – Examples of dynamic programming models and their solutions.

5. INTEGRAL TRANSFORMS 9

Finite Fourier transform - Fourier series - Finite sine Transform - Cosine transform - finite Hankel transform - definition, Transform of df/dx where p is a root of Jn(p) = 0, Transform of

$$\frac{d^2f}{dx^2} + \frac{1}{x}\frac{df}{dx}, \text{ and Transform of } \frac{d^2f}{dx^2} + \frac{1}{x}\frac{df}{dx} - \frac{n^2f}{x^2}$$

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Lewis.D.W., Matrix Theory ,Allied Publishers, Chennai 1995.
2. Bronson, R, Matrix Operations, Schaums outline Series, McGraw Hill, New York. 1989.
3. Andrews, L.A., and Shivamoggi B.K., “Integral Transforms for Engineers and Applied Mathematicians”, Macmillan , New York ,1988.
4. Taha, H.A., " Operations research - An Introduction ", Mac Millan publishing Co., (1982).
5. Gupta, P.K.and Hira, D.S., " Operations Research ", S.Chand & Co., New Delhi, (1999).6..
6. Ochi, M.K. " Applied Probability and Stochastic Processes ", John Wiley & Sons (1992).
7. Peebles Jr., P.Z., " Probability Random Variables and Random Signal Principles, McGraw Hill Inc., (1993).

19253E16A - SYSTEM THEORY

3 1 0 4

1. PHYSICAL SYSTEMS AND STATE ASSIGNMENT **9**

Systems - electrical - mechanical - hydraulic - pneumatic - thermal systems - modelling of some typical systems like D.C. Machines - inverted pendulum.

2. STATE SPACE ANALYSIS **9**

Realisation of state models - non-uniqueness - minimal realisation - balanced realisation - solution of state equations - state transition matrix and its properties - free and forced responses - properties - controllability and observability - stabilisability and detectability - Kalman decomposition.

3. MIMO SYSTEMS - FREQUENCY DOMAIN DESCRIPTIONS **9**

Properties of transfer functions - impulse response matrices - poles and zeros of transfer function matrices - critical frequencies - resonance - steady state and dynamic response - bandwidth - Nyquist plots - singular value analysis.

4. NON-LINEAR SYSTEMS **9**

Types of non-linearity - typical examples - equivalent linearization - phase plane analysis - limit cycles - describing functions - analysis using describing functions - jump resonance.

5. STABILITY **9**

Stability concepts - equilibrium points - BIBO and asymptotic stability - direct method of Liapunov - application to non-linear problems - frequency domain stability criteria - Popov's method and its extensions.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. M. Gopal, 'Modern Control Engineering', Wiley, 1996.
2. J.S. Bay, 'Linear State Space Systems', McGraw-Hill, 1999.
3. Eroni-Umez and Eroni, 'System dynamics & Control', Thomson Brooks / Cole, 1998.
4. K. Ogatta, 'Modern Control Engineering', Pearson Education, Low Priced Edition, 1997.
5. G.J. Thaler, 'Automatic control systems', Jaico publishers, 1993.
6. John S. Bay, 'Linear State Space Systems', McGraw-Hill International Edition, 1999.

19272H13 - POWER SYSTEM MODELLING AND ANALYSIS

3 1 0 4

1. SOLUTION TECHNIQUE 9

Sparse Matrix techniques for large scale power systems: Optimal ordering schemes for preserving sparsity. Flexible packed storage scheme for storing matrix as compact arrays – Factorization by Bifactorization and Gauss elimination methods; Repeat solution using Left and Right factors and L and U matrices.

2. POWER FLOW ANALYSIS 9

Power flow equation in real and polar forms; Review of Newton's method for solution; Adjustment of P-V buses; Review of Fast Decoupled Power Flow method; Sensitivity factors for P-V bus adjustment; Net Interchange power control in Multi-area power flow analysis: ATC, Assessment of Available Transfer Capability (ATC) using Repeated Power Flow method; Continuation Power Flow method.

3. OPTIMAL POWER FLOW 9

Problem statement; Solution of Optimal Power Flow (OPF) – The gradient method, Newton's method, Linear Sensitivity Analysis; LP methods – With real power variables only – LP method with AC power flow variables and detailed cost functions; Security constrained Optimal Power Flow; Interior point algorithm; Bus Incremental costs.

4. SHORT CIRCUIT ANALYSIS 9

Fault calculations using sequence networks for different types of faults. Bus impedance matrix (ZBUS) construction using Building Algorithm for lines with mutual coupling; Simple numerical problems. Computer method for fault analysis using ZBUS and sequence components. Derivation of equations for bus voltages, fault current and line currents, both in sequence and phase domain using Thevenin's equivalent and ZBUS matrix for different faults.

5. TRANSIENT STABILITY ANALYSIS 9

Introduction, Numerical Integration Methods: Euler and Fourth Order Runge-Kutta methods, Algorithm for simulation of SMIB and multi-machine system with classical synchronous machine model; Factors influencing transient stability, Numerical stability and implicit Integration methods.

L = 45 T = 15 P = 0 C =4

REFERENCES:

1. G W Stagg, A.H El. Abiad "Computer Methods in Power System Analysis", McGraw Hill 1968.
2. P.Kundur, "Power System Stability and Control", McGraw Hill, 1994.
3. A.J.Wood and B.F.Wollenberg, "Power Generation Operation and Control", John Wiley and sons, New York, 1996.
4. W.F.Tinney and W.S.Meyer, "Solution of Large Sparse System by Ordered Triangular Factorization" IEEE Trans. on Automatic Control, Vol: AC-18, pp: 333-346, Aug 1973.
5. K.Zollenkopf, "Bi-Factorization: Basic Computational Algorithm and Programming Techniques; pp: 75-96; Book on "Large Sparse Set of Linear Systems" Editor: J.K.Rerd,Academic Press, 1971.

19272H14 - ECONOMIC OPERATIONS OF POWER SYSTEMS-I

3 1 0 4

1. INTRODUCTION 9

Planning and operational problems of power systems – review of economic dispatch and calculation using B matrix loss formula – use of participation factors in on line economic dispatch.

2. OPTIMAL POWER FLOW PROBLEM 9

Real and reactive power control variables – operation and security constraints and their limits – general OPF problem with different objective functions – formulation – cost loss minimization using Dommel and Tinney's method and SLP – development of model and algorithm – MVAR planning – optimal sitting and sizing of capacitors using SLR method – interchange evaluation using SLP.

3. HYDRO THERMAL SCHEDULING 9

Problems definition and mathematical model of long and short term problems – discretization – dynamic and incremental dynamic programming – methods of local variation – hydro thermal system with pumped hydro units – solution by local variation treating pumped hydro unit for load management and spinning reserve.

4. UNIT COMMITMENT 9

Constraints in unit commitment – solution by priority list method – dynamic programming method – backward and forward – restricted search range.

5. MAINTENANCE SCHEDULING 9

Factors considered in maintenance scheduling for generating units – turbines – boilers – introduction to maintenance scheduling using mathematical programming.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Allen J.Wood and Bruce F.Wollenberg, "Power generation and control", John Wiley & Sons, New York, 1984.
2. Krichmayer L., "Economic operation of power systems", John Wiley and sons Inc, New York, 1958.
3. Krichmayer L.K, "Economic control of Interconnected systems", Jhon Wiley and sons Inc, New York, 1959.
4. Elgerd O.I., "Electric energy systems theory – an introduction", McGraw Hill, New Delhi, 1971.

19253E16B - HIGH VOLTAGE DIRECT CURRENT TRANSMISSION SYSTEM

3 1 0 4

1. DC POWER TRANSMISSION TECHNOLOGY 9

Introduction – comparison of Ac and DC transmission _ application of DC transmission – description of DC transmission system system – planning for HVDC transmission – modern trends in DC transmission.

2. ANALYSIS OF HVDC CONVERTERS 9

Pulse number – choice of converter configuration simplified analysis of Graetz circuit converter converter bridge characteristics – characteristics of a twelve pulse converter – detailed analysis of converters.

3. CONVERTER AND HVDC SYSTEM CONTROL 9

General principles of DC link control – converter control characteristics – systems control hierarchy – firing angle control – current and extinction angle control – starting and stopping of DC link – power control – higher level controllers – telecommunication requirements.

4. HARMONICS AND FILTERS 9

Introduction – generation of harmonics – design of AC filters – DC filters – carrier frequency and RI noise.

5. SIMULATION OF HVDC SYSTEMS 9

Introduction – system simulation: Philosophy and tools- HVDC system simulation – modeling of HVDC systems for digital dynamic simulation.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Padiyar. K.R., HVDC power transmission system, Wiley Eastern Limited, New Delhi, 1990.
2. Edward Wilson Kimbark, Direct Current Transmission, Vol.1, Wiley Interscience, New York, London, Sydney, 1971.
3. Rakosh Das Begamudre, Extra high voltage AC transmission engineering Wiley Eastern Ltd., New Delhi, 1990.
4. Arrillaga, J, High voltage direct current transmission, peter Pregrinus, London, 1983.
5. Adamson.C and Hingorani.N.G., High Voltage Direct Current Power Transmission, Garraway Limited, London, 1960. WWW.hvdc.ca

Skill Development Employability Entrepreneurship

19272L17- POWER SYSTEM SIMULATION LABORATORY – I 0 0 3 3

EXPERIMENTS

1. Formation of Y bus, Z bus, line parameters and modeling of transmission lines.
2. Power flow analysis: Gauss – Seidel Method.
3. Power flow analysis: Newton Raphson method.
4. Plain Decoupled and Fast Decoupled methods.
5. Contingency analysis – single and multiple symmetrical and unsymmetrical faults.

P=3 C=3

19272H21 - EHV POWER TRANSMISSION

3 1 0 4

1. INTRODUCTION **9**

Standard transmission voltages – different configurations of EHV and UHV lines – average values of line parameters – power handling capacity and line loss – costs of transmission lines and equipment – mechanical considerations in line performance.

2. CALCULATION OF LINE PARAMETERS **9**

Calculation of resistance, inductance and capacitance for multi-conductor lines – calculation of sequence inductances and capacitances – line parameters for different modes of propagation – resistance and inductance of ground return, numerical example involving a typical 400/220kV line using line constant program.

3. VOLTAGE GRADIENTS OF CONDUCTORS **9**

Charge-potential relations for multi-conductor lines – surface voltage gradient on conductors – gradient factors and their use – distribution of voltage gradient on sub conductors of bundle - voltage gradients on conductors in the presence of ground wires on towers.

4. CORONA EFFECTS **9**

Power losses and audible losses: I R loss and corona loss - audible noise generation and characteristics - limits for audible noise - Day-Night equivalent noise level- radio interference: corona pulse generation and properties - limits for radio interference fields

5. ELECTROSTATIC FIELD OF EHV LINES **9**

Effect of EHV line on heavy vehicles - calculation of electrostatic field of AC lines- effect of high field on humans, animals, and plants - measurement of electrostatic fields - electrostatic Induction in unenergised circuit of a D/C line - induced voltages in insulated ground wires - electromagnetic interference

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Rakosh Das Begamudre, “Extra High Voltage AC Transmission Engineering”, Second Edition, New Age International Pvt. Ltd., 1990.
2. Power Engineer’s Handbook, Revised and Enlarged 6th Edition, TNEB Engineers’ Association, October 2002.
3. Microtran Power System Analysis Corporation, Microtran Reference Manual, Vancouver Canada. (Website: www.microtran.com).

19272H22 - ECONOMIC OPERATIONS OF POWER SYSTEMS-II

3 1 0 4

1. AUTOMATIC GENERATION CONTROL 9

Plant and system level control problem – ALFC of single area system modeling state and transient response – EDC control loop – ALFC of multi area system – modeling – static and transient response of two area system development of state variable model – two area system – AGC system design Kalman's method.

2. AUTOMATIC VOLTAGE CONTROL 9

Modeling of AVR loop – components – dynamic and static analysis – stability compensation – system level voltage control using OLTC, capacitor and generator voltages – expert system application for system voltage control.

3. SECURITY CONTROL CONCEPT 9

System operating states by security control functions – monitoring evaluation of system state by contingency analysis – corrective controls (preventive, emergency and restorative) – islanding scheme.

4. STATE ESTIMATION 9

Least square estimation – basic solution – sequential form of solution – static state estimation of power system by different algorithms – tracking state estimation of power system-computation consideration – external equivalency. Treatment of bad data and on line load flow analysis.

5. COMPUTER CONTROL OF POWER SYSTEM 9

Energy control center – various levels – national – regional and state level SCADA system – computer configuration – functions, monitoring, data acquisition and controls – EMS system – software in EMS system. Expert system applications for power system operation.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Kundur.P., “power system stability and control”, McGraw Hill, 1994.
2. Anderson P.M., and Fouad A.A, “power system control and stability”, Galgotia publication, New Delhi, 1981.
3. Taylor C.W., “power systems voltage stability”, McGraw Hill, New Delhi, 1993.
4. IEEE recommended practice for excitation system models for power system stability studies, IEEE standard 421.5, 1992.
5. Kimbark E.W., “power system stability”, Vol.3., Synchronous machines, John Wiley and sons, 1956.
6. T.V Custem, C.Vournas, “voltage stability of power system”, Kluwer Acadamic Publishers, 1998.
7. Elgerd O.L., “Elctric energy systems theory – an introduction”, McGraw Hill, New Delhi, 1971.

19272H23 - POWER SYSTEM PROTECTION

3 1 0 4

1. INTRODUCTION 9

General philosophy – Review of conventional equipment protection schemes – state of the art: Numerical relays

2. DISTANCE PROTECTION 9

Transmission line protection – fault clearing times – relaying quantities during swings – evaluation of distance relay performance during swings – prevention of tripping during transient conditions – automatic line reclosing – generator out of step protection – simulation of distance relays during transients.

3. GENERATOR PROTECTION 9

Out – of – step, loss of excitation. System response to severe upsets – nature of system response to severe upsets – frequency actuated schemes for load shedding and islanding.

4. INTRODUCTION TO COMPUTER RELAYING 9

Development of computer relaying – historical background – Expected benefits of computer relaying – computer relay architecture – A/D converter – Anti aliasing filters – substation computer hierarchy.

5. DIGITAL TRANSMISSION LINE RELAYING 9

Introduction – source of error – relaying as parameter estimation – beyond parameter estimation – symmetrical component distance relay – protection of series compensated lines. Digital protection of transformers, machines and buses.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Arun k. Phadke, James.S.Thorp, " Computer relaying for power system", John Wiley and sons, New York, 1988.
2. Jones D., "Analysis and protection of electrical power systems", Pitman Publishing, 1971.
3. "Power system references manual, Ray rolls protection", Orient press, 1982.
4. Stanly H., Horowitz (ED), "Protective relaying for power system", IEEE press, 1980.
5. Kundur P., "power system stability and control", McGraw Hill, 1994.

Skill Development Employability Entrepreneurship

19272L26- POWER SYSTEM SIMULATION LAB – II 0 0 3 3

LIST OF EXPRIMENTS:

1. Small signal stability analysis: SMIB and Multi machine configuration.
2. Transients stability analysis of Multi – machine configuration.
3. Load Frequency control: single area, multi area control.
4. Economic load dispatch with losses
5. Unit commitment by dynamic programming & priority list method

P=3 C=3

19272H31 - ELECTRICAL TRANSIENTS IN POWER SYSTEMS

3 1 0 4

1. TRAVELLING WAVES ON TRANSMISSION LINE 9

Lumped and Distributed Parameters – Wave Equation – Reflection, Refraction, Behavior of Travelling waves at the line terminations – Lattice Diagrams – Attenuation and Distortion – Multi-conductor system and Velocity wave.

2. COMPUTATION OF POWER SYSTEM TRANSIENTS 9

Principle of digital computation – Matrix method of solution, Modal analysis, Z transforms, Computation using EMTP – Simulation of switches and non-linear elements.

3. LIGHTNING, SWITCHING AND TEMPORARY OVERVOLTAGES 9

Lightning: Physical phenomena of lightning – Interaction between lightning and power system – Factors contributing to line design – Switching: Short line or kilometric fault – Energizing transients - closing and re-closing of lines - line dropping, load rejection - Voltage induced by fault – Very Fast Transient Overvoltage (VFTO)

4. BEHAVIOUR OF WINDING UNDER TRANSIENT CONDITION 9

Initial and Final voltage distribution - Winding oscillation - traveling wave solution - Behavior of the transformer core under surge condition – Rotating machine – Surge in generator and motor

5. INSULATION CO-ORDINATION 9

Principle of insulation co-ordination in Air Insulated substation (AIS) and Gas Insulated Substation (GIS), insulation level, statistical approach, co-ordination between insulation and protection level –overvoltage protective devices – lightning arresters, substation earthing.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Pritindra Chowdhari, "Electromagnetic transients in Power System", John Wiley and Sons Inc., 1996.
2. Allan Greenwood, "Electrical Transients in Power System", Wiley & Sons Inc. New York, 1991.
3. Klaus Ragaller, "Surges in High Voltage Networks", Plenum Press, New York, 1980.
4. Rakosh Das Begamudre, "Extra High Voltage AC Transmission Engineering", (Second edition) Newage International (P) Ltd., New Delhi, 1990.
5. Naidu M S and Kamaraju V, "High Voltage Engineering", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.
6. IEEE Guide for safety in AC substation grounding IEEE Standard 80-2000.
7. Working Group 33/13-09 (1988), 'Very fast transient phenomena associated with Gas Insulated System', CIGRE, 33-13, pp. 1-2

19272E16A – ANALYSIS AND DESIGN OF POWER CONVERTERS L T P C
3 0 0 3

OBJECTIVES:

- To determine the operationand characteristics of controlled rectifiers.
- To apply switching techniques and basic topologies of DC-DC switching regulators.
- To introduce the design of power converter components.
- To provide an in depth knowledge about resonant converters.
- To comprehend the conceptsof AC-AC power converters and their applications.

UNIT I SINGLE PHASE & THREE PHASE CONVERTERS 9

Principle of phase controlled converter operation – single-phase full converter and semi-converter (RL,RLE load)- single phase dual converter – Three phase operation full converter and semi-converter (R,RL,RLE load) – reactive power – power factor improvement techniques – PWM rectifiers.

UNIT II DC-DC CONVERTERS 9

Limitations of linear power supplies, switched mode power conversion, Non-isolated DC-DC converters: operation and analysis of Buck, Boost, Buck-Boost, Cuk& SEPIC – under continuous and discontinuous operation – Isolated converters: basic operation of Flyback, Forward and Push-pull topologies.

UNIT III DESIGN OF POWER CONVERTER COMPONENTS 9

Introduction to magnetic materials- hard and soft magnetic materials –types of cores , copper windings – Design of transformer –Inductor design equations –Examples of inductor design for buck/flyback converter-selection of output filter capacitors – selection of ratings for devices – input filter design.

UNIT IV RESONANT DC-DC CONVERTERS 9

Switching loss, hard switching, and basic principles of soft switching- classification of resonant converters- load resonant converters – series and parallel – resonant switch converters – operation and analysis of ZVS, ZCS converters comparison of ZCS/ZVS-Introduction to ZVT/ZCT PWM converters.

UNIT V AC-AC CONVERTERS 9

Principle of on-off and phase angle control – single phase ac voltage controller – analysis with R & RL load – Three phase ac voltage controller – principle of operation of cyclo converter – single phase and three phase cyclo converters – Introduction to matrix converters.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course the student will be able to:

- Analyze various single phase and three phase power converters
- Select and design dc-dc converter topologies for a broad range of power conversion applications.
- Develop improved power converters for any stringent application requirements.
- Design ac-ac converters for variable frequency applications.

TEXT BOOKS:

1. Ned Mohan,T.MUndeland and W.P Robbin, “Power Electronics: converters, Application and design” John Wiley and sons.Wiley India edition, 2006.
2. Rashid M.H., “Power Electronics Circuits, Devices and Applications ", Prentice Hall India, Third Edition, New Delhi, 2004.
3. P.C. Sen, “Modern Power Electronics”, Wheeler Publishing Co, First Edition, New Delhi, 1998.
4. P.S.Bimbra, “Power Electronics”, Khanna Publishers, Eleventh Edition, 2003
5. Simon Ang, Alejandro Oliva, “Power-Switching Converters, Second Edition, CRC Press, Taylor & Francis Group, 2010
6. V.Ramanarayanan, “Course material on Switched mode power conversion”, 2007
7. Alex Van den Bossche and VencislavCekovValchev, “Inductors and TransformersforPowerElectronics”, CRC Press, Taylor & Francis Group, 2005
8. W. G. Hurley and W. H.Wolfle, “Transformers and Inductors for Power Electronics Theory, Design and Applications”, 2013 John Wiley & Sons Ltd.
9. Marian.K.Kazimierczuk and DariuszCzarkowski, “Resonant Power Converters”, John Wiley & Sons limited, 2011

19272E16B - MODELLING AND ANALYSIS OF ELECTRICAL MACHINES

3 1 0 4

UNIT I PRINCIPLES OF ELECTROMAGNETIC ENERGY CONVERSION

General expression of stored magnetic energy - co-energy and force/torque - example using single and doubly excited system.

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UNIT II BASIC CONCEPTS OF ROTATING MACHINES

Calculation of air gap M.M.F. - per phase machine inductance using physical machine data - voltage and torque equation of D.C. machine - three phase symmetrical induction machine and salient pole synchronous machines in phase variable form.

UNIT III INTRODUCTION TO REFERENCE FRAME THEORY

Static and rotating reference frames - transformation relationships - examples using static symmetrical three phase R, R-L, R-L-M and R-L-C circuits - application of reference frame theory to three phase symmetrical induction and synchronous machines - dynamic direct and quadrature axis model in arbitrarily rotating reference frames - voltage and torque equations - derivation of steady state phasor relationship from dynamic model - generalized theory of rotating electrical machine and Kron's primitive machine.

UNIT IVD ETERMINATIONOF SYNCHRONOUS MACHINE DYNAMIC EQUIVALENT CIRCUIT PARAMETERS

Standard and derived machine time constants - frequency response test - analysis and dynamic modeling of two phase asymmetrical induction machine and single phase induction machine.

UNIT V SPECIAL MACHINES

Permanent magnet synchronous machine - surface permanent magnet (square and sinusoidal back E.M.F. type) and interior permanent magnet machines - construction and operating principle - dynamic modeling and self controlled operation - analysis of switch reluctance motors.

L = 45 T = 15 P = 0 C =4

TEXT BOOKS

1. Charles Kingsley, A.E. Fitzgerald Jr. and Stephen D. Umans, 'Electric Machinery', Tata McGraw-Hill, Fifth Edition, 1992.

2. R. Krishnan, 'Electric Motor & Drives: Modelling, Analysis and Control', Prentice Hall of India, 2001.

REFERENCES

1. C.V. Jones, 'The Unified Theory of Electrical Machines', Butterworth, 1967.

2. T.J.E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives' Clarendon Press, 1989.

19272E16C ADVANCED POWER SYSTEM DYNAMICS **L T P C**
OBJECTIVES: **3 0 0 3**

- To perform transient stability analysis using unified algorithm.
- To impart knowledge on sub-synchronous resonance and oscillations
- To analyze voltage stability problem in power system.
- To familiarize the methods of transient stability enhancement

UNIT I TRANSIENT STABILITY ANALYSIS **9**

Review of numerical integration methods: Euler and Fourth Order Runge-Kutta methods, Numerical stability and implicit methods, Interfacing of Synchronous machine (variable voltage) model to the transient stability algorithm (TSA) with partitioned – explicit and implicit approaches – Interfacing SVC with TSA-methods to enhance transient stability

UNIT II UNIFIED ALGORITHM FOR DYNAMIC ANALYSIS OF POWER SYSTEMS **9**

Need for unified algorithm- numerical integration algorithmic steps-truncation error-variable step size – handling the discontinuities- numerical stability- application of the algorithm for transient. Mid-term and long-term stability simulations

UNIT III SUBSYSNCHRONOUS RESONANCE (SSR) AND OSCILLATIONS **9**

Subsynchronous Resonance (SSR) – Types of SSR - Characteristics of series –Compensated transmission systems –Modeling of turbine-generator-transmission network- Self-excitation due to induction generator effect – Torsional interaction resulting in SSR – Methods of analyzing SSR – Numerical examples illustrating instability of subsynchronous oscillations – time-domain simulation of subsynchronous resonance – EMTP with detailed synchronous machine model- Turbine Generator Torsional Characteristics: Shaft system model – Examples of torsional characteristics – Torsional Interaction with Power System Controls: Interaction with generator excitation controls – Interaction with speed governors – Interaction with nearby DC converters

UNIT IV TRANSMISSION, GENERATION AND LOAD ASPECTS OF VOLTAGE STABILITY ANALYSIS **9**

Review of transmission aspects – Generation Aspects: Review of synchronous machine theory – Voltage and frequency controllers – Limiting devices affecting voltage stability – Voltage-reactive power characteristics of synchronous generators – Capability curves – Effect of machine limitation on deliverable power – Load Aspects – Voltage dependence of loads – Load restoration dynamics – Induction motors – Load tap changers – Thermostatic load recovery – General aggregate load models.

UNIT V ENHANCEMENT OF TRANSIENT STABILITY AND COUNTER MEASURES FOR SUB SYNCHRONOUS RESONANCE **9**

Principle behind transient stability enhancement methods: high-speed fault clearing, reduction of transmission system reactance, regulated shunt compensation, dynamic braking, reactor switching, independent pole-operation of circuit-breakers, single-pole switching, fast-valving, high-speed excitation systems; NGH damper scheme.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will be able to understand the various schemes available in Transformer protection
- Learners will have knowledge on Over current protection.
- Learners will attain knowledge about Distance and Carrier protection in transmission lines.
- Learners will understand the concepts of Busbar protection.
- Learners will attain basic knowledge on numerical protection techniques

REFERENCES

1 R.Ramnujam," Power System Dynamics Analysis and Simulation", PHI Learning Private Limited, New Delhi, 2009

2 T.V. Cutsem and C.Vournas, "Voltage Stability of Electric Power Systems", Kluwer publishers,1998

3 P. Kundur, "Power System Stability and Control", McGraw-Hill, 1993.

4 H.W. Dommel and N.Sato, "Fast Transient Stability Solutions," IEEE Trans., Vol. PAS-91, pp, 1643-1650, July/August 1972.

5 Roderick J . Frowd and J. C. Giri, "Transient stability and Long term dynamics unified", IEEE Trans., Vol 101, No. 10, October 1982.

6 M.Stubbe, A.Bihain,J.Deuse, J.C.Baader, "A New Unified software program for the study of the dynamic behaviour of electrical power system" IEEE Transaction, Power Systems, Vol.4.No.1,Feb:1989 Pg.129 to 138

19253E16D **DESIGN OF SUBSTATIONS** **L T P C**
OBJECTIVES: **3 0 0 3**

- To provide in-depth knowledge on design criteria of Air Insulated Substation (AIS) and Gas Insulated Substation (GIS).
- To study the substation insulation co-ordination and protection scheme.
- To study the source and effect of fast transients in AIS and GIS.

UNIT I INTRODUCTION TO AIS AND GIS 9

Introduction – characteristics – comparison of Air Insulated Substation (AIS) and Gas Insulated Substation (GIS) – main features of substations, Environmental considerations, Planning and installation- GIB / GIL

UNIT II MAJOR EQUIPMENT AND LAYOUT OF AIS AND GIS 9

Major equipment – design features – equipment specification, types of electrical stresses, mechanical aspects of substation design- substation switching schemes- single feeder circuits; single or main bus and sectionalized single bus- double main bus-main and transfer bus- main, reserve and transfer bus- breaker-and-a- half scheme-ring bus

UNIT III INSULATION COORDINATION OF AIS AND GIS 9

Introduction – stress at the equipment – insulation strength and its selection – standard BILs – Application of simplified method – Comparison with IEEE and IEC guides.

UNIT IV GROUNDING AND SHIELDING 9

Definitions – soil resistivity measurement – ground fault currents – ground conductor – design of substation grounding system – shielding of substations – Shielding by wires and masts.

UNIT V FAST TRANSIENTS PHENOMENON IN AIS AND GIS 9

Introduction – Disconnector switching in relation to very fast transients – origin of VFTO – propagation and mechanism of VFTO – VFTO characteristics – Effects of VFTO.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to apply Awareness towards substation equipment and their arrangements.
- Ability to design the substation for present requirement with proper insulation coordination and protection against fast transients.

REFERENCES

1 Andrew R. Hileman, “Insulation coordination for power systems”, Taylor and Francis, 1999.
2 M.S. Naidu, “Gas Insulation Substations”, I.K. International Publishing House Private Limited, 2008.
3 Klaus Ragallar, “Surges in high voltage networks” Plenum Press,New York, 1980.
4 “Power Engineer’s handbook”, TNEB Association.

5 Pritindra Chowdhuri, “Electromagnetic transients in power systems”, PHI Learning Private Limited, New Delhi, Second edition, 2004.
6 “Design guide for rural substation”, United States Department of Agriculture, RUS Bulletin, 1724E-300, June 2001.
7 AIEE Committee Report, “Substation One-line Diagrams,” AIEE Trans. On Power Apparatus and Systems, August 1953.
8 Hermann Koch, “Gas Insulated Substations”, Wiley-IEEE Press, 2014.

19272E24A SMART GRID LTPC

3003

OBJECTIVES:

- To Study about Smart Grid technologies, different smart meters and advanced metering infrastructure.
- To familiarize the power quality management issues in Smart Grid.
- To familiarize the high performance computing for Smart Grid applications

UNIT I INTRODUCTION TO SMART GRID

9

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, National and International Initiatives in Smart Grid.

UNIT II SMART GRID TECHNOLOGIES

9

Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/Var control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV).

UNIT III SMART METERS AND ADVANCED METERING INFRASTRUCTURE

9

Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU), Intelligent Electronic Devices (IED) & their application for monitoring & protection.

UNIT IV POWER QUALITY MANAGEMENT IN SMART GRID

9

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

UNIT V HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS 9

Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will develop more understanding on the concepts of Smart Grid and its present developments.
- Learners will study about different Smart Grid technologies.
- Learners will acquire knowledge about different smart meters and advanced metering infrastructure.
- Learners will have knowledge on power quality management in Smart Grids
- Learners will develop more understanding on LAN, WAN and Cloud Computing for Smart Grid application

REFERENCES

1 Stuart Borlase "Smart Grid :Infrastructure, Technology and Solutions", CRC Press 2012.

2 Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley 2012.

3 Vehbi C. Güngör, DilanSahin, TaskinKocak, Salih Ergüt, Concettina Buccella, Carlo Cecati, and Gerhard P. Hancke, "Smart Grid Technologies: Communication Technologies and Standards" IEEE Transactions On Industrial Informatics, Vol. 7, No. 4, November 2011.

4 Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang "Smart Grid – The New and Improved Power Grid: A Survey" , IEEE Transaction on Smart Grids, vol. 14, 2012.

19272E24B SOLAR AND ENERGY STORAGE SYSTEMS LTPC

3003

OBJECTIVES:

- To Study about solar modules and PV system design and their applications
- To Deal with grid connected PV systems
- To Discuss about different energy storage systems

UNIT I INTRODUCTION 9

Characteristics of sunlight – semiconductors and P-N junctions –behavior of solar cells – cell properties – PV cell interconnection

UNIT II STAND ALONE PV SYSTEM 9

Solar modules – storage systems – power conditioning and regulation - MPPT- protection – stand alone PV systems design – sizing

UNIT III GRID CONNECTED PV SYSTEMS 9

PV systems in buildings – design issues for central power stations – safety – Economic aspect – Efficiency and performance - International PV programs

UNIT IV ENERGY STORAGE SYSTEMS 9

Impact of intermittent generation – Battery energy storage – solar thermal energy storage – pumped hydroelectric energy storage

UNIT V APPLICATIONS 9

Water pumping – battery chargers – solar car – direct-drive applications –Space – Telecommunications.

TOTAL : 45 PERIODS

OUTCOMES:

- Students will develop more understanding on solar energy storage systems
- Students will develop basic knowledge on standalone PV system
- Students will understand the issues in grid connected PV systems
- Students will study about the modeling of different energy storage systems and their performances
- Students will attain more on different applications of solar energy

REFERENCES

1 Solanki C.S., "Solar Photovoltaics: Fundamentals, Technologies And Applications", PHI Learning Pvt. Ltd.,2015.

2 Stuart R.Wenham, Martin A.Green, Muriel E. Watt and Richard Corkish, "Applied Photovoltaics", 2007,Earthscan, UK. Eduardo Lorenzo G. Araujo, "Solar electricity engineering of photovoltaic systems", Progensa,1994.

3 Frank S. Barnes & Jonah G. Levine, “Large Energy storage Systems Handbook”, CRC Press, 2011.

4 McNeils, Frenkel, Desai, “Solar & Wind Energy Technologies”, Wiley Eastern, 1990

5 S.P. Sukhatme , “Solar Energy”, Tata McGraw Hill,1987.

19272E24C POWER SYSTEM RELIABILITY **L T P C**

OBJECTIVES: **3 0 0 3**

- To introduces the objectives of Load forecasting.
- To study the fundamentals of Generation system, transmission system and Distribution system reliability analysis
- To illustrate the basic concepts of Expansion planning

UNIT I LOAD FORECASTING 9

Objectives of forecasting - Load growth patterns and their importance in planning - Load forecasting Based on discounted multiple regression technique-Weather sensitive load forecasting-Determination of annual forecasting-Use of AI in load forecasting.

UNIT II GENERATION SYSTEM RELIABILITY ANALYSIS 9

Probabilistic generation and load models- Determination of LOLP and expected value of demand not served –Determination of reliability of ISO and interconnected generation systems

UNIT III TRANSMISSION SYSTEM RELIABILITY ANALYSIS 9

Deterministic contingency analysis-probabilistic load flow-Fuzzy load flow probabilistic transmission system reliability analysis-Determination of reliability indices like LOLP and expected value of demand not served

UNIT IV EXPANSION PLANNING 9

Basic concepts on expansion planning-procedure followed for integrate transmission system planning, current practice in India-Capacitor placer problem in transmission system and radial distributions system.

UNIT V DISTRIBUTION SYSTEM PLANNING OVERVIEW 9

Introduction, sub transmission lines and distribution substations-Design primary and secondary systems-distribution system protection and coordination of protective devices.

TOTAL: 45 PERIODS

OUTCOMES:

- Students will develop the ability to learn about load forecasting.
- Students will learn about reliability analysis of ISO and interconnected systems.
- Students will understand the concepts ot Contingency analysis and Probabilistic Load flow Analysis
- Students will be able to understand the concepts of Expansion planning
- Students will have knowledge on the fundamental concepts of the Distribution system planning

REFERENCES

1 Roy Billinton & Ronald N. Allan, "Reliability Evaluation of Power Systems" Springer Publication,

2 R.L. Sullivan, "Power System Planning", Tata McGraw Hill Publishing Company Ltd 1977.

3 X. Wang & J.R. McDonald, "Modern Power System Planning", McGraw Hill Book Company 1994.

4 T. Gonen, "Electrical Power Distribution Engineering", McGraw Hill Book Company 1986.

5 B.R. Gupta, "Generation of Electrical Energy",S.Chand Publications 1983.

19272E24D DISTRIBUTED GENERATION AND MICROGRID **L T P C**

OBJECTIVES: **3 0 0 3**

- To illustrate the concept of distributed generation
- To analyze the impact of grid integration.
- To study concept of Microgrid and its configuration

UNIT I INTRODUCTION 9

Conventional power generation: advantages and disadvantages, Energy crises, Non-conventional energy (NCE) resources: review of Solar PV, Wind Energy systems, Fuel Cells, micro-turbines, biomass, and tidal sources.

UNIT II DISTRIBUTED GENERATIONS (DG) 9

Concept of distributed generations, topologies, selection of sources, regulatory standards/ framework, Standards for interconnecting Distributed resources to electric power systems: IEEE 1547. DG installation classes, security issues in DG implementations. Energy storage elements: Batteries, ultra-capacitors, flywheels. Captive power plants

UNIT III IMPACT OF GRID INTEGRATION 9

Requirements for grid interconnection, limits on operational parameters,: voltage, frequency, THD, response to grid abnormal operating conditions, islanding issues. Impact of grid integration with NCE sources on existing power system: reliability, stability and power quality issues.

UNIT IV BASICS OF A MICROGRID 9

Concept and definition of microgrid, microgrid drivers and benefits, review of sources of microgrids, typical structure and configuration of a microgrid, AC and DC microgrids, Power Electronics interfaces in DC and AC microgrids

UNIT V CONTROL AND OPERATION OF MICROGRID 9

Modes of operation and control of microgrid: grid connected and islanded mode, Active and reactive power control, protection issues, anti-islanding schemes: passive, active and communication based techniques, microgrid communication infrastructure, Power quality issues in microgrids, regulatory standards, Microgrid economics, Introduction to smart microgrids.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will attain knowledge on the various schemes of conventional and nonconventional power generation.

- Learners will have knowledge on the topologies and energy sources of distributed generation.
- Learners will learn about the requirements for grid interconnection and its impact with NCE sources
- Learners will understand the fundamental concept of Microgrid.

REFERENCES

1 Amirnaser Yezdani, and Reza Iravani, “Voltage Source Converters in Power Systems: Modeling, Control and Applications”, IEEE John Wiley Publications, 2010.

2 DorinNeacsu, “Power Switching Converters: Medium and High Power”, CRC Press, Taylor & Francis, 2006

3 Chetan Singh Solanki, “Solar Photo Voltaics”, PHI learning Pvt. Ltd., New Delhi,2009

4 J.F. Manwell, J.G. McGowan “Wind Energy Explained, theory design and applications”, Wiley publication 2010.

5 D. D. Hall and R. P. Grover, “Biomass Regenerable Energy”, John Wiley, New York, 1987.

6 John Twidell and Tony Weir, “Renewable Energy Resources” Tyalor and Francis Publications, Second edition 2006.

19272E25A - WIND ENERGY CONVERSION SYSTEMS

3 1 0 4

UNIT-I INTRODUCTION: **9**

History of wind Electric generation - Darrieus wind - Horizontal and vertical axis-Wind turbine - other modern developments - Future possibilities.

UNIT-II WIND RESOURCE AND ITS POTENTIAL FOR ELECVTRIC POWER GENERATION: **9**

Power Extracted By A Wind Driven Machine - Nature and occurrence of wind characteristics and power production - variation of mean wind speed with time.

UNIT-III WIND POWER SITES AND WIND MEASUREMENTS: **9**

Average wind speed and other factors affecting choice of the site - Effect of wind direction - Measurement of wind velocity - Personal estimation without instruments- anemometers - Measurement of wind direction.

UNIT-IV WIND TURBINES WITH ASYNCHRONOUS GENERATORS AND CONTROL ASPECTS: **9**

Asynchronous systems - Ac Generators - Self excitation of Induction Generator - Single Phase operation of Induction Generator - Permanenet magnet Generators - Basic control aspects - fixed speed ratio control scheme - fixed vs variable speed operation of WECS.

UNIT-V GENERATION OF ELECTRICITY **9**

Active and reactive power - P and Q transfer in power systems - Power converters - Characteristics of Generators - Variable Speed options - Economics.

L = 45 T = 15 P = 0 C =4

REFERENCES:

1. N.G.Calvert, 'Wind Power Principles: Their Application on small scale', Charles Friffin& co. Ltd, London, 1979.
2. Gerald W.Koeppel, "Pirnam's and Power from the wind", Van Nastran Reinhold Co., London, 1979.
3. Gary L. Johnson, "Wind Energy System", Prentice hall Inc., Englewood Cliffs, New Jersey, 1985.
4. Wind energy conversion system by L. Lfreris, Prentice hall (U.K) Ltd., 1990.

19272E25B - AI TECHNIQUES TO POWER SYSTEMS

3 1 0 4

1. INTRODUCTION TO NEURAL NETWORKS 9

Basics of ANN - perceptron - delta learning rule - back propagation algorithm - multilayer feed forward network - memory models - bi-directional associative memory - Hopfield network.

2. APPLICATIONS TO POWER SYSTEM PROBLEMS 9

Application of neural networks to load forecasting - contingency analysis - VAR control - economic load dispatch.

3. INTRODUCTION TO FUZZY LOGIC 9

Crispness - vagueness - fuzziness - uncertainty - fuzzy set theory fuzzy sets - fuzzy set operations - fuzzy measures - fuzzy relations - fuzzy function - structure of fuzzy logic controller – fuzzification models - data base - rule base - inference engine defuzzification module.

4. APPLICATIONS TO POWER SYSTEMS 9

Decision making in power system control through fuzzy set theory - use of fuzzy set models of LP in power systems scheduling problems - fuzzy logic based power system stabilizer.

5. GENETIC ALGORITHM AND ITS APPLICATIONS TO POWER SYSTEMS 9

Introduction - simple genetic algorithm - reproduction - crossover - mutation – advanced operators in genetic search - applications to voltage control and stability studies.

L = 45 T = 15 P = 0 C =4

REFERENCES:

1. James A. Freeman and Skapura.B.M „Neural Networks - Algorithms Applications and Programming Techniques‟, Addison Wesley, 1990.
2. George Klir and Tina Folger.A, „Fuzzy sets, Uncertainty and Information‟, Prentice Hall of India, 1993.
3. Zimmerman.H.J„„Fuzzy Set Theory and its Applications‟, Kluwer Academic Publishers 1994.
4. IEEE tutorial on „Application of Neural Network to Power Systems‟, 1996.
5. Loi Lei Lai, „Intelligent System Applications in Power Engineering‟, John Wiley & SonsLtd.,1998.

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19272E25C ELECTRICAL DISTRIBUTION SYSTEM L T P C

OBJECTIVES: 3 0 0 3

- To provide knowledge about the distribution system electrical characteristics
- To gain knowledge about planning and designing of distribution system
- To analyze power quality in distribution system
- To analyze the power flow in balanced and unbalanced system

UNIT I INTRODUCTION 9

Distribution System-Distribution Feeder Electrical Characteristics-Nature of Loads : Individual Customer Load, Distribution Transformer Loading and Feeder Load -Approximate Method of Analysis: Voltage Drop, Line Impedance, "K" Factors, Uniformly Distributed Loads and Lumping Loads in Geometric Configurations.

UNIT II DISTRIBUTION SYSTEM PLANNING 9

Factors effecting planning, present techniques, planning models(Short term planning, long term planning and dynamic planning), planning in the future, future nature of distribution planning, Role of computer in Distribution planning. Load forecast, Load characteristics and Load models.

UNIT III DISTRIBUTION SYSTEM LINE MODEL 9

Exact Line Segment Model-Modified Line Model- Approximate Line Segment Model-Modified "Ladder" Iterative Technique-General Matrices for Parallel Lines.

UNIT IV VOLTAGE REGULATION 9

Standard Voltage Ratings-Two-Winding Transformer Theory-Two-Winding Autotransformer-Step-Voltage Regulators: Single-Phase Step-Voltage Regulators-Three-Phase Step-Voltage Regulators- Application of capacitors in Distribution system.

UNIT V DISTRIBUTION FEEDER ANALYSIS 9

Power-Flow Analysis- Ladder Iterative Technique -Unbalanced Three-Phase Distribution Feeder- Modified Ladder Iterative Technique- Load Allocation- Short-Circuit Studies.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to apply the concepts of planning and design of distribution system for utility systems
- Ability to implement the concepts of volatage control in distribution system.
- Ability to analyze the power flow in balanced and unbalanced system

REFERENCES

1. William H. Kersting," Distribution System Modeling and Analysis " CRC press 3rd edition,2012.

2. Turan Gonen, “Electric Power Distribution System Engineering”, McGraw Hill Company. 1986
3. James Northcote – Green, Robert Wilson, “Control and Automation of Electrical Power Distribution Systems”, CRC Press, New York, 2007.
4. Pabla H S, “Electrical Power Distribution Systems”, Tata McGraw Hill. 2004

19272E25D ENERGY MANAGEMENT AND AUDITING L T P C

OBJECTIVES: 3 0 0 3

- To study the concepts behind economic analysis and Load management.
- To emphasize the energy management on various electrical equipments and metering.
- To illustrate the concept of lighting systems and cogeneration.

UNIT I INTRODUCTION 9

Need for energy management - energy basics- designing and starting an energy management program – energy accounting -energy monitoring, targeting and reporting-energy audit process.

UNIT II ENERGY COST AND LOAD MANAGEMENT 9

Important concepts in an economic analysis - Economic models-Time value of money-Utility rate structures- cost of electricity-Loss evaluation- Load management: Demand control techniques-Utility monitoring and control system-HVAC and energy management-Economic justification.

UNIT III ENERGY MANAGEMENT FOR MOTORS, SYSTEMS, AND ELECTRICAL EQUIPMENT 9

Systems and equipment- Electric motors-Transformers and reactors-Capacitors and synchronous machines.

UNIT IV METERING FOR ENERGY MANAGEMENT 9

Relationships between parameters-Units of measure-Typical cost factors- Utility meters - Timing of meter disc for kilowatt measurement - Demand meters - Paralleling of current transformers - Instrument transformer burdens-Multitasking solid-state meters - Metering location vs. requirements- Metering techniques and practical examples.

UNIT V LIGHTING SYSTEMS & COGENERATION 9

Concept of lighting systems - The task and the working space -Light sources - Ballasts - Luminaries - Lighting controls-Optimizing lighting energy - Power factor and effect of harmonics on power quality - Cost analysis techniques-Lighting and energy standards Cogeneration: Forms of cogeneration - feasibility of cogeneration- Electrical interconnection.

TOTAL : 45 PERIODS

OUTCOMES:

- Students will develop the ability to learn about the need for energy management and auditing process
- Learners will learn about basic concepts of economic analysis and load management.
- Students will understand the energy management on various electrical equipments.
- Students will have knowledge on the concepts of metering and factors influencing cost function

- Students will be able to learn about the concept of lighting systems, light sources and various forms of cogeneration

REFERENCES

1 Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, "Guide to Energy Management", Fifth Edition, The Fairmont Press, Inc., 2006
2 Eastop T.D & Croft D.R, "Energy Efficiency for Engineers and Technologists", Logman Scientific & Technical, 1990.
3 Reay D.A, "Industrial Energy Conservation", 1st edition, Pergamon Press, 1977.
4 "IEEE Recommended Practice for Energy Management in Industrial and Commercial Facilities", IEEE, 1996
5 Amit K. Tyagi, "Handbook on Energy Audits and Management", TERI, 2003.

19272E32A - POWER ELECTRONICS APPLICATIONS IN POWER SYSTEMS

3 1 0 4

UNIT: I STATIC COMPENSATOR CONTROL 9

Theory of load compensation - voltage regulation and power factor correction - phase balance and PF correction of unsymmetrical loads - Property of static compensator - Thyristor controlled rectifier (TCR) - Thyristor Controlled Capacitor (TSC) -Saturable core reactor - Control Strategies.

UNIT: II HARMONIC CONTROL AND POWER FACTOR IMPROVEMENT 9

Input power factor for different types of converters - power factor improvement using Load and forced commutated converters.

UNIT: III VOLTAGE CONTROL USING STATIC TAP-CHANGERS 9

Conventional tap changing methods, static tap changers using Thyristor, different schemes - comparison.

UNIT: IV STATIC EXCITATION CONTROL 9

Solid state excitation of synchronous generators - Different schemes - Generex excitation systems.

UNIT: V UNINTERRUPTABLE POWER SUPPLY SYSTEM 9

Parallel, Redundant and non- redundant UPS - Ups using resonant power converters - Switch mode power supplies.

L = 45 T = 15 P = 0 C =4

TEXT BOOK

Miller. T.J.E, “Reactive power control in Electric systems”. Wiley inter science, New York, 1982.

REFRENCES

1. “Static Compensator for AC power systems”, Proc. IEE vol.128 Nov. 1981. pp 362-406.
2 “A Static alternative to the transformer on load tap changing”, IEEE Trans. On Pas, Vol.PAS-99, Jan. /Feb. 1980, pp86-89.
3. “Improvements in Thyristor controlled static on- load tap controllers for transformers”, IEEE Trans. on PAS, Vol.PAS-101, Sept.1982, pp3091-3095.
4. “Shunt Thyristor rectifiers for the Generex Excitation systems”, IEEE Trans. On PAS. PAS -96, July/August, 1977, pp1219-1325.

Skill Development Employability Entrepreneurship

19272E32B- POWER SYSTEM DYNAMICS

3 1 0 4

1. SYNCHRONOUS MACHINE MODELLING 9

Schematic Diagram, Physical Description: armature and field structure, machines with multiple pole pairs, mmf waveforms, direct and quadrature axes, Mathematical Description of a Synchronous Machine: Basic equations of a synchronous machine: stator circuit equations, stator self, stator mutual and stator to rotor mutual inductances, dq0 Transformation: flux linkage and voltage equations for stator and rotor in dq0 coordinates, electrical power and torque, physical interpretation of dq0 transformation, Per Unit Representations: L_{ad}-reciprocal per unit system and that from power-invariant form of Park's transformation; Equivalent Circuits for direct and quadrature axes, Steady-state Analysis: Voltage, current and flux-linkage relationships, Phasor representation, Rotor angle, Steady-state equivalent circuit, Computation of steady-state values, Equations of Motion: Swing Equation, calculation of inertia constant, Representation in system studies, Synchronous Machine Representation in Stability Studies: Simplifications for large-scale studies : Neglect of stator $p\Psi$ terms and speed variations, Simplified model with amortisseurs neglected: two-axis model with amortisseur windings neglected, classical model.

2. MODELLING OF EXCITATION AND SPEED GOVERNING SYSTEMS 9

Excitation System Requirements; Elements of an Excitation System; Types of Excitation System;Control and protective functions;IEEE (1992) block diagram for simulation of excitation systems. Turbine and Governing System Modelling: Functional Block Diagram of Power Generation and Control, Schematic of a hydroelectric plant, classical transfer function of a hydraulic turbine (no derivation), special characteristic of hydraulic turbine, electrical analogue of hydraulic turbine, Governor for Hydraulic Turbine: Requirement for a transient droop, Block diagram of governor with transient droop compensation, Steam turbine modelling: Single reheat tandem compounded type only and IEEE block diagram for dynamic simulation; generic speed-governing system model for normal speed/load control function.

3. SMALL-SIGNAL STABILITY ANALYSIS WITHOUT CONTROLLERS 9

Classification of Stability, Basic Concepts and Definitions: Rotor angle stability, The Stability Phenomena. Fundamental Concepts of Stability of Dynamic Systems: State-space representation, stability of dynamic system, Linearisation, Eigen properties of the state matrix: Eigen values and eigenvectors, modal matrices, eigen value and stability, mode shape and participation factor. Single-Machine Infinite Bus (SMIB) Configuration: Classical Machine Model stability analysis with numerical example, Effects of Field Circuit Dynamics: synchronous machine, network and linearised system equations, block diagram representation with K-constants; expression for K-constants (no derivation), effect of field flux variation on system stability: analysis with numerical example,

4. SMALL-SIGNAL STABILITY ANALYSIS WITH CONTROLLERS 9

Effects Of Excitation System: Equations with definitions of appropriate K-constants and simple thyristor excitation system and AVR, block diagram with the excitation system, analysis of effect of AVR on synchronizing and damping components using a numerical example, Power System Stabiliser: Block diagram with AVR and PSS, Illustration of principle of PSS application with numerical example, Block diagram of PSS with description, system state matrix including PSS, analysis of stability with numerical a example. Multi-Machine Configuration: Equations in a common reference frame, equations in individual machine rotor coordinates, illustration of formation of system state matrix for a two-machine system with classical models for synchronous machines, illustration of stability analysis using a numerical example. Principle behind small-signal stability improvement methods: delta-omega and delta P-omega stabilizers.

5. ENHANCEMENT OF SMALL SIGNAL STABILITY 9

Power System Stabilizer – Stabilizer based on shaft speed signal (delta omega) – Delta –P-Omega stabilizer-Frequency-based stabilizers – Digital Stabilizer – Excitation control design – Exciter gain – Phase lead compensation – Stabilizing signal washout stabilizer gain – Stabilizer limits

L = 45 T = 15 P = 0 C =4

REFERENCES

1. P. Kundur, "Power System Stability and Control", McGraw-Hill, 1993.
2. IEEE Committee Report, "Dynamic Models for Steam and Hydro Turbines in Power System Studies", IEEE Trans., Vol.PAS-92, pp 1904-1915, November/December, 1973. on Turbine-Governor Model.
3. P.M Anderson and A.A Fouad, "Power System Control and Stability", Iowa State University Press, Ames, Iowa, 1978.

19272E32C ELECTRIC VEHICLES AND POWER MANAGEMENTL

	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the concept of electrical vehicles and its operations
- To understand the need for energy storage in hybrid vehicles
- To provide knowledge about various possible energy storage technologies that can be used in electric vehicles

UNIT I ELECTRIC VEHICLES AND VEHICLE MECHANICS 9

Electric Vehicles (EV), Hybrid Electric Vehicles (HEV), Engine ratings, Comparisons of EV with internal combustion Engine vehicles, Fundamentals of vehicle mechanics

UNIT II ARCHITECTURE OF EV's AND POWER TRAIN COMPONENTS 9

Architecture of EV's and HEV's – Plug-n Hybrid Electric Vehicles (PHEV)- Power train components and sizing, Gears, Clutches, Transmission and Brakes

UNIT III CONTROL OF DC AND AC DRIVES 9

DC/DC chopper based four quadrant operations of DC drives – Inverter based V/f Operation (motoring and braking) of induction motor drive system – Induction motor and permanent motor based vector control operation – Switched reluctance motor (SRM) drives

UNIT IV BATTERY ENERGY STORAGE SYSTEM 9

Battery Basics, Different types, Battery Parameters, Battery modeling, Traction Batteries

UNIT V ALTERNATIVE ENERGY STORAGE SYSTEMS 9

Fuel cell – Characteristics- Types – hydrogen Storage Systems and Fuel cell EV – Ultra capacitors

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will understand the operation of Electric vehicles and various energy storage technologies for electrical vehicles

REFERENCES

1 Iqbal Hussain, "**Electric and Hybrid Vehicles: Design Fundamentals, Second Edition"** CRC Press, Taylor & Francis Group, Second Edition (2011).

2 Ali Emadi, Mehrdad Ehsani, John M.Miller, "Vehicular Electric Power Systems", Special Indian Edition, Marcel dekker, Inc 2010.

19272E32D	ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide fundamental knowledge on electromagnetic interference and electromagnetic compatibility.
- To study the important techniques to control EMI and EMC.
- To expose the knowledge on testing techniques as per Indian and international standards in EMI measurement.

UNIT I INTRODUCTION 9

Definitions of EMI/EMC -Sources of EMI- Intersystems and Intrasystem- Conducted and radiated interference- Characteristics - Designing for electromagnetic compatibility (EMC)- EMC regulation typical noise path- EMI predictions and modeling, Cross talk - Methods of eliminating interferences.

UNIT II GROUNDING AND CABLING 9

Cabling- types of cables, mechanism of EMI emission / coupling in cables –capacitive coupling inductive coupling- shielding to prevent magnetic radiation- shield transfer impedance, Grounding – safety grounds – signal grounds- single point and multipoint ground systems hybrid grounds- functional ground layout –grounding of cable shields- -guard shields- isolation, neutralizing transformers, shield grounding at high frequencies, digital grounding- Earth measurement Methods

UNIT III BALANCING, FILTERING AND SHIELDING 9

Power supply decoupling- decoupling filters-amplifier filtering –high frequency filtering- EMI filters characteristics of LPF, HPF, BPF, BEF and power line filter design -Choice of capacitors, inductors, transformers and resistors, EMC design components -shielding – near and far fields shielding effectiveness - absorption and reflection loss- magnetic materials as a shield, shield discontinuities, slots and holes, seams and joints, conductive gaskets-windows and coatings - grounding of shields

UNIT IVEMI IN ELEMENTS AND CIRCUITS 9

Electromagnetic emissions, noise from relays and switches, non- linearities in circuits, passive inter modulation, transients in power supply lines, EMI from power electronic equipment, EMI as combination of radiation and conduction

UNIT V ELECTROSTATIC DISCHARGE, STANDARDS AND TESTING TECHNIQUES 9

Static Generation- human body model- static discharges- ESD versus EMC, ESD protection in equipment's- standards – FCC requirements – EMI measurements – Open area test site measurements and precautions- Radiated and conducted interference measurements, Control requirements and testing methods

TOTAL: 45 PERIODS

OUTCOMES:

- Recognize the sources of Conducted and radiated EMI in Power Electronic Converters and consumer appliances and suggest remedial measures to mitigate the problems
- Assess the insertion loss and design EMI filters to reduce the loss
- Design EMI filters, common-mode chokes and RC-snubber circuits measures to keep the interference within tolerable limits

REFERENCES

1. V.P. Kodali, "Engineering Electromagnetic Compatibility", S. Chand, 1996
2. Henry W.Ott, " Noise reduction techniques in electronic systems", John Wiley & Sons, 1989
3. Bernhard Keiser, "Principles of Electro-magnetic Compatibility", Artech House, Inc. (685 canton street, Norwood, MA 020062 USA) 1987
4. Bridges, J.E Milleta J. and Ricketts.L.W., "EMP Radiation and Protective techniques", John Wiley and sons, USA 1976
5. William Duff G., & Donald White R. J, "Series on Electromagnetic Interference and Compatibility", Vol.
6. Weston David A., "Electromagnetic Compatibility, Principles and Applications", 1991.

ELECTIVES – V (semester-III)

19272E33A - POWER CONDITIONING

3 1 0 4

1. INTRODUCTION 9

Introduction – Characterization of Electric Power Quality: Transients, short duration and long duration voltage variations, Voltage imbalance, waveform distortion, Voltage fluctuations, Power frequency variation, Power acceptability curves – power quality problems: poor load power factor, Non linear and unbalanced loads, DC offset in loads, Notching in load voltage, Disturbance in supply voltage – Power quality standards.

2. NON-LINEAR LOADS 9

Single phase static and rotating AC/DC converters, Three phase static AC/DC converters, Battery chargers, Arc furnaces, Fluorescent lighting, pulse modulated devices, Adjustable speed drives.

3. MEASUREMENT AND ANALYSIS METHODS 9

Voltage, Current, Power and Energy measurements, power factor measurements and definitions, event recorders, Measurement Error – Analysis: Analysis in the periodic steady state, Time domain methods, Frequency domain methods: Laplace’ s, Fourier and Hartley transform – The Walsh Transform – Wavelet Transform.

4. ANALYSIS AND CONVENTIONAL MITIGATION METHODS 9

Analysis of power outages, Analysis of unbalance: Symmetrical components of phasor quantities, Instantaneous symmetrical components, Instantaneous real and reactive powers, Analysis of distortion: On–line extraction of fundamental sequence components from measured samples – Harmonic indices – Analysis of voltage sag: Detorit Edison sag score, Voltage sag energy, Voltage Sag Lost Energy Index (VSLEI)- Analysis of voltage flicker, Reduced duration and customer impact of outages, Classical load balancing problem: Open loop balancing, Closed loop balancing, current balancing, Harmonic reduction, Voltage sag reduction.

5. POWER QUALITY IMPROVEMENT 9

Utility-Customer interface –Harmonic filters: passive, Active and hybrid filters – Custom power devices: Network reconfiguring Devices, Load compensation using DSTATCOM, Voltage regulation using DSTATCOM, protecting sensitive loads using DVR, UPQC –control strategies: P- Q theory, Synchronous detection method – Custom power park –Status of application of custom power devices

L = 45 T = 15 P = 0 C =4

REFERENCES:

1. Arindam Ghosh “Power Quality Enhancement Using Custom Power Devices”, Kluwer Academic Publishers, 2002.
2. Heydt.G.T, “Electric Power Quality”, Stars in a Circle Publications, 1994(2nd edition)
3. Dugan.R.C, “ Electrical Power System Quality”,TMH,2008.
4. Arrillga.A.J and Neville R.Watson, Power System Harmonics, John Wiley second Edition,2003.
5. Derek A. Paice, “Power electronic converter harmonics”,John Wiley & sons, 1999.

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ELECTIVES – V (semester-III)

19272E33B – POWER SYSTEM RESTRUCTURING AND DEREGULATION

3 1 0 4

1. FUNDAMENTALS AND ARCHITECTURE OF POWERMARKETS 9

Deregulation of Electric utilities: Introduction-Unbundling-Wheeling- Reform motivations- Fundamentals of Deregulated Markets – Types (Future, Day-ahead and Spot) – Participating in Markets (Consumer and Producer Perspective) – bilateral markets – pool markets. Independent System Operator (ISO)-components-types of ISO - role of ISO - Lessons and Operating Experiences of Deregulated Electricity Markets in various Countries (UK, Australia, Europe, US, Asia).

2. TECHNICAL CHALLENGES 9

Total Transfer Capability – Limitations - Margins – Available transfer capability (ATC) – Procedure - Methods to compute ATC – Static and Dynamic ATC – Effect of contingency analysis – Case Study. Concept of Congestion Management – Bid, Zonal and Node Congestion Principles – Inter and Intra zonal congestion – Generation Rescheduling - Transmission congestion contracts – Case Study.

3. TRANSMISSION NETWORKS AND SYSTEM SECURITY SERVICES 9

Transmission expansion in the New Environment – Introduction – Role of transmission planning – Physical Transmission Rights – Limitations – Flow gate - Financial Transmission Rights – Losses – Managing Transmission Risks – Hedging – Investment. Ancillary Services – Introduction – Describing Needs – Compulsory and Demand-side provision – Buying and Selling Ancillary Services – Standards.

4. MARKET PRICING 9

Transmission pricing in open access system – Introduction – Spot Pricing – Uniform Pricing – Zonal Pricing – Locational Marginal Pricing – Congestion Pricing – Ramping and Opportunity Costs. Embedded cost based transmission pricing methods (Postage stamp, Contract path and MW-mile) – Incremental cost based transmission pricing methods (Short run marginal cost, Long run marginal cost) - Pricing of Losses on Lines and Nodes.

5. INDIAN POWER MARKET 9

Current Scenario – Regions – Restructuring Choices – Statewise Operating Strategies – Salient features of Indian Electricity Act 2003 – Transmission System Operator – Regulatory and Policy development in Indian power Sector – Opportunities for IPP and Capacity Power Producer. Availability based tariff – Necessity – Working Mechanism – Beneficiaries – Day Scheduling Process – Deviation from Schedule – Unscheduled Interchange Rate – System Marginal Rate – Trading Surplus Generation – Applications.

L = 45 T = 15 P = 0 C =4

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REFERENCES

1. Kankar Bhattacharya, Math H.J. Bollen and Jaap E. Daalder, “Operation of Restructured Power Systems”, Kluwer Academic Publishers, 2001
2. Loi Lei Lai, “Power system Restructuring and Regulation”, John Wiley sons, 2001.
3. Shahidehpour.M and Alomoush.M, “Restructuring Electrical Power Systems”, Marcel Decker Inc., 2001.
4. Steven Stoft, “ Power System Economics”, Wiley – IEEE Press, 2002
5. Daniel S. Kirschen and Goran Strbac, “ Fundamentals of Power System Economics”, John Wiley & Sons Ltd., 2004.
6. Scholarly Transaction Papers and Utility web sites

19272E33C **CONTROL SYSTEM DESIGN FOR POWER ELECTRONICS**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To explore conceptual bridges between the fields of Control Systems and Power Electronics
- To Study Control theories and techniques relevant to the design of feedback controllers in Power Electronics.

UNIT I MODELLING OF DC-TO-DC POWER CONVERTERS **9**

Modelling of Buck Converter , Boost Converter ,Buck- Boost Converter, Cuk Converter ,Sepic Converter, Zeta Converter, Quadratic Buck Converter ,Double Buck-Boost Converter, Boost-Boost Converter General Mathematical Model for Power Electronics Devices.

UNIT II SLIDING MODE CONTROLLER DESIGN **9**

Variable Structure Systems. Single Switch Regulated Systems Sliding Surfaces, Accessibility of the Sliding Surface Sliding Mode Control Implementation of Boost Converter ,Buck-Boost Converter, Cuk Converter ,Sepic Converter, Zeta Converter, Quadratic Buck Converter ,Double Buck-Boost Converter, Boost-Boost Converter.

UNIT III APPROXIMATE LINEARIZATION CONTROLLER DESIGN **9**

Linear Feedback Control, Pole Placement by Full State Feedback , Pole Placement Based on Observer Design ,Reduced Order Observers , Generalized Proportional Integral Controllers, Passivity Based Control , Sliding Mode Control Implementation of Buck Converter , Boost Converter ,Buck-Boost Converter.

UNIT IV NONLINEAR CONTROLLER DESIGN **9**

Feedback Linearization Isidori's Canonical Form, Input-Output Feedback Linearization, State Feedback Linearization, Passivity Based Control , Full Order Observers , Reduced Order Observers.

UNIT V PREDICTIVE CONTROL OF POWER CONVERTERS **9**

Basic Concepts, Theory, and Methods, Application of Predictive Control in Power Electronics, AC-DC-AC Converter System, Faults and Diagnosis Systems in Power Converters.

TOTAL:45 PERIODS

OUTCOMES:

- Ability to understand an overview on modern linear and nonlinear control strategies for power electronics devices
- Ability to model modern power electronic converters for industrial applications
- Ability to design appropriate controllers for modern power electronics devices.

REFERENCES

1. Hebertt Sira-Ramírez, Ramón Silva-Ortigoza, "Control Design Techniques in Power Electronics Devices", Springer 2012

2. Mahesh Patil, Pankaj Rodey, "Control Systems for Power Electronics: A Practical Guide", Springer India, 2015.

3. Blaabjerg José Rodríguez, "Advanced and Intelligent Control in Power Electronics and Drives" , Springer, 2014

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4. Enrique Acha, Vassilios Agelidis, Olimpo Anaya, TJE Miller, "Power Electronic Control in Electrical Systems", Newnes, 2002

5. Marija D. Aranya Chakrabortty, Marija , "Control and Optimization Methods for Electric Smart Grids", Springer, 2012.

19272E33D ADVANCED DIGITAL SIGNAL PROCESSING LT P C 3003

COURSE OBJECTIVES

- To expose the students to the fundamentals of digital signal processing in frequency domain& its application
- To teach the fundamentals of digital signal processing in time-frequency domain& its application
- To compare Architectures & features of Programmable DSprocessors & develop logical functions of DSProcessors
- To discuss on Application development with commercial family of DS Processors
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

UNIT I FUNDAMENTALS OF DSP 12

Frequency interpretation, sampling theorem, aliasing, discrete-time systems, constant-coefficient difference equation. Digital filters: FIR filter design – rectangular,Hamming,Hanning windowing technique. IIR filter design – Butterworth filter, bilinear transformation method, frequency transformation. Fundamentals of multirate processing – decimation and interpolation.

UNIT II TRANSFORMS AND PROPERTIES 9

Discrete Fourier transform (DFT): - properties, Fast Fourier transform (FFT), DIT -FFT, and DIF-FFT. Wavelet transforms:Introduction, wavelet coefficients – orthonormal wavelets and their relationship to filter banks, multi-resolution analysis, and Haar and Daubechies wavelet.

UNIT III ADAPTIVE FILTERS 9

Wiener filters – an introduction. Adaptive filters: Fundamentals of adaptive filters, FIR adaptive filter – steepest descent algorithm, LMS algorithm, NLMS, applications – channel equalization. Adaptive recursive filters – exponentially weighted RLS algorithm.

UNIT IV ARCHITECTURE OF COMMERCIAL DIGITAL SIGNAL PROCESSORS 9

Introduction to commercial digital signal processors, Categorization of DSP processor – Fixed point and floating point, Architecture and instruction set of the TI TMS 320 C54xx and TMS 320 C6xxx DSP processors, On-chip and On-board peripherals – memory (Cache, Flash, SDRAM), codec, multichannel buffered I/O serial ports (McBSPs), interrupts, direct memory access (DMA), timers and general purpose I/Os.

UNIT V INTERFACING I/O PERIPHERALS FOR DSP BASED APPLICATIONS 6

Introduction, External Bus Interfacing Signals, Memory Interface, I/O Interface, Programmed I/O, Interrupts, Design of Filter, FFT Algorithm, ,Application for Serial Interfacing, DSP based Power Meter, Position control , CODEC Interface .

TOTAL : 45 PERIODS

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Note: Discussions / Exercise / practice on signal analysis, transforms, filter design concepts with simulation tools such as Matlab / Labview / CC studio will help the student understand signal processing concepts and DSP processors.
Overview of TMS320C54xx and TMS320C67xx /other DSP Starter Kits, Introduction to code composer studio (CCS), Board support library, Chip support library and Runtime support library, Generating basic signals, Digital filter design, Spectrum analysis, Adaptive filters, Speech and Audio processing applications.

OUTCOMES : After the completion of this course the student will be able to:

- Students will learn the essential advanced topics in DSP that are necessary for successful Postgraduate level research.
- Students will have the ability to solve various types of practical problems in DSP
- Comprehend the DFTs and FFTs, design and Analyze the digital filters, comprehend the Finite word length effects in Fixed point DSP Systems.
- The conceptual aspects of Signal processing Transforms are introduced.
- The comparison on commercial available DSP Processors helps to understand system design through processor interface.
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

REFERENCES:

1. John. G. Proakis, Dimitris G. Manolakis, “Digital signal processing”, Pearson Edu, 2002
2. Sen M.Kuo,Woon-Seng S.Gan, “Digital Signal Processors- Pearson Edu, 2012
3. Ifeachor E. C., Jervis B. W ,”Digital Signal Processing: A practical approach, Pearson- Education, PHI/ 2002
4. Shaila D. Apte, “ Digital Signal Processing”, Second Edition, Wiley, 2016.
5. Robert J.Schilling,Sandra L.Harris,”Introd. To Digital Signal Processing with Matlab”,Cengage,2014.
6. Steven A. Tretter, “Communication System Design Using DSP Algorithms with Laboratory Experiments for the TMS320C6713™ DSK”, Springer, 2008.
7. RulphChassaing and Donald Reay, “Digital Signal Processing and Applications with the TMS320C6713 and TMS320C6416 DSK”, John Wiley & Sons, Inc., Hoboken, New Jersey,2008.
8. K.P. Soman and K.L. Ramchandran,Insight into WAVELETS from theory to practice, Eastern Economy Edition, 2008
9. B Venkataramani and M Bhaskar **“**Digital Signal Processors**”**, TMH, 2nd, 2010
10. Vinay K.Ingle,John G.Proakis,”DSP-A Matlab Based Approach”,Cengage Learning,2010
11. Taan S.Elali,”Discrete Systems and Digital Signal Processing with Matlab”,CRC Press2009.
12. Monson H. Hayes, “Statistical Digital signal processing and modelling”, John Wiley & Sons, 2008.
13. Avatar Sing, S. Srinivasan, “Digital Signal Processing- Implementation using DSP Microprocessors with Examples from TMS320C54xx”, Thomson India,2004.

ELECTIVES – VI (semester-III)

19272E34A - SOFTWARE FOR CONTROL SYSTEM DESIGN

3 1 0 4

1. INTRODUCTION TO DESIGN AND CLASSICAL PID CONTROL

Systems performance and specifications –Proportional, Integral and Derivative Controllers – Structure – Empirical tuning- Zeigler Nichols-Cohen Coon – Root Locus method – Open loop inversion-– Tuning using ISE, IAE and other performance indices.

2. COMPENSATOR DESIGN

Design of lag, lead, lead-lag compensators – Design using bode plots – Polar plots – Nichols charts – root locus and Routh Hurwitz criterion.

3. MATLAB

Introduction – function description – Data types – Tool boxes – Graphical Displays – Programs for solution of state equations – Controller design – Limitations.-simulink-Introduction – Graphical user interface – Starting – Selection of objects – Blocks – Lines - simulation – Application programs – Limitations.

4. MAPLE

Introduction – symbolic programming – Programming constructs – Data structure computation with formulae – Procedures – Numerical Programming.

5. MATLAB

Programs using MATLAB software

L = 45 T = 15 P = 0 C =4

REFERENCES

1. MAPLE V Programming guide.
2. MATLAB user manual.
3. SIMULINK user manual.
4. K.Ogatta ,"Modern Control Engineering",PHI,1997.
5. Dorf and Bishop,"Modern control Engineering', Addison Wesley, 1998.

ELECTIVES – VI (semester-III)

19272E34B - INDUSTRIAL POWER SYSTEM ANALYSIS AND DESIGN

3 1 0 4

1. MOTOR STARTING STUDIES **9**

Introduction-Evaluation Criteria-Starting Methods-System Data-Voltage Drop Calculations-Calculation of Acceleration time-Motor Starting with Limited-Capacity Generators-Computer-Aided Analysis-Conclusions.

2. POWER FACTOR CORRECTION STUDIES **9**

Introduction-System Description and Modeling-Acceptance Criteria-Frequency Scan Analysis-Voltage Magnification Analysis-Sustained Overvoltages-Switching Surge Analysis-Back-to-Back Switching-Summary and Conclusions.

3. HARMONIC ANALYSIS **9**

Harmonic Sources-System Response to Harmonics-System Model for Computer-Aided Analysis-Acceptance Criteria-Harmonic Filters-Harmonic Evaluation-Case Study-Summary and Conclusions.

4. FLICKER ANALYSIS **9**

Sources of Flicker-Flicker Analysis-Flicker Criteria-Data for Flicker analysis- Case Study-Arc Furnace Load-Minimizing the Flicker Effects-Summary.

5. GROUND GRID ANALYSIS **9**

Introduction-Acceptance Criteria-Ground Grid Calculations-Computer-Aided Analysis - Improving the Performance of the Grounding Grids-Conclusions.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Ramasamy Natarajan, ”Computer-Aided Power System Analysis”, Marcel Dekker Inc., 2002.

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19272E34C SOFT COMPUTING TECHNIQUES **L T P C**

OBJECTIVES: **3 0 0 3**

- To expose the concepts of feed forward neural networks.
- To provide adequate knowledge about feed back neural networks.
- To teach about the concept of fuzziness involved in various systems.
- To expose the ideas about genetic algorithm
- To provide adequate knowledge about of FLC and NN toolbox

UNIT I INTRODUCTION AND ARTIFICIAL NEURAL NETWORKS 9

Introduction to intelligent systems- Soft computing techniques- Conventional Computing versus Swarm Computing - Classification of meta-heuristic techniques - Properties of Swarm intelligent Systems - Application domain - Discrete and continuous problems - Single objective and multi-objective problems -Neuron- Nerve structure and synapse- Artificial Neuron and its model- activation functions- Neural network architecture- single layer and multilayer feed forward networks- Mc Culloch Pitts neuron model- perceptron model- Adaline and Madaline- multilayer perception model- back propogation learning methods- effect of learning rule coefficient -back propagation algorithm- factors affecting back propagation training- applications.

UNIT II ARTIFICIAL NEURAL NETWORKS AND ASSOCIATIVE MEMORY 9

Counter propagation network- architecture- functioning & characteristics of counter Propagation network- Hopfield/ Recurrent network configuration - stability constraints associative memory and characteristics- limitations and applications- Hopfield v/s Boltzman machine- Adaptive Resonance Theory- Architecture- classifications- Implementation and training - Associative Memory.

UNIT III FUZZY LOGIC SYSTEM 9

Introduction to crisp sets and fuzzy sets- basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modeling and control- Fuzzification inferencing and defuzzification-Fuzzy knowledge and rule bases-Fuzzy modeling and control schemes for nonlinear systems. Self organizing fuzzy logic control- Fuzzy logic control for nonlinear time delay system.

UNIT IV GENETIC ALGORITHM 9

Evolutionary programs – Genetic algorithms, genetic programming and evolutionary programming - Genetic Algorithm versus Conventional Optimization Techniques - Genetic representations and selection mechanisms; Genetic operators- different types of crossover and mutation operators - Optimization problems using GA-discrete and continuous - Single objective and multi-objective problems - Procedures in evolutionary programming.

UNIT V HYBRID CONTROL SCHEMES 9

Fuzzification and rule base using ANN–Neuro fuzzy systems-ANFIS – Fuzzy Neuron - Optimization of membership function and rule base using Genetic Algorithm – Introduction to Support Vector Machine - Evolutionary Programming-Particle Swarm Optimization - Case study – Familiarization of NN, FLC and ANFIS Tool Box.

TOTAL : 45 PERIODS

OUTCOMES:

- Will be able to know the basic ANN architectures, algorithms and their limitations.
- Also will be able to know the different operations on the fuzzy sets.
- Will be capable of developing ANN based models and control schemes for non-linear system.
- Will get expertise in the use of different ANN structures and online training algorithm.
- Will be knowledgeable to use Fuzzy logic for modeling and control of non-linear systems.
- Will be competent to use hybrid control schemes and P.S.O and support vector Regressive.

TEXT BOOKS:

1. Laurene V. Fausett, "Fundamentals of Neural Networks: Architectures, Algorithms And Applications", Pearson Education.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India, 2008.
3. Zimmermann H.J. "Fuzzy set theory and its Applications" Springer international edition, 2011.
4. David E.Goldberg, "Genetic Algorithms in Search, Optimization, and Machine Learning", Pearson Education, 2009.
5. W.T.Miller, R.S.Sutton and P.J.Webrose, "Neural Networks for Control" MIT Press", 1996.
6. T. Ross, "Fuzzy Logic with Engineering Applications", Tata McGraw Hill, New Delhi, 1995.
7. Ethem Alpaydin, "Introduction to Machine Learning (Adaptive Computation and Machine Learning Series)", MIT Press, 2004.
8. Corinna Cortes and V. Vapnik, " Support - Vector Networks, Machine Learning " 1995.

19272E34D RESTRUCTURED POWER SYSTEM LTPC
OBJECTIVES: 3003

- To introduce the restructuring of power industry and market models.
- To impart knowledge on fundamental concepts of congestion management.
- To analyze the concepts of locational marginal pricing and financial transmission rights.
- To Illustrate about various power sectors in India

UNIT I INTRODUCTION TO RESTRUCTURING OF POWER INDUSTRY 9

Introduction: Deregulation of power industry, Restructuring process, Issues involved in deregulation, Deregulation of various power systems – Fundamentals of Economics: Consumer behavior, Supplier behavior, Market equilibrium, Short and long run costs, Various costs of production – Market models: Market models based on Contractual arrangements, Comparison of various market models, Electricity vis – a – vis other commodities, Market architecture, Case study.

UNIT II TRANSMISSION CONGESTION MANAGEMENT 9

Introduction: Definition of Congestion, reasons for transfer capability limitation, Importance of congestion management, Features of congestion management – Classification of congestion management methods – Calculation of ATC - Non – market methods – Market methods – Nodal pricing – Inter zonal and Intra zonal congestion management – Price area congestion management – Capacity alleviation method.

UNIT III LOCATIONAL MARGINAL PRICES AND FINANCIAL TRANSMISSION RIGHTS 9

Mathematical preliminaries: - Locational marginal pricing– Lossless DCOPF model for LMP calculation – Loss compensated DCOPF model for LMP calculation – ACOPF model for LMP calculation – Financial Transmission rights – Risk hedging functionality -Simultaneous feasibility test and revenue adequency – FTR issuance process: FTR auction, FTR allocation – Treatment of revenue shortfall – Secondary trading of FTRs – Flow gate rights – FTR and market power - FTR and merchant transmission investment.

UNIT IV ANCILLARY SERVICE MANAGEMENT AND PRICING OF TRANSMISSION NETWORK 9

Introduction of ancillary services – Types of Ancillary services – Classification of Ancillary services – Load generation balancing related services – Voltage control and reactive power support devices – Black start capability service - How to obtain ancillary service –Co-optimization of energy and reserve services - Transmission pricing – Principles – Classification – Rolled in transmission pricing methods – Marginal transmission pricing paradigm – Composite pricing paradigm – Merits and demerits of different paradigm.

UNIT V REFORMS IN INDIAN POWER SECTOR 9

Introduction – Framework of Indian power sector – Reform initiatives - Availability based tariff – Electricity act 2003 – Open access issues – Power exchange – Reforms in the near future

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will have knowledge on restructuring of power industry
- Learners will understand basics of congestion management
- Learners will attain knowledge about locational margin prices and financial transmission rights
- Learners will understand the significance ancillary services and pricing of transmission network
- Learners will have knowledge on the various power sectors in India

REFERENCES

1 Mohammad Shahidehpour, Muwaffaq Alomoush, Marcel Dekker, “Restructured electrical power systems: operation, trading and volatility” Pub., 2001.
2 Kankar Bhattacharya, Jaap E. Daadler, Math H.J. Boolen, “Operation of restructured power systems”, Kluwer Academic Pub., 2001.
3 Paranjothi, S.R. , “Modern Power Systems” Paranjothi, S.R. , New Age International, 2017.
4 Sally Hunt,” Making competition work in electricity”, John Willey and Sons Inc. 2002.
5 Steven Stoft, “Power system economics: designing markets for electricity”, John Wiley & Sons, 2002.

Research Integrated Curriculum

The relationship between teacher and learner is completely different in higher education from what it is in school. At the higher level, the teacher is not there for the sake of the student, both have their justification in the service of scholarship. For the students who are the professionals of the future, developing the ability to investigate problems, make judgments on the basis of sound evidences, take decisions on a rational basis and understand what they are doing and why is vital. Research and inquiry is not just for those who choose to pursue an academic career. It is central to professional life in the twenty-first century.

It is observed that the modern world is characterized by heightened levels of complexity and uncertainty. Fluidity, fuzziness, instability, fragility, unpredictability, indeterminacy, turbulence, changeability, contestability: these are some of the terms that mark out the world of the twenty-first century. Teaching and research is correlated when they are co-related. Growing out of the research on teaching- research relations, the following framework has been developed and widely adopted to help individual staff, course teams and whole institutions analyse their curricula and consider ways of strengthening students understanding of and through research. Curricula can be:

Research – Led: Learning about current research in the discipline

Here the curriculum focus is to ensure that what students learn clearly reflects current and ongoing research in their discipline. This may include research done by staff teaching them.

Research – Oriented: Developing research skills and techniques

Here the focus is on developing student’s knowledge of and ability to carry out the research methodologies and methods appropriate to their discipline(s)

Research – Based: Undertaking research and inquiry

Here the curriculum focus is on ensuring that as much as possible the student learns in research and or inquiry mode (i.e. the students become producers of knowledge not just consumers). The strongest curricula form of this is in those special undergraduate programmes for selected students, but such research and inquiry may also be mainstreamed for all or many students.

Research- Tutored: engaging in research discussions

Here the focus is on students and staff critically discussing ongoing research in the discipline.

All four ways of engaging students with research and inquiry are valid and valuable and curricula can and should contain elements of them.

Moreover, the student participation in research may be classified as,

Level 1: Prescribed Research
Level 2: Bounded Research
Level 3: Scaffolded Research
Level 4: Self actuated Research
Level 5: Open Research

Taking into consideration the above mentioned facts in respect of integrating research into the M.Tech Power system curriculum, the following Research Skill Based Courses are introduced in the curriculum.

Semester	RSB Courses	Credits
I	Research Led Seminar	1
II	Research Methodology	3
II	Participation in Bounded Research	2
III	Design Project/ Socio Technical Project (Scaffolded Research)	4
IV	Project Work	12

Blueprint for assessment of student's performance in Research Led Seminar Course

- **Internal Assessment: 40 Marks**
    - Seminar Report (UG)/Concept Note(PG) : 5 X 4= 20 Marks
    - Seminar Review Presentation : 10 Marks
    - Literature Survey : 10 Marks
- **Semester Examination : 60 Marks**

(Essay type Questions set by the concerned resource persons)

Blueprint for assessment of student's performance in Design/Socio Technical Project

- **Continuous Internal Assessment through Reviews: 40 Marks**
    - Review I : 10 Marks
    - Review II : 10 Marks
    - Review III : 20 Marks
- **Evaluation of Socio Technical Practicum Final Report: 40 Marks**
- **Viva- Voce Examination: 20 Marks**
- **Total: 100 Marks**

Blueprint for assessment of student's performance in Research Methodology Courses

Continuous Internal Assessment: 20 Marks

- Research Tools(Lab) : 10 Marks
- Tutorial: 10 Marks

Model Paper Writing: 40 Marks

- Abstract: 5 Marks
- Introduction: 10 Marks
- Discussion: 10 Marks
- Review of Literature: 5 Marks
- Presentation: 10 Marks

Semester Examination: 40 Marks

Total: 100 Marks

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PONNAIYAH RAMAJAYAM INSTITUTE OF SCIENCE & TECHNOLOGY (PRIST)

Declared as DEEMED-TO-BE-UNIVERSITY
U/s 3 of UGC Act, 1956

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

PROGRAM COURSE STRUCTURE R-2022

M.TECH-POWER SYSTEMS (FULL TIME) [Regulation 2022]

[for candidates admitted to M. Tech Power System program from June 2022 onwards]

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

PROGRAMME: M.TECH-POWER SYSTEMS (FULL TIME)

CURRICULUM -REGULATION 2022

SEMESTER – I

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1.	22248S11D	Applied Mathematics for Power System Engineering	3	1	0	4
2	22272C12	System Theory	3	1	0	4
3	22272C13	Advanced Power System Analysis	3	1	0	4
4	22272C14	Economic Operations of Power Systems	3	1	0	4
5	22272C15	HVDC and FACTS	3	1	0	4
6	22272E16_	Elective-I	3	0	0	3
7	22272L17	Power System Simulation Laboratory	0	0	3	3
		TOTAL				**26**

SEMESTER – II

SL. NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272C21	EHV power transmission	3	1	0	4
2	22272C22	Power System Control	3	1	0	4
3	22272C23	Advanced Power System Protection	3	1	0	4
4	22272E24_	Elective –II	3	0	0	3
5	22272E25_	Elective –III	3	0	0	3
6	22272L26	Advanced Power System Simulation Laboratory	0	0	3	3
7	222TECWR	Technical Writing/Seminars	0	0	3	3
		TOTAL				**24**

SEMESTER – III

SL. NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272C31	Electrical Transients in power systems	3	1	0	4
2	22272E32_	Elective –IV	3	0	0	3
3	22272E33_	Elective –V	3	0	0	3
4	22272E34_	Elective –VI	3	0	0	3
5	22272P35	Project work Phase-I	0	0	10	10
		TOTAL				**23**

SEMESTER – IV

SL. NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272P41	Project work Phase-II	0	0	15	15

Elective –I

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E16A	Analysis of Inverters	3	0	0	3
2.	22272E16B	Modeling and Analysis of Electrical Machines	3	0	0	3
3.	22272E16C	Advanced Power System Dynamics	3	0	0	3
4.	22272E16D	Analysis and Computation of Electromagnetic Transients in Power Systems	3	0	0	3

Elective –II

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E24A	Smart Grid	3	0	0	3
2.	22272E24B	Solar and Energy Storage Systems	3	0	0	3
3.	22272E24C	Power System Reliability	3	0	0	3
4.	22272E24D	Distributed Generation and Microgrid	3	0	0	3

Elective –III

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E25A	Wind Energy conversion systems	3	0	0	3
2.	22272E25B	AI Techniques to Power Systems	3	0	0	3
3.	22272E25C	Electrical Distribution	3	0	0	3
4.	22272E25D	Energy Management and Auditing	3	0	0	3

Elective –IV

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E32A	Power Electronics applications in Power systems	3	0	0	3
2.	22272E32B	Power system Dynamics	3	0	0	3
3.	22272E32C	Electric Vehicles and Power Management	3	0	0	3
4.	22272E32D	Electromagnetic Interference and Compatibility	3	0	0	3

Elective –V

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E33A	Power Conditioning	3	0	0	3
2.	22272E33B	Deregulated Power System	3	0	0	3
3.	22272E33C	Control System Design for Power Electronics	3	0	0	3
4.	22272E33D	Principles of EHV Transmission	3	0	0	3

Elective –VI

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E34A	Software for Control system Design	3	0	0	3
2.	22272E34B	Industrial Power system analysis and design	3	0	0	3
3.	22272E34C	Soft Computing Techniques	3	0	0	3
4.	22272E34D	Restructured Power System	3	0	0	3

Total Credits = 88

Credit Distribution

Sem.	Core Courses				Elective Courses		Total Credits
	Theory Courses		Practical Courses				
	Nos.	Credits	Nos.	Credits	Nos.	Credits	
I	04	16	01	03	01	03	26
II	03	12	02	06	02	06	24
III	01	04	-	-	03	09	23
IV	-	-	-	-	-	-	15
Total Credits							**88**

HOD **DEAN**

DEAN ACADEMIC AFFAIRS

22248S11D - APPLIED MATHEMATICS for POWER SYSTEM ENGINEERING

ENGINEERING **3 1 0 4**

1. ADVANCED MATRIX THEORY **9**

Matrix norms – Jordan canonical form – Generalized eigenvectors – Singular value decomposition – Pseudo inverse – Least square approximations.

2. RANDOM PROCESSES **9**

Random variable, discrete, continuous types - Binomial, Poisson, normal and exponential distributions density & distribution Functions- Moments Moment Generating Functions – Notion of stochastic processes - Auto-correlation – Cross correlation .

3. LINEAR PROGRAMMING **9**

Basic concepts – Graphical and Simplex methods –Transportation problem – Assignment problem.

4. DYNAMIC PROGRAMMING **9**

Elements of the dynamic programming model – optimality principle – Examples of dynamic programming models and their solutions.

5. INTEGRAL TRANSFORMS **9**

Finite Fourier transform - Fourier series - Finite sine Transform - Cosine transform - finite Hankel transform - definition, Transform of df/dx where p is a root of Jn(p) = 0, Transform of

$$\frac{d2f}{dx2} + \frac{1}{x}\frac{df}{dx}, \text{ and Transform of } \frac{d2f}{dx2} + \frac{1}{x}\frac{df}{dx} - \frac{n2f}{x2}$$

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Lewis.D.W., Matrix Theory ,Allied Publishers, Chennai 1995.
2. Bronson, R, Matrix Operations, Schaums outline Series, McGraw Hill, New York. 1989.
3. Andrews, L.A., and Shivamoggi B.K., “Integral Transforms for Engineers and Applied Mathematicians”, Macmillan , New York ,1988.
4. Taha, H.A., " Operations research - An Introduction ", Mac Millan publishing Co., (1982).
5. Gupta, P.K.and Hira, D.S., " Operations Research ", S.Chand & Co., New Delhi, (1999).6..
6. Ochi, M.K. " Applied Probability and Stochastic Processes ", John Wiley & Sons (1992).
7. Peebles Jr., P.Z., " Probability Random Variables and Random Signal Principles, McGraw Hill Inc., (1993).

22272C12- SYSTEM THEORY

3 1 0 4

1. PHYSICAL SYSTEMS AND STATE ASSIGNMENT 9

Systems - electrical - mechanical - hydraulic - pneumatic - thermal systems - modelling of some typical systems like D.C. Machines - inverted pendulum.

2. STATE SPACE ANALYSIS 9

Realisation of state models - non-uniqueness - minimal realisation - balanced realisation - solution of state equations - state transition matrix and its properties - free and forced responses - properties - controllability and observability - stabilisability and detectability - Kalman decomposition.

3. MIMO SYSTEMS - FREQUENCY DOMAIN DESCRIPTIONS 9

Properties of transfer functions - impulse response matrices - poles and zeros of transfer function matrices - critical frequencies - resonance - steady state and dynamic response - bandwidth - Nyquist plots - singular value analysis.

4. NON-LINEAR SYSTEMS 9

Types of non-linearity - typical examples - equivalent linearization - phase plane analysis - limit cycles - describing functions - analysis using describing functions - jump resonance.

5. STABILITY 9

Stability concepts - equilibrium points - BIBO and asymptotic stability - direct method of Liapunov - application to non-linear problems - frequency domain stability criteria - Popov's method and its extensions.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. M. Gopal, 'Modern Control Engineering', Wiley, 1996.
2. J.S. Bay, 'Linear State Space Systems', McGraw-Hill, 1999.
3. Eroni-Umez and Eroni, 'System dynamics & Control', Thomson Brooks / Cole, 1998.
4. K. Ogatta, 'Modern Control Engineering', Pearson Education, Low Priced Edition, 1997.
5. G.J. Thaler, 'Automatic control systems', Jaico publishers, 1993.
6. John S. Bay, 'Linear State Space Systems', McGraw-Hill International Edition, 1999.

22272C13 - ADVANCED POWER SYSTEM ANALYSIS

3 1 0 4

OBJECTIVES:

- To introduce different techniques of dealing with sparse matrix for large scale power systems.
- To impart in-depth knowledge on different methods of power flow solutions.
- To perform optimal power flow solutions in detail.
- To perform short circuit fault analysis and understand the consequence of different type of faults.
- To Illustrate different numeric al integration methods and factors influencing transient stability

UNIT I SOLUTION TECHNIQUE 9

Sparse Matrix techniques for large scale power systems: Optimal ordering schemes forpreserving sparsity. Flexible packed storage scheme for storing matrix as compact arrays –Factorization by Bifactorization and Gauss elimination methods; Repeat solution using Left and Right factors and L and U matrices.

UNIT II POWER FLOW ANALYSIS 9

Power flow equation in real and polar forms; Review of Newton's method for solution; Adjustment of P-V buses; Review of Fast Decoupled Power Flow method; Sensitivity factors for P-V bus adjustment..

UNIT III OPTIMAL POWER FLOW 9

Problem statement; Solution of Optimal Power Flow (OPF) – The gradient method, Newton's method, Linear Sensitivity Analysis; LP methods – With real power variables only – LP method with AC power flow variables and detailed cost functions; Security constrained Optimal Power Flow; Interior point algorithm; Bus Incremental costs.

UNIT IV SHORT CIRCUIT ANALYSIS 9

Formation of bus impedance matrix with mutual coupling (single phase basis and three phase basis)- Computer method for fault analysis using ZBUS and sequence components. Derivation of equations for bus voltages, fault current and line currents, both in sequence and phase – symmetrical and unsymmetrical faults.

UNIT V TRANSIENT STABILITY ANALYSIS 9

Introduction, Numerical Integration Methods: Euler and Fourth Order Runge-Kutta methods, Algorithm for simulation of SMIB and multi-machine system with classical synchronous machine model; Factors influencing transient stability, Numerical stability and implicit Integration methods.

L = 45 T = 15 P = 0 C =4

OUTCOMES:

- Ability to apply the concepts of sparse matrix for large scale power system analysis
- Ability to analyze power system studies that needed for the transmission system planning.

REFERENCES:

1. A.J.Wood and B.F.Wollenberg, "Power Generation Operation and Control", John Wiley and sons, New York, 1996.
2. W.F.Tinney and W.S.Meyer, "Solution of Large Sparse System by Ordered Triangular Factorization" IEEE Trans. on Automatic Control, Vol : AC-18, pp:333346 Aug 1973.
3.K.Zollenkopf, "Bi-Factorization: Basic Computational Algorithm and Programming Techniques ; pp:75-96 ; Book on "Large Sparse Set of Linear Systems" Editor: J.K.Rerd,Academic Press, 1971.
4. M.A.Pai," Computer Techniques in Power System Analysis",Tata McGraw-Hill Publishing Company Limited, New Delhi, 2006.
5. G W Stagg , A.H El. Abiad, "Computer Methods in Power System Analysis", McGraw Hill, 1968.
6. P.Kundur, "Power System Stability and Control", McGraw Hill, 1994.

22272C14- ECONOMIC OPERATIONS OF POWER SYSTEMS

3 1 0 4

1. INTRODUCTION 9

Planning and operational problems of power systems – review of economic dispatch and calculation using B matrix loss formula – use of participation factors in on line economic dispatch.

2. OPTIMAL POWER FLOW PROBLEM 9

Real and reactive power control variables – operation and security constraints and their limits – general OPF problem with different objective functions – formulation – cost loss minimization using Dommel and Tinney's method and SLP – development of model and algorithm – MVAR planning – optimal sitting and sizing of capacitors using SLR method – interchange evaluation using SLP.

3. HYDRO THERMAL SCHEDULING 9

Problems definition and mathematical model of long and short term problems – discretization – dynamic and incremental dynamic programming – methods of local variation – hydro thermal system with pumped hydro units – solution by local variation treating pumped hydro unit for load management and spinning reserve.

4. UNIT COMMITMENT 9

Constraints in unit commitment – solution by priority list method – dynamic programming method – backward and forward – restricted search range.

5. MAINTENANCE SCHEDULING 9

Factors considered in maintenance scheduling for generating units – turbines – boilers – introduction to maintenance scheduling using mathematical programming.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Allen J.Wood and Bruce F.Wollenberg, "Power generation and control", John Wiley & Sons, New York, 1984.
2. Krichmayer L., "Economic operation of power systems", John Wiley and sons Inc, New York, 1958.
3. Krichmayer L.K, "Economic control of Interconnected systems", Jhon Wiley and sons Inc, New York, 1959.
4. Elgerd O.I., "Electric energy systems theory – an introduction", McGraw Hill, New Delhi, 1971.

22272C15- HVDC AND FACTS

3 1 0 4

OBJECTIVES:

- To emphasis the need for FACTS controllers.
- To learn the characteristics, applications and modeling of series and controllers.
- To analyze the interaction of different FACTS controller and coordination
- To impart knowledge on operation, modelling and control of HVDC link.
- To perform steady state analysis of AC/DC system.

UNIT I INTRODUCTION 9

Review of basics of power transmission networks-control of power flow in AC transmission line- Analysis of uncompensated AC Transmission line- Passive reactive power compensation: Effect of series and shunt compensation at the mid-point of the line on power transfer- Need for FACTS controllers- types of FACTS controllers. Comparison of AC & DC Transmission, Applications of DC Transmission Topologies.

UNIT II SVC & STATCOM 9

Configuration of SVC- voltage regulation by SVC- Modelling of SVC for load flow analysisDesign of SVC to regulate the mid-point voltage of a SMIB system- Applications Static synchronous compensator (STATCOM)- Operation of STATCOM – Voltage regulation – Power flow control with STATCOM.

UNIT III TCSC and SSSC 9

Concepts of Controlled Series Compensation- Operation of TCSC - Analysis of TCSC operation - Modelling of TCSC for load flow studies - Static synchronous series compensator (SSSC)- Operation of SSSC - Modelling of SSSC for power flow – operation of Unified power flow controllers(UPFC).

UNIT IV ANALYSIS OF HVDC LINK 9

Simplified analysis of six pulse Graetz bridge – Charecteristics - Analysis of converter operations – Commutation overlap – Equivalence circuit of bipolar DC transmission link – Modes of operation – Mode ambiguity – Different firing angle controllers – Power flow control.

UNIT V POWER FLOW ANALYSIS IN AC/DC SYSTEMS 9

Per unit system for DC Quantities - Modelling of DC links - Solution of DC load flow - Solution of AC-DC power flow – Unified and Sequential methods.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will be able to refresh on basics of power transmission networks and need for FACTS controllers
- Learners will understand the significance about different voltage source converter based FACTS controllers
- Learners will understand the significance of HVDC converters and HVDC system control
- Learners will attain knowledge on AC/DC power flow analysis

REFERENCES

1. Mohan Mathur, R., Rajiv. K. Varma, "Thyristor – Based Facts Controllers for Electrical Transmission Systems", IEEE press and John Wiley & Sons, Inc.

2. K.R.Padiyar, “FACTS Controllers in Power Transmission and Distribution”, New Age International (P) Ltd., Publishers, New Delhi, Reprint 2008.
3. K.R.Padiyar, “HVDC Power Transmission Systems”, New Age International (P) Ltd., New Delhi, 2002.
4. J.Arrillaga, “High Voltage Direct Current Transmission”, Peter Pregrinus, London, 1983.
5. V.K.Sood, “HVDC and FACTS controllers- Applications of Static Converters in Power System”, Kluwer Academic Publishers 2004

22272L17- POWER SYSTEM SIMULATION LABORATORY 0 0 3 3

OBJECTIVES:

- To have hands on experience on various system studies and different techniques used
- for system planning using Software packages
- To perform the dynamic analysis of power system
-

LIST OF EXPERIMENTS

1. Power flow analysis by Newton-Raphson method and Fast decoupled method

2. Transient stability analysis of single machine-infinite bus system using classical machine model

3. Contingency analysis: Generator shift factors and line outage distribution factors

4. Economic dispatch using lambda-iteration method

5. Unit commitment: Priority-list schemes and dynamic programming

6. State Estimation (DC)

7. Analysis of switching surge using EMTP: Energisation of a long distributed- parameter line

8. Analysis of switching surge using EMTP : Computation of transient recovery voltage

9. Simulation and Implementation of Voltage Source Inverter

10. Digital Over Current Relay Setting and Relay Coordination using Suitable software packages

11 Co-ordination of over-current and distance relays for radial line protection

TOTAL: 60 PERIODS

OUTCOMES:

- Upon Completion of the course, the students will be able to:
- Analyze the power flow using Newton-Raphson method and Fast decoupled method.
- Perform contingency analysis & economic dispatch
- Set Digital Over Current Relay and Coordinate Relay

22272C21- EHV POWER TRANSMISSION

3 1 0 4

1. INTRODUCTION 9

Standard transmission voltages – different configurations of EHV and UHV lines – average values of line parameters – power handling capacity and line loss – costs of transmission lines and equipment – mechanical considerations in line performance.

2. CALCULATION OF LINE PARAMETERS 9

Calculation of resistance, inductance and capacitance for multi-conductor lines – calculation of sequence inductances and capacitances – line parameters for different modes of propagation – resistance and inductance of ground return, numerical example involving a typical 400/220kV line using line constant program.

3. VOLTAGE GRADIENTS OF CONDUCTORS 9

Charge-potential relations for multi-conductor lines – surface voltage gradient on conductors – gradient factors and their use – distribution of voltage gradient on sub conductors of bundle - voltage gradients on conductors in the presence of ground wires on towers.

4. CORONA EFFECTS 9

Power losses and audible losses: I R loss and corona loss - audible noise generation and characteristics - limits for audible noise - Day-Night equivalent noise level- radio interference: corona pulse generation and properties - limits for radio interference fields

5. ELECTROSTATIC FIELD OF EHV LINES 9

Effect of EHV line on heavy vehicles - calculation of electrostatic field of AC lines- effect of high field on humans, animals, and plants - measurement of electrostatic fields - electrostatic Induction in unenergised circuit of a D/C line - induced voltages in insulated ground wires - electromagnetic interference

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Rakosh Das Begamudre, “Extra High Voltage AC Transmission Engineering”, Second Edition, New Age International Pvt. Ltd., 1990.
2. Power Engineer’s Handbook, Revised and Enlarged 6th Edition, TNEB Engineers’ Association, October 2002.
3. Microtran Power System Analysis Corporation, Microtran Reference Manual, Vancouver Canada. (Website: www.microtran.com).

22272C22 POWER SYSTEM CONTROL 3 1 0 4

1. AUTOMATIC GENERATION CONTROL 9

Plant and system level control problem – ALFC of single area system modeling state and transient response – EDC control loop – ALFC of multi area system – modeling – static and transient response of two area system development of state variable model – two area system – AGC system design Kalman's method.

2. AUTOMATIC VOLTAGE CONTROL 9

Modeling of AVR loop – components – dynamic and static analysis – stability compensation – system level voltage control using OLTC, capacitor and generator voltages – expert system application for system voltage control.

3. SECURITY CONTROL CONCEPT 9

System operating states by security control functions – monitoring evaluation of system state by contingency analysis – corrective controls (preventive, emergency and restorative) – islanding scheme.

4. STATE ESTIMATION 9

Least square estimation – basic solution – sequential form of solution – static state estimation of power system by different algorithms – tracking state estimation of power system-computation consideration – external equivalency. Treatment of bad data and on line load flow analysis.

5. COMPUTER CONTROL OF POWER SYSTEM 9

Energy control center – various levels – national – regional and state level SCADA system – computer configuration – functions, monitoring, data acquisition and controls – EMS system – software in EMS system. Expert system applications for power system operation.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Kundur.P., "power system stability and control", McGraw Hill, 1994.
2. Anderson P.M., and Fouad A.A, "power system control and stability", Galgotia publication, New Delhi, 1981.
3. Taylor C.W., "power systems voltage stability", McGraw Hill, New Delhi, 1993.
4. IEEE recommended practice for excitation system models for power system stability studies, IEEE standard 421.5, 1992.
5. Kimbark E.W., "power system stability", Vol.3., Synchronous machines, John Wiley and sons, 1956.
6. T.V Custem, C.Vournas, "voltage stability of power system", Kluwer Acadamic Publishers, 1998.
7. Elgerd O.L., "Elctric energy systems theory – an introduction", McGraw Hill, New Delhi, 1971.

22272C23- ADVANCED POWER SYSTEM PROTECTION

3 1 0 4

OBJECTIVES:

- To illustrate concepts of transformer protection
- To describe about the various schemes of Over current protection
- To analyze distance and carrier protection
- To familiarize the concepts of Generator protection and Numerical protection

UNIT I OVER CURRENT & EARTH FAULT PROTECTION 9

Zones of protection – Primary and Backup protection – operating principles and Relay Construction - Time – Current characteristics-Current setting – Time setting-Over current protective schemes –Concept of Coordination - Protection of parallel / ring feeders – Reverse power or directional relay –Polarisation Techniques – Cross Polarisation – Quadrature Connection -Earth fault and phase fault protection - Combined Earth fault and phase fault protection scheme - Phase fault protective - scheme directional earth fault relay - Static over current relays – Numerical over – current protection; numerical coordination example for a radial feeder

UNIT II TRANSFORMER & BUSBAR PROTECTION 9

Types of transformers –Types of faults in transformers- Types of Differential Protection – High Impedance – External fault with one CT saturation – Actual behaviors of a protective CT – Circuit model of a saturated CT - Need for high impedance – Disadvantages - Percentage Differential Bias Characteristics – Vector group & its impact on differential protection - Inrush phenomenon – Zero Sequence filtering – High resistance Ground Faults in Transformers – Restricted Earth fault Protection - Inter-turn faults in transformers – Incipient faults in transformers - Phenomenon of overfluxing in transformers – Transformer protection application chart. Differential protection of busbars external and internal fault - Supervisory relay-protection of three – Phase busbars – Numerical examples on design of high impedance busbar differential scheme –Biased Differential Characteristics – Comparison between Transformer differential & Busbar differential.

UNIT III DISTANCE AND CARRIER PROTECTION OF TRANSMISSION LINES 9

Drawback of over – Current protection – Introduction to distance relay – Simple impedance relay – Reactance relay – mho relays comparison of distance relay – Distance protection of a three – Phase line-reasons for inaccuracy of distance relay reach - Three stepped distance protection Trip contact configuration for the three - Stepped distance protection - Three-stepped protection f three-phase line against all ten shunt faults - Impedance seen from relay side - Three-stepped protection of double end fed lines-need for carrier – Aided protection – Various options for a carrier –Coupling and trapping the carrier into the desired line section - Unit type carrier aided directional comparison relaying – Carrier aided distance schemes for acceleration of zone II; numerical example for a typical distance protection scheme for a transmission line.

UNIT IV GENERATOR PROTECTION 9

Electrical circuit of the generator –Various faults and abnormal operating conditions – Stator Winding Faults – Protection against Stator (earth) faults – third harmonic voltage protection – Rotor fault – Abnormal operating conditions - Protection against Rotor faults – Potentiometer Method – injection method – Pole slipping – Loss of excitation – Protection against Mechanical faults; Numerical examples for typical generator protection schemes

UNIT V NUMERICAL PROTECTION

Introduction–Block diagram of numerical relay - Sampling theorem- Correlation with a reference (LES) technique-Digital filtering-numerical over - Current protection– Numerical transformer differential protection-Numerical distance protection of transmission line

L = 45 T = 15 P = 0 C =4

OUTCOMES:

- Learners will be able to understand the various schemes available in Transformer
- protection
- Learners will have knowledge on Overcurrent protection.
- Learners will attain knowledge about Distance and Carrier protection in transmission lines.
- Learners will understand the concepts of Generator protection.
- Learners will attain basic knowledge on substation automation.

REFERENCES

1 Y.G. Paithankar and S.R Bhide, “Fundamentals of Power System Protection”, Prentice-Hall of India, 2003

2 Badri Ram and D.N. Vishwakarma, “Power System Protection and Switchgear”, Tata McGraw- Hill Publishing Company, 2002.

3 T.S.M. Rao, “Digital Relay / Numerical relays”, Tata McGraw Hill, New Delhi, 1989.

4 P.Kundur, “Power System Stability and Control”, McGraw-Hill, 1993.

22272L26 ADVANCED POWER SYSTEM SIMULATION LABORATORY

LT P C

0 0 4 2

OBJECTIVES:

- To analyze the effect of FACTS controllers by performing steady state analysis.
- To have hands on experience on different wind energy conversion technologies

LIST OF EXPERIMENTS

1. Small-signal stability analysis of single machine-infinite bus system using classical machine model
2. Small-signal stability analysis of multi-machine configuration with classical machine model
3. Induction motor starting analysis
4. Load flow analysis of two-bus system with STATCOM
5. Transient analysis of two-bus system with STATCOM
6. Available Transfer Capability calculation using an existing load flow program
7. Study of variable speed wind energy conversion system- DFIG
8. Study of variable speed wind energy conversion system- PMSG
9. Computation of harmonic indices generated by a rectifier feeding a R-L load
10. Design of active filter for mitigating harmonics

22272C31- ELECTRICAL TRANSIENTS IN POWER SYSTEMS

3 1 0 4

1. TRAVELLING WAVES ON TRANSMISSION LINE 9

Lumped and Distributed Parameters – Wave Equation – Reflection, Refraction, Behavior of Travelling waves at the line terminations – Lattice Diagrams – Attenuation and Distortion – Multi-conductor system and Velocity wave.

2. COMPUTATION OF POWER SYSTEM TRANSIENTS 9

Principle of digital computation – Matrix method of solution, Modal analysis, Z transforms, Computation using EMTP – Simulation of switches and non-linear elements.

3. LIGHTNING, SWITCHING AND TEMPORARY OVERVOLTAGES 9

Lightning: Physical phenomena of lightning – Interaction between lightning and power system – Factors contributing to line design – Switching: Short line or kilometric fault – Energizing transients - closing and re-closing of lines - line dropping, load rejection - Voltage induced by fault – Very Fast Transient Overvoltage (VFTO)

4. BEHAVIOUR OF WINDING UNDER TRANSIENT CONDITION 9

Initial and Final voltage distribution - Winding oscillation - traveling wave solution - Behavior of the transformer core under surge condition – Rotating machine – Surge in generator and motor

5. INSULATION CO-ORDINATION 9

Principle of insulation co-ordination in Air Insulated substation (AIS) and Gas Insulated Substation (GIS), insulation level, statistical approach, co-ordination between insulation and protection level –overvoltage protective devices – lightning arresters, substation earthing.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Pritindra Chowdhari, “Electromagnetic transients in Power System”, John Wiley and Sons Inc., 1996.
2. Allan Greenwood, “Electrical Transients in Power System”, Wiley & Sons Inc. New York, 1991.
3. Klaus Ragaller, “Surges in High Voltage Networks”, Plenum Press, New York, 1980.
4. Rakosh Das Begamudre, “Extra High Voltage AC Transmission Engineering”, (Second edition) Newage International (P) Ltd., New Delhi, 1990.
5. Naidu M S and Kamaraju V, “High Voltage Engineering”, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.
6. IEEE Guide for safety in AC substation grounding IEEE Standard 80-2000.
7. Working Group 33/13-09 (1988), ‘Very fast transient phenomena associated with Gas Insulated System’, CIGRE, 33-13, pp. 1-2

22272E16A – ANALYSIS of INVERTERS **L T P C**
3 0 0 3

OBJECTIVES:

- To determine the operationand characteristics of controlled rectifiers.
- To apply switching techniques and basic topologies of DC-DC switching regulators.
- To introduce the design of power converter components.
- To provide an in depth knowledge about resonant converters.
- To comprehend the conceptsof AC-AC power converters and their applications.

UNIT I SINGLE PHASE & THREE PHASE CONVERTERS 9

Principle of phase controlled converter operation – single-phase full converter and semi-converter (RL,RLE load)- single phase dual converter – Three phase operation full converter and semi-converter (R,RL,RLE load) – reactive power – power factor improvement techniques – PWM rectifiers.

UNIT II DC-DC CONVERTERS 9

Limitations of linear power supplies, switched mode power conversion, Non-isolated DC-DC converters: operation and analysis of Buck, Boost, Buck-Boost, Cuk& SEPIC – under continuous and discontinuous operation – Isolated converters: basic operation of Flyback, Forward and Push-pull topologies.

UNIT III DESIGN OF POWER CONVERTER COMPONENTS 9

Introduction to magnetic materials- hard and soft magnetic materials –types of cores , copper windings – Design of transformer –Inductor design equations –Examples of inductor design for buck/flyback converter-selection of output filter capacitors – selection of ratings for devices – input filter design.

UNIT IV RESONANT DC-DC CONVERTERS 9

Switching loss, hard switching, and basic principles of soft switching- classification of resonant converters- load resonant converters – series and parallel – resonant switch converters – operation and analysis of ZVS, ZCS converters comparison of ZCS/ZVS-Introduction to ZVT/ZCT PWM converters.

UNIT V AC-AC CONVERTERS 9

Principle of on-off and phase angle control – single phase ac voltage controller – analysis with R & RL load – Three phase ac voltage controller – principle of operation of cyclo converter – single phase and three phase cyclo converters – Introduction to matrix converters.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course the student will be able to:

- Analyze various single phase and three phase power converters
- Select and design dc-dc converter topologies for a broad range of power conversion applications.
- Develop improved power converters for any stringent application requirements.
- Design ac-ac converters for variable frequency applications.

TEXT BOOKS:

1 Ned Mohan,T.MUndeland and W.P Robbin, “Power Electronics: converters, Application and design” John Wiley and sons.Wiley India edition, 2006.

2 Rashid M.H., “Power Electronics Circuits, Devices and Applications ", Prentice Hall India, Third Edition, New Delhi, 2004.

3 P.C. Sen, “Modern Power Electronics”, Wheeler Publishing Co, First Edition, New Delhi, 1998.

4 P.S.Bimbra, “Power Electronics”, Khanna Publishers, Eleventh Edition, 2003

5 Simon Ang, Alejandro Oliva, “Power-Switching Converters, Second Edition, CRC Press, Taylor & Francis Group, 2010

6 V.Ramanarayanan, “Course material on Switched mode power conversion”, 2007

7 Alex Van den Bossche and VencislavCekovValchev, “Inductors and TransformersforPowerElectronics”, CRC Press, Taylor & Francis Group, 2005

8 W. G. Hurley and W. H.Wolfle, “Transformers and Inductors for Power Electronics Theory, Design and Applications”, 2013 John Wiley & Sons Ltd.

9 Marian.K.Kazimierczuk and DariuszCzarkowski, “Resonant Power Converters”, John Wiley & Sons limited, 2011

22272E16B - MODELLING AND ANALYSIS OF ELECTRICAL MACHINES

3 1 0 4

UNIT I PRINCIPLES OF ELECTROMAGNETIC ENERGY CONVERSION

General expression of stored magnetic energy - co-energy and force/torque - example using single and doubly excited system.

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UNIT II BASIC CONCEPTS OF ROTATING MACHINES

Calculation of air gap M.M.F. - per phase machine inductance using physical machine data - voltage and torque equation of D.C. machine - three phase symmetrical induction machine and salient pole synchronous machines in phase variable form.

UNIT III INTRODUCTION TO REFERENCE FRAME THEORY

Static and rotating reference frames - transformation relationships - examples using static symmetrical three phase R, R-L, R-L-M and R-L-C circuits - application of reference frame theory to three phase symmetrical induction and synchronous machines - dynamic direct and quadrature axis model in arbitrarily rotating reference frames - voltage and torque equations - derivation of steady state phasor relationship from dynamic model - generalized theory of rotating electrical machine and Kron's primitive machine.

UNIT IVD ETERMINATIONOF SYNCHRONOUS MACHINE DYNAMIC EQUIVALENT CIRCUIT PARAMETERS

Standard and derived machine time constants - frequency response test - analysis and dynamic modeling of two phase asymmetrical induction machine and single phase induction machine.

UNIT V SPECIAL MACHINES

Permanent magnet synchronous machine - surface permanent magnet (square and sinusoidal back E.M.F. type) and interior permanent magnet machines - construction and operating principle - dynamic modeling and self controlled operation - analysis of switch reluctance motors.

L = 45 T = 15 P = 0 C =4

TEXT BOOKS

1. Charles Kingsley, A.E. Fitzgerald Jr. and Stephen D. Umans, 'Electric Machinery', Tata McGraw-Hill, Fifth Edition, 1992.
2. R. Krishnan, 'Electric Motor & Drives: Modelling, Analysis and Control', Prentice Hall of India, 2001.

REFERENCES

1. C.V. Jones, 'The Unified Theory of Electrical Machines', Butterworth, 1967.
2. T.J.E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives' Clarendon Press, 1989.

22272E16C ADVANCED POWER SYSTEM DYNAMICS L T P C

OBJECTIVES: 3 0 0 3

- To perform transient stability analysis using unified algorithm.
- To impart knowledge on sub-synchronous resonance and oscillations
- To analyze voltage stability problem in power system.
- To familiarize the methods of transient stability enhancement

UNIT I TRANSIENT STABILITY ANALYSIS 9

Review of numerical integration methods: Euler and Fourth Order Runge-Kutta methods, Numerical stability and implicit methods, Interfacing of Synchronous machine (variable voltage) model to the transient stability algorithm (TSA) with partitioned – explicit and implicit approaches – Interfacing SVC with TSA-methods to enhance transient stability

UNIT II UNIFIED ALGORITHM FOR DYNAMIC ANALYSIS OF POWER SYSTEMS 9

Need for unified algorithm- numerical integration algorithmic steps-truncation error-variable step size – handling the discontinuities- numerical stability- application of the algorithm for transient. Mid-term and long-term stability simulations

UNIT III SUBSYSNCHRONOUS RESONANCE (SSR) AND OSCILLATIONS 9

Sub synchronous Resonance (SSR) – Types of SSR - Characteristics of series –Compensated transmission systems –Modeling of turbine-generator-transmission network- Self-excitation due to induction generator effect – Torsional interaction resulting in SSR – Methods of analyzing SSR – Numerical examples illustrating instability of subsynchronous oscillations – time-domain simulation of subsynchronous resonance – EMTP with detailed synchronous machine model- Turbine Generator Torsional Characteristics: Shaft system model – Examples of torsional characteristics – Torsional Interaction with Power System Controls: Interaction with generator excitation controls – Interaction with speed governors – Interaction with nearby DC converters

UNIT IV TRANSMISSION, GENERATION AND LOAD ASPECTS OF VOLTAGE STABILITY ANALYSIS 9

Review of transmission aspects – Generation Aspects: Review of synchronous machine theory – Voltage and frequency controllers – Limiting devices affecting voltage stability – Voltage-reactive power characteristics of synchronous generators – Capability curves – Effect of machine limitation on deliverable power – Load Aspects – Voltage dependence of loads – Load restoration dynamics – Induction motors – Load tap changers – Thermostatic load recovery – General aggregate load models.

UNIT V ENHANCEMENT OF TRANSIENT STABILITY AND COUNTER MEASURES FOR SUB SYNCHRONOUS RESONANCE 9

Principle behind transient stability enhancement methods: high-speed fault clearing, reduction of transmission system reactance, regulated shunt compensation, dynamic braking, reactor switching, independent pole-operation of circuit-breakers, single-pole switching, fast-valving, high-speed excitation systems; NGH damper scheme.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will be able to understand the various schemes available in Transformer protection
- Learners will have knowledge on Over current protection.
- Learners will attain knowledge about Distance and Carrier protection in transmission lines.
- Learners will understand the concepts of Busbar protection.
- Learners will attain basic knowledge on numerical protection techniques

REFERENCES

1 R.Ramnujam," Power System Dynamics Analysis and Simulation", PHI Learning Private Limited, New Delhi, 2009
2 T.V. Cutsem and C.Vournas, "Voltage Stability of Electric Power Systems", Kluwer publishers,1998
3 P. Kundur, "Power System Stability and Control", McGraw-Hill, 1993.
4 H.W. Dommel and N.Sato, "Fast Transient Stability Solutions," IEEE Trans., Vol. PAS-91, pp, 1643-1650, July/August 1972.
5 Roderick J . Frowd and J. C. Giri, "Transient stability and Long term dynamics unified", IEEE Trans., Vol 101, No. 10, October 1982.
6 M.Stubbe, A.Bihain,J.Deuse, J.C.Baader, "A New Unified software program for the study of the dynamic behaviour of electrical power system" IEEE Transaction, Power Systems, Vol.4.No.1,Feb:1989 Pg.129 to 138

22272E16D ANALYSIS AND COMPUTATION OF ELECTROMAGNETIC TRANSIENTS IN POWER SYSTEMS

L T P C
3 0 0 3

OBJECTIVES:

- To understand the various types of transients and its analysis in power system.
- To learn about modeling and computational aspects transients computation

UNIT I REVIEW OF TRAVELLING WAVE PHENOMENA 9

Lumped and Distributed Parameters – Wave Equation – Reflection, Refraction, Behaviour of Travelling waves at the line terminations – Lattice Diagrams – Attenuation and Distortion.

UNIT II LIGHTNING, SWITCHING AND TEMPORARY OVERVOLTAGES 9

Lightning overvoltages: interaction between lightning and power system- ground wire voltage and voltage across insulator; switching overvoltage: Short line or kilometric fault, energizing transients - closing and re-closing of lines, methods of control; temporary overvoltages: line dropping, load rejection; voltage induced by fault; very fast transient overvoltage (VFTO).

UNIT III PARAMETERS AND MODELING OF OVERHEAD LINES 9

Review of line parameters for simple configurations: series resistance, inductance and shunt capacitance; bundle conductors : equivalent GMR and equivalent radius; modal propagation in transmission lines: modes on multi-phase transposed transmission lines, α-β-0 transformation and symmetrical components transformation, modal impedances; analysis of modes on untransposed lines; effect of ground return and skin effect; transposition schemes;

UNIT V FAST TRANSIENTS PHENOMENON IN AIS AND GIS 9

Digital computation of line parameters: why line parameter evaluation programs? Salient features of a typical line parameter evaluation program; constructional features of that affect transmission line parameters; line parameters for physical and equivalent phase conductors elimination of ground wires bundling of conductors; principle of digital computation of transients: features and capabilities of electromagnetic transients program; steady state and time step solution modules: basic solution methods; case studies on simulation of various types of transients

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will be able to model over head lines, cables and transformers.
- Learners will be able to analyze power system transients.

REFERENCES

1 Allan Greenwood, "Electrical Transients in Power System", Wiley & Sons Inc. New York, 1991.

2 R. Ramanujam, "Computational Electromagnetic Transients: Modeling, Solution Methods and Simulation", I.K. International Publishing House Pvt. Ltd, New Delhi, 2014.

3 Naidu M S and Kamaraju V, "High Voltage Engineering", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.

22272E24A SMART GRID LTPC

3003

OBJECTIVES:

- To Study about Smart Grid technologies, different smart meters and advanced metering infrastructure.
- To familiarize the power quality management issues in Smart Grid.
- To familiarize the high performance computing for Smart Grid applications

UNIT I INTRODUCTION TO SMART GRID 9

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, National and International Initiatives in Smart Grid.

UNIT II SMART GRID TECHNOLOGIES 9

Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/Var control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV).

UNIT III SMART METERS AND ADVANCED METERING INFRASTRUCTURE 9

Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU), Intelligent Electronic Devices (IED) & their application for monitoring & protection.

UNIT IV POWER QUALITY MANAGEMENT IN SMART GRID 9

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

UNIT V HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS 9

Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will develop more understanding on the concepts of Smart Grid and its present developments.
- Learners will study about different Smart Grid technologies.
- Learners will acquire knowledge about different smart meters and advanced metering infrastructure.
- Learners will have knowledge on power quality management in Smart Grids
- Learners will develop more understanding on LAN, WAN and Cloud Computing for Smart Grid application

REFERENCES

1 Stuart Borlase "Smart Grid :Infrastructure, Technology and Solutions", CRC Press 2012.

2 Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley 2012.

3 Vehbi C. Güngör, DilanSahin, TaskinKocak, Salih Ergüt, Concettina Buccella, Carlo Cecati, and Gerhard P. Hancke, "Smart Grid Technologies: Communication Technologies and Standards" IEEE Transactions On Industrial Informatics, Vol. 7, No. 4, November 2011.

4 Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang "Smart Grid – The New and Improved Power Grid: A Survey" , IEEE Transaction on Smart Grids, vol. 14, 2012.

22272E24B SOLAR AND ENERGY STORAGE SYSTEMS LTPC

3003

OBJECTIVES:

- To Study about solar modules and PV system design and their applications
- To Deal with grid connected PV systems
- To Discuss about different energy storage systems

UNIT I INTRODUCTION 9

Characteristics of sunlight – semiconductors and P-N junctions –behavior of solar cells – cell properties – PV cell interconnection

UNIT II STAND ALONE PV SYSTEM 9

Solar modules – storage systems – power conditioning and regulation - MPPT- protection – stand alone PV systems design – sizing

UNIT III GRID CONNECTED PV SYSTEMS 9

PV systems in buildings – design issues for central power stations – safety – Economic aspect – Efficiency and performance - International PV programs

UNIT IV ENERGY STORAGE SYSTEMS 9

Impact of intermittent generation – Battery energy storage – solar thermal energy storage – pumped hydroelectric energy storage

UNIT V APPLICATIONS 9

Water pumping – battery chargers – solar car – direct-drive applications –Space – Telecommunications.

TOTAL : 45 PERIODS

OUTCOMES:

- Students will develop more understanding on solar energy storage systems
- Students will develop basic knowledge on standalone PV system
- Students will understand the issues in grid connected PV systems
- Students will study about the modeling of different energy storage systems and their performances
- Students will attain more on different applications of solar energy

REFERENCES

1 Solanki C.S., "Solar Photovoltaics: Fundamentals, Technologies And Applications", PHI Learning Pvt. Ltd.,2015.

2 Stuart R.Wenham, Martin A.Green, Muriel E. Watt and Richard Corkish, “Applied Photovoltaics”, 2007,Earthscan, UK. Eduardo Lorenzo G. Araujo, “Solar electricity engineering of photovoltaic systems”, Progensa,1994.

3 Frank S. Barnes & Jonah G. Levine, “Large Energy storage Systems Handbook”, CRC Press, 2011.

4 McNeils, Frenkel, Desai, “Solar & Wind Energy Technologies”, Wiley Eastern, 1990

5 S.P. Sukhatme , “Solar Energy”, Tata McGraw Hill,1987.

22272E24C POWER SYSTEM RELIABILITY L T P C

OBJECTIVES: 3 0 0 3

- To introduces the objectives of Load forecasting.
- To study the fundamentals of Generation system, transmission system and Distribution system reliability analysis
- To illustrate the basic concepts of Expansion planning

UNIT I LOAD FORECASTING 9

Objectives of forecasting - Load growth patterns and their importance in planning - Load forecasting Based on discounted multiple regression technique-Weather sensitive load forecasting-Determination of annual forecasting-Use of AI in load forecasting.

UNIT II GENERATION SYSTEM RELIABILITY ANALYSIS 9

Probabilistic generation and load models- Determination of LOLP and expected value of demand not served –Determination of reliability of ISO and interconnected generation systems

UNIT III TRANSMISSION SYSTEM RELIABILITY ANALYSIS 9

Deterministic contingency analysis-probabilistic load flow-Fuzzy load flow probabilistic transmission system reliability analysis-Determination of reliability indices like LOLP and expected value of demand not served

UNIT IV EXPANSION PLANNING 9

Basic concepts on expansion planning-procedure followed for integrate transmission system planning, current practice in India-Capacitor placer problem in transmission system and radial distributions system.

UNIT V DISTRIBUTION SYSTEM PLANNING OVERVIEW 9

Introduction, sub transmission lines and distribution substations-Design primary and secondary systems-distribution system protection and coordination of protective devices.

TOTAL: 45 PERIODS

OUTCOMES:

- Students will develop the ability to learn about load forecasting.
- Students will learn about reliability analysis of ISO and interconnected systems.
- Students will understand the concepts ot Contingency analysis and Probabilistic Load flow Analysis
- Students will be able to understand the concepts of Expansion planning
- Students will have knowledge on the fundamental concepts of the Distribution system planning

REFERENCES

1 Roy Billinton & Ronald N. Allan, "Reliability Evaluation of Power Systems" Springer Publication,

2 R.L. Sullivan, "Power System Planning", Tata McGraw Hill Publishing Company Ltd 1977.

3 X. Wang & J.R. McDonald, "Modern Power System Planning", McGraw Hill Book Company 1994.

4 T. Gonen, "Electrical Power Distribution Engineering", McGraw Hill Book Company 1986.

5 B.R. Gupta, "Generation of Electrical Energy",S.Chand Publications 1983.

22272E24D DISTRIBUTED GENERATION AND MICROGRID **L T P C**

OBJECTIVES: **3 0 0 3**

- To illustrate the concept of distributed generation
- To analyze the impact of grid integration.
- To study concept of Microgrid and its configuration

UNIT I INTRODUCTION 9

Conventional power generation: advantages and disadvantages, Energy crises, Non-conventional energy (NCE) resources: review of Solar PV, Wind Energy systems, Fuel Cells, micro-turbines, biomass, and tidal sources.

UNIT II DISTRIBUTED GENERATIONS (DG) 9

Concept of distributed generations, topologies, selection of sources, regulatory standards/ framework, Standards for interconnecting Distributed resources to electric power systems: IEEE 1547. DG installation classes, security issues in DG implementations. Energy storage elements: Batteries, ultra-capacitors, flywheels. Captive power plants

UNIT III IMPACT OF GRID INTEGRATION 9

Requirements for grid interconnection, limits on operational parameters,: voltage, frequency, THD, response to grid abnormal operating conditions, islanding issues. Impact of grid integration with NCE sources on existing power system: reliability, stability and power quality issues.

UNIT IV BASICS OF A MICROGRID 9

Concept and definition of microgrid, microgrid drivers and benefits, review of sources of microgrids, typical structure and configuration of a microgrid, AC and DC microgrids, Power Electronics interfaces in DC and AC microgrids

UNIT V CONTROL AND OPERATION OF MICROGRID 9

Modes of operation and control of microgrid: grid connected and islanded mode, Active and reactive power control, protection issues, anti-islanding schemes: passive, active and communication based techniques, microgrid communication infrastructure, Power quality issues in microgrids, regulatory standards, Microgrid economics, Introduction to smart microgrids.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will attain knowledge on the various schemes of conventional and nonconventional power generation.

- Learners will have knowledge on the topologies and energy sources of distributed generation.
- Learners will learn about the requirements for grid interconnection and its impact with NCE sources
- Learners will understand the fundamental concept of Microgrid.

REFERENCES

1 Amirnaser Yezdani, and Reza Iravani, "Voltage Source Converters in Power Systems: Modeling, Control and Applications", IEEE John Wiley Publications, 2010.

2 DorinNeacsu, "Power Switching Converters: Medium and High Power", CRC Press, Taylor & Francis, 2006

3 Chetan Singh Solanki, "Solar Photo Voltaics", PHI learning Pvt. Ltd., New Delhi,2009

4 J.F. Manwell, J.G. McGowan "Wind Energy Explained, theory design and applications", Wiley publication 2010.

5 D. D. Hall and R. P. Grover, "Biomass Regenerable Energy", John Wiley, New York, 1987.

6 John Twidell and Tony Weir, "Renewable Energy Resources" Tyalor and Francis Publications, Second edition 2006.

22272E25A - WIND ENERGY CONVERSION SYSTEMS

3 1 0 4

UNIT-I INTRODUCTION: **9**

History of wind Electric generation - Darrieus wind - Horizontal and vertical axis-Wind turbine - other modern developments - Future possibilities.

UNIT-II WIND RESOURCE AND ITS POTENTIAL FOR ELECVTRIC POWER GENERATION: **9**

Power Extracted By A Wind Driven Machine - Nature and occurrence of wind characteristics and power production - variation of mean wind speed with time.

UNIT-III WIND POWER SITES AND WIND MEASUREMENTS: **9**

Average wind speed and other factors affecting choice of the site - Effect of wind direction - Measurement of wind velocity - Personal estimation without instruments- anemometers - Measurement of wind direction.

UNIT-IV WIND TURBINES WITH ASYNCHRONOUS GENERATORS AND CONTROL ASPECTS: **9**

Asynchronous systems - Ac Generators - Self excitation of Induction Generator - Single Phase operation of Induction Generator - Permanenet magnet Generators - Basic control aspects - fixed speed ratio control scheme - fixed vs variable speed operation of WECS.

UNIT-V GENERATION OF ELECTRICITY **9**

Active and reactive power - P and Q transfer in power systems - Power converters - Characteristics of Generators - Variable Speed options - Economics.

L = 45 T = 15 P = 0 C =4

REFERENCES:

1. N.G.Calvert, 'Wind Power Principles: Their Application on small scale', Charles Friffin& co. Ltd, London, 1979.
2. Gerald W.Koeppel, "Pirnam's and Power from the wind", Van Nastran Reinhold Co., London, 1979.
3. Gary L. Johnson, "Wind Energy System", Prentice hall Inc., Englewood Cliffs, New Jersey, 1985.
4. Wind energy conversion system by L. Lfreris, Prentice hall (U.K) Ltd., 1990.

22272E25B - AI TECHNIQUES TO POWER SYSTEMS

3 1 0 4

1. INTRODUCTION TO NEURAL NETWORKS 9

Basics of ANN - perceptron - delta learning rule - back propagation algorithm - multilayer feed forward network - memory models - bi-directional associative memory - Hopfield network.

2. APPLICATIONS TO POWER SYSTEM PROBLEMS 9

Application of neural networks to load forecasting - contingency analysis - VAR control - economic load dispatch.

3. INTRODUCTION TO FUZZY LOGIC 9

Crispness - vagueness - fuzziness - uncertainty - fuzzy set theory fuzzy sets - fuzzy set operations - fuzzy measures - fuzzy relations - fuzzy function - structure of fuzzy logic controller – fuzzification models - data base - rule base - inference engine defuzzification module.

4. APPLICATIONS TO POWER SYSTEMS 9

Decision making in power system control through fuzzy set theory - use of fuzzy set models of LP in power systems scheduling problems - fuzzy logic based power system stabilizer.

5. GENETIC ALGORITHM AND ITS APPLICATIONS TO POWER SYSTEMS 9

Introduction - simple genetic algorithm - reproduction - crossover - mutation – advanced operators in genetic search - applications to voltage control and stability studies.

L = 45 T = 15 P = 0 C =4

REFERENCES:

1. James A. Freeman and Skapura.B.M „Neural Networks - Algorithms Applications and Programming Techniques‟, Addison Wesley, 1990.
2. George Klir and Tina Folger.A, „Fuzzy sets, Uncertainty and Information‟, Prentice Hall of India, 1993.
3. Zimmerman.H.J,„Fuzzy Set Theory and its Applications‟, Kluwer Academic Publishers 1994.
4. IEEE tutorial on „Application of Neural Network to Power Systems‟, 1996.
5. Loi Lei Lai, „Intelligent System Applications in Power Engineering‟, John Wiley & SonsLtd.,1998.

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22272E25C **ELECTRICAL DISTRIBUTION SYSTEM** **L T P C**

OBJECTIVES: **3 0 0 3**

- To provide knowledge about the distribution system electrical characteristics
- To gain knowledge about planning and designing of distribution system
- To analyze power quality in distribution system
- To analyze the power flow in balanced and unbalanced system

UNIT I **INTRODUCTION** **9**

Distribution System-Distribution Feeder Electrical Characteristics-Nature of Loads : Individual Customer Load, Distribution Transformer Loading and Feeder Load -Approximate Method of Analysis: Voltage Drop, Line Impedance, "K" Factors, Uniformly Distributed Loads and Lumping Loads in Geometric Configurations.

UNIT II **DISTRIBUTION SYSTEM PLANNING** **9**

Factors effecting planning, present techniques, planning models(Short term planning, long term planning and dynamic planning), planning in the future, future nature of distribution planning, Role of computer in Distribution planning. Load forecast, Load characteristics and Load models.

UNIT III **DISTRIBUTION SYSTEM LINE MODEL** **9**

Exact Line Segment Model-Modified Line Model- Approximate Line Segment Model-Modified "Ladder" Iterative Technique-General Matrices for Parallel Lines.

UNIT IV **VOLTAGE REGULATION** **9**

Standard Voltage Ratings-Two-Winding Transformer Theory-Two-Winding Autotransformer-Step-Voltage Regulators: Single-Phase Step-Voltage Regulators-Three-Phase Step-Voltage Regulators- Application of capacitors in Distribution system.

UNIT V **DISTRIBUTION FEEDER ANALYSIS** **9**

Power-Flow Analysis- Ladder Iterative Technique -Unbalanced Three-Phase Distribution Feeder- Modified Ladder Iterative Technique- Load Allocation- Short-Circuit Studies.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to apply the concepts of planning and design of distribution system for utility systems
- Ability to implement the concepts of volatage control in distribution system.
- Ability to analyze the power flow in balanced and unbalanced system

REFERENCES

1. William H. Kersting," Distribution System Modeling and Analysis " CRC press 3rd edition,2012.

2. Turan Gonen, “Electric Power Distribution System Engineering”, McGraw Hill Company. 1986
3. James Northcote – Green, Robert Wilson, “Control and Automation of Electrical Power Distribution Systems”, CRC Press, New York, 2007.
4. Pabla H S, “Electrical Power Distribution Systems”, Tata McGraw Hill. 2004

22272E25D ENERGY MANAGEMENT AND AUDITING L T P C

OBJECTIVES: 3 0 0 3

- To study the concepts behind economic analysis and Load management.
- To emphasize the energy management on various electrical equipments and metering.
- To illustrate the concept of lighting systems and cogeneration.

UNIT I INTRODUCTION 9

Need for energy management - energy basics- designing and starting an energy management program – energy accounting -energy monitoring, targeting and reporting-energy audit process.

UNIT II ENERGY COST AND LOAD MANAGEMENT 9

Important concepts in an economic analysis - Economic models-Time value of money-Utility rate structures- cost of electricity-Loss evaluation- Load management: Demand control techniques-Utility monitoring and control system-HVAC and energy management-Economic justification.

UNIT III ENERGY MANAGEMENT FOR MOTORS, SYSTEMS, AND ELECTRICAL EQUIPMENT 9

Systems and equipment- Electric motors-Transformers and reactors-Capacitors and synchronous machines.

UNIT IV METERING FOR ENERGY MANAGEMENT 9

Relationships between parameters-Units of measure-Typical cost factors- Utility meters - Timing of meter disc for kilowatt measurement - Demand meters - Paralleling of current transformers - Instrument transformer burdens-Multitasking solid-state meters - Metering location vs. requirements- Metering techniques and practical examples.

UNIT V LIGHTING SYSTEMS & COGENERATION 9

Concept of lighting systems - The task and the working space -Light sources - Ballasts - Luminaries - Lighting controls-Optimizing lighting energy - Power factor and effect of harmonics on power quality - Cost analysis techniques-Lighting and energy standards Cogeneration: Forms of cogeneration - feasibility of cogeneration- Electrical interconnection.

TOTAL : 45 PERIODS

OUTCOMES:

- Students will develop the ability to learn about the need for energy management and auditing process
- Learners will learn about basic concepts of economic analysis and load management.
- Students will understand the energy management on various electrical equipments.
- Students will have knowledge on the concepts of metering and factors influencing cost function

- Students will be able to learn about the concept of lighting systems, light sources and various forms of cogeneration

REFERENCES

1 Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, “Guide to Energy Management”, Fifth Edition, The Fairmont Press, Inc., 2006

2 Eastop T.D & Croft D.R, “Energy Efficiency for Engineers and Technologists”, Logman Scientific & Technical, 1990.

3 Reay D.A, “Industrial Energy Conservation”, 1st edition, Pergamon Press, 1977.

4 “IEEE Recommended Practice for Energy Management in Industrial and Commercial Facilities”, IEEE, 1996

5 Amit K. Tyagi, “Handbook on Energy Audits and Management”, TERI, 2003.

22272E32A - POWER ELECTRONICS APPLICATIONS IN POWER SYSTEMS

3 1 0 4

UNIT: I STATIC COMPENSATOR CONTROL 9

Theory of load compensation - voltage regulation and power factor correction - phase balance and PF correction of unsymmetrical loads - Property of static compensator - Thyristor controlled rectifier (TCR) - Thyristor Controlled Capacitor (TSC) -Saturable core reactor - Control Strategies.

UNIT: II HARMONIC CONTROL AND POWER FACTOR IMPROVEMENT 9

Input power factor for different types of converters - power factor improvement using Load and forced commutated converters.

UNIT: III VOLTAGE CONTROL USING STATIC TAP-CHANGERS 9

Conventional tap changing methods, static tap changers using Thyristor, different schemes - comparison.

UNIT: IV STATIC EXCITATION CONTROL 9

Solid state excitation of synchronous generators - Different schemes - Generex excitation systems.

UNIT: V UNINTERRUPTABLE POWER SUPPLY SYSTEM 9

Parallel, Redundant and non- redundant UPS - Ups using resonant power converters - Switch mode power supplies.

L = 45 T = 15 P = 0 C =4

TEXT BOOK

Miller. T.J.E, “Reactive power control in Electric systems”. Wiley inter science, New York, 1982.

REFRENCES

1. “Static Compensator for AC power systems”, Proc. IEE vol.128 Nov. 1981. pp 362-406.
2 “A Static alternative to the transformer on load tap changing”, IEEE Trans. On Pas, Vol.PAS-99, Jan. /Feb. 1980, pp86-89.
3. “Improvements in Thyristor controlled static on- load tap controllers for transformers”, IEEE Trans. on PAS, Vol.PAS-101, Sept.1982, pp3091-3095.
4. “Shunt Thyristor rectifiers for the Generex Excitation systems”, IEEE Trans. On PAS. PAS -96, July/August, 1977, pp1219-1325.

22272E32B- POWER SYSTEM DYNAMICS

3 1 0 4

1. SYNCHRONOUS MACHINE MODELLING 9

Schematic Diagram, Physical Description: armature and field structure, machines with multiple pole pairs, mmf waveforms, direct and quadrature axes, Mathematical Description of a Synchronous Machine: Basic equations of a synchronous machine: stator circuit equations, stator self, stator mutual and stator to rotor mutual inductances, dq0 Transformation: flux linkage and voltage equations for stator and rotor in dq0 coordinates, electrical power and torque, physical interpretation of dq0 transformation, Per Unit Representations: L_{ad}-reciprocal per unit system and that from power-invariant form of Park's transformation; Equivalent Circuits for direct and quadrature axes, Steady-state Analysis: Voltage, current and flux-linkage relationships, Phasor representation, Rotor angle, Steady-state equivalent circuit, Computation of steady-state values, Equations of Motion: Swing Equation, calculation of inertia constant, Representation in system studies, Synchronous Machine Representation in Stability Studies: Simplifications for large-scale studies : Neglect of stator $p\Psi$ terms and speed variations, Simplified model with amortisseurs neglected: two-axis model with amortisseur windings neglected, classical model.

2. MODELLING OF EXCITATION AND SPEED GOVERNING SYSTEMS 9

Excitation System Requirements; Elements of an Excitation System; Types of Excitation System;Control and protective functions;IEEE (1992) block diagram for simulation of excitation systems. Turbine and Governing System Modelling: Functional Block Diagram of Power Generation and Control, Schematic of a hydroelectric plant, classical transfer function of a hydraulic turbine (no derivation), special characteristic of hydraulic turbine, electrical analogue of hydraulic turbine, Governor for Hydraulic Turbine: Requirement for a transient droop, Block diagram of governor with transient droop compensation, Steam turbine modelling: Single reheat tandem compounded type only and IEEE block diagram for dynamic simulation; generic speed-governing system model for normal speed/load control function.

3. SMALL-SIGNAL STABILITY ANALYSIS WITHOUT CONTROLLERS 9

Classification of Stability, Basic Concepts and Definitions: Rotor angle stability, The Stability Phenomena. Fundamental Concepts of Stability of Dynamic Systems: State-space representation, stability of dynamic system, Linearisation, Eigen properties of the state matrix: Eigen values and eigenvectors, modal matrices, eigen value and stability, mode shape and participation factor. Single-Machine Infinite Bus (SMIB) Configuration: Classical Machine Model stability analysis with numerical example, Effects of Field Circuit Dynamics: synchronous machine, network and linearised system equations, block diagram representation with K-constants; expression for K-constants (no derivation), effect of field flux variation on system stability: analysis with numerical example,

4. SMALL-SIGNAL STABILITY ANALYSIS WITH CONTROLLERS 9

Effects Of Excitation System: Equations with definitions of appropriate K-constants and simple thyristor excitation system and AVR, block diagram with the excitation system, analysis of effect of AVR on synchronizing and damping components using a numerical example, Power System Stabiliser: Block diagram with AVR and PSS, Illustration of principle of PSS application with numerical example, Block diagram of PSS with description, system state matrix including PSS, analysis of stability with numerical a example. Multi-Machine Configuration: Equations in a common reference frame, equations in individual machine rotor coordinates, illustration of formation of system state matrix for a two-machine system with classical models for synchronous machines, illustration of stability analysis using a numerical example. Principle behind small-signal stability improvement methods: delta-omega and delta P-omega stabilizers.

5. ENHANCEMENT OF SMALL SIGNAL STABILITY 9

Power System Stabilizer – Stabilizer based on shaft speed signal (delta omega) – Delta –P-Omega stabilizer-Frequency-based stabilizers – Digital Stabilizer – Excitation control design – Exciter gain – Phase lead compensation – Stabilizing signal washout stabilizer gain – Stabilizer limits

L = 45 T = 15 P = 0 C =4

REFERENCES

1. P. Kundur, "Power System Stability and Control", McGraw-Hill, 1993.
2. IEEE Committee Report, "Dynamic Models for Steam and Hydro Turbines in Power System Studies", IEEE Trans., Vol.PAS-92, pp 1904-1915, November/December, 1973. on Turbine-Governor Model.
3. P.M Anderson and A.A Fouad, "Power System Control and Stability", Iowa State University Press, Ames, Iowa, 1978.

22272E32C ELECTRIC VEHICLES AND POWER MANAGEMENTL

	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the concept of electrical vehicles and its operations
- To understand the need for energy storage in hybrid vehicles
- To provide knowledge about various possible energy storage technologies that can be used in electric vehicles

UNIT I ELECTRIC VEHICLES AND VEHICLE MECHANICS 9

Electric Vehicles (EV), Hybrid Electric Vehicles (HEV), Engine ratings, Comparisons of EV with internal combustion Engine vehicles, Fundamentals of vehicle mechanics

UNIT II ARCHITECTURE OF EV's AND POWER TRAIN COMPONENTS 9

Architecture of EV's and HEV's – Plug-n Hybrid Electric Vehicles (PHEV)- Power train components and sizing, Gears, Clutches, Transmission and Brakes

UNIT III CONTROL OF DC AND AC DRIVES 9

DC/DC chopper based four quadrant operations of DC drives – Inverter based V/f Operation (motoring and braking) of induction motor drive system – Induction motor and permanent motor based vector control operation – Switched reluctance motor (SRM) drives

UNIT IV BATTERY ENERGY STORAGE SYSTEM 9

Battery Basics, Different types, Battery Parameters, Battery modeling, Traction Batteries

UNIT V ALTERNATIVE ENERGY STORAGE SYSTEMS 9

Fuel cell – Characteristics- Types – hydrogen Storage Systems and Fuel cell EV – Ultra capacitors

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will understand the operation of Electric vehicles and various energy storage technologies for electrical vehicles

REFERENCES

1 Iqbal Hussain, "**Electric and Hybrid Vehicles: Design Fundamentals, Second Edition"** CRC Press, Taylor & Francis Group, Second Edition (2011).

2 Ali Emadi, Mehrdad Ehsani, John M.Miller, "Vehicular Electric Power Systems", Special Indian Edition, Marcel dekker, Inc 2010.

22272E32D	ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide fundamental knowledge on electromagnetic interference and electromagnetic compatibility.
- To study the important techniques to control EMI and EMC.
- To expose the knowledge on testing techniques as per Indian and international standards in EMI measurement.

UNIT I INTRODUCTION 9

Definitions of EMI/EMC -Sources of EMI- Intersystems and Intrasystem- Conducted and radiated interference- Characteristics - Designing for electromagnetic compatibility (EMC)- EMC regulation typical noise path- EMI predictions and modeling, Cross talk - Methods of eliminating interferences.

UNIT II GROUNDING AND CABLING 9

Cabling- types of cables, mechanism of EMI emission / coupling in cables –capacitive coupling inductive coupling- shielding to prevent magnetic radiation- shield transfer impedance, Grounding – safety grounds – signal grounds- single point and multipoint ground systems hybrid grounds- functional ground layout –grounding of cable shields- -guard shields- isolation, neutralizing transformers, shield grounding at high frequencies, digital grounding- Earth measurement Methods

UNIT III BALANCING, FILTERING AND SHIELDING 9

Power supply decoupling- decoupling filters-amplifier filtering –high frequency filtering- EMI filters characteristics of LPF, HPF, BPF, BEF and power line filter design -Choice of capacitors, inductors, transformers and resistors, EMC design components -shielding – near and far fields shielding effectiveness - absorption and reflection loss- magnetic materials as a shield, shield discontinuities, slots and holes, seams and joints, conductive gaskets-windows and coatings - grounding of shields

UNIT IVEMI IN ELEMENTS AND CIRCUITS 9

Electromagnetic emissions, noise from relays and switches, non- linearities in circuits, passive inter modulation, transients in power supply lines, EMI from power electronic equipment, EMI as combination of radiation and conduction

UNIT V ELECTROSTATIC DISCHARGE, STANDARDS AND TESTING TECHNIQUES 9

Static Generation- human body model- static discharges- ESD versus EMC, ESD protection in equipment's- standards – FCC requirements – EMI measurements – Open area test site measurements and precautions- Radiated and conducted interference measurements, Control requirements and testing methods

TOTAL: 45 PERIODS

OUTCOMES:

- Recognize the sources of Conducted and radiated EMI in Power Electronic Converters and consumer appliances and suggest remedial measures to mitigate the problems
- Assess the insertion loss and design EMI filters to reduce the loss
- Design EMI filters, common-mode chokes and RC-snubber circuits measures to keep the interference within tolerable limits

REFERENCES

1. V.P. Kodali, “Engineering Electromagnetic Compatibility”, S. Chand, 1996
2. Henry W.Ott, “ Noise reduction techniques in electronic systems”, John Wiley & Sons, 1989
3. Bernhard Keiser, “Principles of Electro-magnetic Compatibility”, Artech House, Inc. (685 canton street, Norwood, MA 020062 USA) 1987
4. Bridges, J.E Milleta J. and Ricketts.L.W., “EMP Radiation and Protective techniques”, John Wiley and sons, USA 1976
5. William Duff G., & Donald White R. J, “Series on Electromagnetic Interference and Compatibility”, Vol.
6. Weston David A., “Electromagnetic Compatibility, Principles and Applications”, 1991.

ELECTIVES – V (semester-III)

22272E33A - POWER CONDITIONING

3 1 0 4

1. INTRODUCTION 9

Introduction – Characterization of Electric Power Quality: Transients, short duration and long duration voltage variations, Voltage imbalance, waveform distortion, Voltage fluctuations, Power frequency variation, Power acceptability curves – power quality problems: poor load power factor, Non linear and unbalanced loads, DC offset in loads, Notching in load voltage, Disturbance in supply voltage – Power quality standards.

2. NON-LINEAR LOADS 9

Single phase static and rotating AC/DC converters, Three phase static AC/DC converters, Battery chargers, Arc furnaces, Fluorescent lighting, pulse modulated devices, Adjustable speed drives.

3. MEASUREMENT AND ANALYSIS METHODS 9

Voltage, Current, Power and Energy measurements, power factor measurements and definitions, event recorders, Measurement Error – Analysis: Analysis in the periodic steady state, Time domain methods, Frequency domain methods: Laplace′s, Fourier and Hartley transform – The Walsh Transform – Wavelet Transform.

4. ANALYSIS AND CONVENTIONAL MITIGATION METHODS 9

Analysis of power outages, Analysis of unbalance: Symmetrical components of phasor quantities, Instantaneous symmetrical components, Instantaneous real and reactive powers, Analysis of distortion: On–line extraction of fundamental sequence components from measured samples – Harmonic indices – Analysis of voltage sag: Detorit Edison sag score, Voltage sag energy, Voltage Sag Lost Energy Index (VSLEI)- Analysis of voltage flicker, Reduced duration and customer impact of outages, Classical load balancing problem: Open loop balancing, Closed loop balancing, current balancing, Harmonic reduction, Voltage sag reduction.

5. POWER QUALITY IMPROVEMENT 9

Utility-Customer interface –Harmonic filters: passive, Active and hybrid filters –Custom power devices: Network reconfiguring Devices, Load compensation using DSTATCOM, Voltage regulation using DSTATCOM, protecting sensitive loads using DVR, UPQC –control strategies: P- Q theory, Synchronous detection method – Custom power park –Status of application of custom power devices

L = 45 T = 15 P = 0 C =4

REFERENCES:

1. Arindam Ghosh "Power Quality Enhancement Using Custom Power Devices", Kluwer Academic Publishers, 2002.
2. Heydt.G.T, "Electric Power Quality", Stars in a Circle Publications, 1994(2nd edition)
3. Dugan.R.C, " Electrical Power System Quality",TMH,2008.
4.Arrillga.A.J and Neville R.Watson, Power System Harmonics, John Wiley second Edition,2003.
5. Derek A. Paice, "Power electronic converter harmonics",John Wiley & sons, 1999.

ELECTIVES – V (semester-III)

22272E33B – DEREGULATED POWER SYSTEM

3 1 0 4

1. FUNDAMENTALS AND ARCHITECTURE OF POWERMARKETS 9

Deregulation of Electric utilities: Introduction-Unbundling-Wheeling- Reform motivations- Fundamentals of Deregulated Markets – Types (Future, Day-ahead and Spot) – Participating in Markets (Consumer and Producer Perspective) – bilateral markets – pool markets. Independent System Operator (ISO)-components-types of ISO - role of ISO - Lessons and Operating Experiences of Deregulated Electricity Markets in various Countries (UK, Australia, Europe, US, Asia).

2. TECHNICAL CHALLENGES 9

Total Transfer Capability – Limitations - Margins – Available transfer capability (ATC) – Procedure - Methods to compute ATC – Static and Dynamic ATC – Effect of contingency analysis – Case Study. Concept of Congestion Management – Bid, Zonal and Node Congestion Principles – Inter and Intra zonal congestion – Generation Rescheduling - Transmission congestion contracts – Case Study.

3. TRANSMISSION NETWORKS AND SYSTEM SECURITY SERVICES 9

Transmission expansion in the New Environment – Introduction – Role of transmission planning – Physical Transmission Rights – Limitations – Flow gate - Financial Transmission Rights – Losses – Managing Transmission Risks – Hedging – Investment. Ancillary Services – Introduction – Describing Needs – Compulsory and Demand-side provision – Buying and Selling Ancillary Services – Standards.

4. MARKET PRICING 9

Transmission pricing in open access system – Introduction – Spot Pricing – Uniform Pricing – Zonal Pricing – Locational Marginal Pricing – Congestion Pricing – Ramping and Opportunity Costs. Embedded cost based transmission pricing methods (Postage stamp, Contract path and MW-mile) – Incremental cost based transmission pricing methods (Short run marginal cost, Long run marginal cost) - Pricing of Losses on Lines and Nodes.

5. INDIAN POWER MARKET 9

Current Scenario – Regions – Restructuring Choices – Statewise Operating Strategies – Salient features of Indian Electricity Act 2003 – Transmission System Operator – Regulatory and Policy development in Indian power Sector – Opportunities for IPP and Capacity Power Producer. Availability based tariff – Necessity – Working Mechanism – Beneficiaries – Day Scheduling Process – Deviation from Schedule – Unscheduled Interchange Rate – System Marginal Rate – Trading Surplus Generation – Applications.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Kankar Bhattacharya, Math H.J. Bollen and Jaap E. Daalder, “Operation of Restructured Power Systems”, Kluwer Academic Publishers, 2001

2. Loi Lei Lai, "Power system Restructuring and Regulation", John Wiley sons, 2001.
3. Shahidehpour.M and Alomoush.M, "Restructuring Electrical Power Systems", Marcel Decker Inc., 2001.
4. Steven Stoft, " Power System Economics", Wiley – IEEE Press, 2002
5. Daniel S. Kirschen and Goran Strbac, " Fundamentals of Power System Economics", John Wiley & Sons Ltd., 2004.
6. Scholarly Transaction Papers and Utility web sites

22272E33C	CONTROL SYSTEM DESIGN FOR POWER ELECTRONICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explore conceptual bridges between the fields of Control Systems and Power Electronics
- To Study Control theories and techniques relevant to the design of feedback controllers in Power Electronics.

UNIT I MODELLING OF DC-TO-DC POWER CONVERTERS 9

Modelling of Buck Converter , Boost Converter ,Buck- Boost Converter, Cuk Converter ,Sepic Converter, Zeta Converter, Quadratic Buck Converter ,Double Buck-Boost Converter, Boost-Boost Converter General Mathematical Model for Power Electronics Devices.

UNIT II SLIDING MODE CONTROLLER DESIGN 9

Variable Structure Systems. Single Switch Regulated Systems Sliding Surfaces, Accessibility of the Sliding Surface Sliding Mode Control Implementation of Boost Converter ,Buck-Boost Converter, Cuk Converter ,Sepic Converter, Zeta Converter, Quadratic Buck Converter ,Double Buck-Boost Converter, Boost-Boost Converter.

UNIT III APPROXIMATE LINEARIZATION CONTROLLER DESIGN 9

Linear Feedback Control, Pole Placement by Full State Feedback , Pole Placement Based on Observer Design ,Reduced Order Observers , Generalized Proportional Integral Controllers, Passivity Based Control , Sliding Mode Control Implementation of Buck Converter , Boost Converter ,Buck-Boost Converter.

UNIT IV NONLINEAR CONTROLLER DESIGN 9

Feedback Linearization Isidori's Canonical Form, Input-Output Feedback Linearization, State Feedback Linearization, Passivity Based Control , Full Order Observers , Reduced Order Observers.

UNIT V PREDICTIVE CONTROL OF POWER CONVERTERS 9

Basic Concepts, Theory, and Methods, Application of Predictive Control in Power Electronics, AC-DC-AC Converter System, Faults and Diagnosis Systems in Power Converters.

TOTAL:45 PERIODS

OUTCOMES:

- Ability to understand an overview on modern linear and nonlinear control strategies for power electronics devices
- Ability to model modern power electronic converters for industrial applications
- Ability to design appropriate controllers for modern power electronics devices.

REFERENCES

1. Hebertt Sira-Ramírez, Ramón Silva-Ortigoza, "Control Design Techniques in Power Electronics Devices", Springer 2012

2. Mahesh Patil, Pankaj Rodey, "Control Systems for Power Electronics: A Practical Guide", Springer India, 2015.

3. Blaabjerg José Rodríguez, "Advanced and Intelligent Control in Power Electronics and Drives" , Springer, 2014

4. Enrique Acha, Vassilios Agelidis, Olimpo Anaya, TJE Miller, "Power Electronic Control in Electrical Systems", Newnes, 2002

5. Marija D. Aranya Chakrabortty, Marija , "Control and Optimization Methods for Electric Smart Grids", Springer, 2012.

22272E33D PRINCIPLES OF EHV TRANSMISSION L T P C
3 0 0 3

OBJECTIVES:

To impart knowledge on,
- Types of power transmission and configurations various parameters and voltage gradients of transmission line conductors.
- The design requirements of EHV AC and DC lines.

UNIT I INTRODUCTION 9

Standard transmission voltages-AC and DC – different line configurations– average values of line parameters – power handling capacity and line loss – costs of transmission lines and equipment – mechanical considerations in line performance.

UNIT II CALCULATION OF LINE PARAMETERS 9

Calculation of resistance, inductance and capacitance for multi-conductor lines – calculation of sequence inductances and capacitances – line parameters for different modes of propagation – effect of ground return.

UNIT III VOLTAGE GRADIENTS OF CONDUCTORS 9

Charge-potential relations for multi-conductor lines – surface voltage gradient on conductors – gradient factors and their use – distribution of voltage gradient on sub conductors of bundle - voltage gradients on conductors in the presence of ground wires on towers-I2R loss and corona loss-RIV.

UNIT IV ELECTROSTATIC FIELD AND DESIGN OF EHV LINES 9

Effect of EHV line on heavy vehicles - calculation of electrostatic field of AC lines- effect of high field on humans, animals, and plants - measurement of electrostatic fields – electrostatic Induction in unenergised circuit of a D/C line - induced voltages in insulated ground wires - electromagnetic interference, Design of EHV lines.

UNIT V HVDC LINES

Introduction- Reliability and failure issues-Design-tower, ROW, clearances, insulators, electrical and mechanical protection-Maintenance-Control and protection-D.C Electric field band Magnetic field -Regulations and guide lines-underground line design.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to model the transmission lines and estimate the voltage gradients and losses
- Ability to design EHV AC and DC transmission lines

REFERENCES

1 Rakosh Das Begamudre, “Extra High Voltage AC Transmission Engineering”, Second Edition, New Age International Pvt. Ltd., 2006.
2 Pritindra Chowdhari, “Electromagnetic transients in Power System”, John Wiley and Sons Inc., 2009.
3 Sunil S.Rao, “EHV-AC, HVDC Transmission & Distribution Engineering”, Third Edition, Khanna Publishers, 2008.
4 William H. Bailey, Deborah E. Weil and James R. Stewart, “A Review on HVDC Power Transmission Environmental Issues”, Oak Ridge National Laboratory.
5 J.C Molburg, J.A. Kavicky, and K.C. Picel ,”A report on The design, Construction and operation of Long-distance High-Voltage Electricity Transmission Technologies” Argonne (National Laboratory) 2007.
6 “Power Engineer’s Handbook”, Revised and Enlarged 6th Edition, TNEB Engineers’ Association, October 2002.

ELECTIVES – VI (semester-III)

22272E34A - SOFTWARE FOR CONTROL SYSTEM DESIGN

3 1 0 4

1. INTRODUCTION TO DESIGN AND CLASSICAL PID CONTROL

Systems performance and specifications –Proportional, Integral and Derivative Controllers – Structure – Empirical tuning- Zeigler Nichols-Cohen Coon – Root Locus method – Open loop inversion-– Tuning using ISE, IAE and other performance indices.

2. COMPENSATOR DESIGN

Design of lag, lead, lead-lag compensators – Design using bode plots – Polar plots – Nichols charts – root locus and Routh Hurwitz criterion.

3. MATLAB

Introduction – function description – Data types – Tool boxes – Graphical Displays – Programs for solution of state equations – Controller design – Limitations.- simulink-Introduction – Graphical user interface – Starting – Selection of objects – Blocks – Lines - simulation – Application programs – Limitations.

4. MAPLE

Introduction – symbolic programming – Programming constructs – Data structure computation with formulae – Procedures – Numerical Programming.

5. MATLAB

Programs using MATLAB software

L = 45 T = 15 P = 0 C =4

REFERENCES

1. MAPLE V Programming guide.
2. MATLAB user manual.
3. SIMULINK user manual.
4. K.Ogatta ,"Modern Control Engineering",PHI,1997.
5. Dorf and Bishop,"Modern control Engineering', Addison Wesley, 1998.

ELECTIVES – VI (semester-III)

22272E34B - INDUSTRIAL POWER SYSTEM ANALYSIS AND DESIGN

3 1 0 4

1. MOTOR STARTING STUDIES **9**

Introduction-Evaluation Criteria-Starting Methods-System Data-Voltage Drop Calculations-Calculation of Acceleration time-Motor Starting with Limited-Capacity Generators-Computer-Aided Analysis-Conclusions.

2. POWER FACTOR CORRECTION STUDIES **9**

Introduction-System Description and Modeling-Acceptance Criteria-Frequency Scan Analysis-Voltage Magnification Analysis-Sustained Overvoltages-Switching Surge Analysis-Back-to-Back Switching-Summary and Conclusions.

3. HARMONIC ANALYSIS **9**

Harmonic Sources-System Response to Harmonics-System Model for Computer-Aided Analysis-Acceptance Criteria-Harmonic Filters-Harmonic Evaluation-Case Study-Summary and Conclusions.

4. FLICKER ANALYSIS **9**

Sources of Flicker-Flicker Analysis-Flicker Criteria-Data for Flicker analysis- Case Study-Arc Furnace Load-Minimizing the Flicker Effects-Summary.

5. GROUND GRID ANALYSIS **9**

Introduction-Acceptance Criteria-Ground Grid Calculations-Computer-Aided Analysis - Improving the Performance of the Grounding Grids-Conclusions.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Ramasamy Natarajan, ”Computer-Aided Power System Analysis”, Marcel Dekker Inc., 2002.

22272E34C SOFT COMPUTING TECHNIQUES **L T P C**

OBJECTIVES: **3 0 0 3**

- To expose the concepts of feed forward neural networks.
- To provide adequate knowledge about feed back neural networks.
- To teach about the concept of fuzziness involved in various systems.
- To expose the ideas about genetic algorithm
- To provide adequate knowledge about of FLC and NN toolbox

UNIT I INTRODUCTION AND ARTIFICIAL NEURAL NETWORKS 9

Introduction to intelligent systems- Soft computing techniques- Conventional Computing versus Swarm Computing - Classification of meta-heuristic techniques - Properties of Swarm intelligent Systems - Application domain - Discrete and continuous problems - Single objective and multi-objective problems -Neuron- Nerve structure and synapse- Artificial Neuron and its model- activation functions- Neural network architecture- single layer and multilayer feed forward networks- Mc Culloch Pitts neuron model- perceptron model- Adaline and Madaline- multilayer perception model- back propogation learning methods- effect of learning rule coefficient -back propagation algorithm- factors affecting back propagation training- applications.

UNIT II ARTIFICIAL NEURAL NETWORKS AND ASSOCIATIVE MEMORY 9

Counter propagation network- architecture- functioning & characteristics of counter Propagation network- Hopfield/ Recurrent network configuration - stability constraints associative memory and characteristics- limitations and applications- Hopfield v/s Boltzman machine- Adaptive Resonance Theory- Architecture- classifications- Implementation and training - Associative Memory.

UNIT III FUZZY LOGIC SYSTEM 9

Introduction to crisp sets and fuzzy sets- basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modeling and control- Fuzzification inferencing and defuzzification-Fuzzy knowledge and rule bases- Fuzzy modeling and control schemes for nonlinear systems. Self organizing fuzzy logic control- Fuzzy logic control for nonlinear time delay system.

UNIT IV GENETIC ALGORITHM 9

Evolutionary programs – Genetic algorithms, genetic programming and evolutionary programming - Genetic Algorithm versus Conventional Optimization Techniques - Genetic representations and selection mechanisms; Genetic operators- different types of crossover and mutation operators - Optimization problems using GA-discrete and continuous - Single objective and multi-objective problems - Procedures in evolutionary programming.

UNIT V HYBRID CONTROL SCHEMES 9

Fuzzification and rule base using ANN–Neuro fuzzy systems-ANFIS – Fuzzy Neuron - Optimization of membership function and rule base using Genetic

Algorithm –Introduction to Support Vector Machine - Evolutionary Programming-Particle Swarm Optimization - Case study – Familiarization of NN, FLC and ANFIS Tool Box.

TOTAL : 45 PERIODS

OUTCOMES:

- Will be able to know the basic ANN architectures, algorithms and their limitations.
- Also will be able to know the different operations on the fuzzy sets.
- Will be capable of developing ANN based models and control schemes for non-linear system.
- Will get expertise in the use of different ANN structures and online training algorithm.
- Will be knowledgeable to use Fuzzy logic for modeling and control of non-linear systems.
- Will be competent to use hybrid control schemes and P.S.O and support vector Regressive.

TEXT BOOKS:

1. Laurene V. Fausett, “Fundamentals of Neural Networks: Architectures, Algorithms And Applications”, Pearson Education.
2. Timothy J. Ross, “Fuzzy Logic with Engineering Applications” Wiley India, 2008.
3. Zimmermann H.J. "Fuzzy set theory and its Applications" Springer international edition, 2011.
4. David E.Goldberg, “Genetic Algorithms in Search, Optimization, and Machine Learning”, Pearson Education, 2009.
5. W.T.Miller, R.S.Sutton and P.J.Webrose, “Neural Networks for Control” MIT Press”, 1996.
6. T. Ross, “Fuzzy Logic with Engineering Applications”, Tata McGraw Hill, New Delhi, 1995.
7. Ethem Alpaydin, “Introduction to Machine Learning (Adaptive Computation and Machine Learning Series)”, MIT Press, 2004.
8. Corinna Cortes and V. Vapnik, " Support - Vector Networks, Machine Learning ” 1995.

22272E34D	RESTRUCTURED POWER SYSTEM	LTPC
OBJECTIVES:		3003

- To introduce the restructuring of power industry and market models.
- To impart knowledge on fundamental concepts of congestion management.
- To analyze the concepts of locational marginal pricing and financial transmission rights.
- To Illustrate about various power sectors in India

UNIT I INTRODUCTION TO RESTRUCTURING OF POWER INDUSTRY 9

Introduction: Deregulation of power industry, Restructuring process, Issues involved in deregulation, Deregulation of various power systems – Fundamentals of Economics: Consumer behavior, Supplier behavior, Market equilibrium, Short and long run costs, Various costs of production – Market models: Market models based on Contractual arrangements, Comparison of various market models, Electricity vis – a – vis other commodities, Market architecture, Case study.

UNIT II TRANSMISSION CONGESTION MANAGEMENT 9

Introduction: Definition of Congestion, reasons for transfer capability limitation, Importance of congestion management, Features of congestion management – Classification of congestion management methods – Calculation of ATC - Non – market methods – Market methods – Nodal pricing – Inter zonal and Intra zonal congestion management – Price area congestion management – Capacity alleviation method.

UNIT III LOCATIONAL MARGINAL PRICES AND FINANCIAL TRANSMISSION RIGHTS 9

Mathematical preliminaries: - Locational marginal pricing– Lossless DCOPF model for LMP calculation – Loss compensated DCOPF model for LMP calculation – ACOPF model for LMP calculation – Financial Transmission rights – Risk hedging functionality -Simultaneous feasibility test and revenue adequency – FTR issuance process: FTR auction, FTR allocation – Treatment of revenue shortfall – Secondary trading of FTRs – Flow gate rights – FTR and market power - FTR and merchant transmission investment.

UNIT IV ANCILLARY SERVICE MANAGEMENT AND PRICING OF TRANSMISSION NETWORK 9

Introduction of ancillary services – Types of Ancillary services – Classification of Ancillary services – Load generation balancing related services – Voltage control and reactive power support devices – Black start capability service - How to obtain ancillary service –Co-optimization of energy and reserve services - Transmission pricing – Principles – Classification – Rolled in transmission pricing methods – Marginal transmission pricing paradigm – Composite pricing paradigm – Merits and demerits of different paradigm.

UNIT V REFORMS IN INDIAN POWER SECTOR 9

Introduction – Framework of Indian power sector – Reform initiatives - Availability based tariff – Electricity act 2003 – Open access issues – Power exchange – Reforms in the near future

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will have knowledge on restructuring of power industry
- Learners will understand basics of congestion management
- Learners will attain knowledge about locational margin prices and financial transmission rights
- Learners will understand the significance ancillary services and pricing of transmission network
- Learners will have knowledge on the various power sectors in India

REFERENCES

1 Mohammad Shahidehpour, Muwaffaq Alomoush, Marcel Dekker, “Restructured electrical power systems: operation, trading and volatility” Pub., 2001.

2 Kankar Bhattacharya, Jaap E. Daadler, Math H.J. Boolen, “Operation of restructured power systems”, Kluwer Academic Pub., 2001.

3 Paranjothi, S.R. , “Modern Power Systems” Paranjothi, S.R. , New Age International, 2017.

4 Sally Hunt,” Making competition work in electricity”, John Willey and Sons Inc. 2002.

5 Steven Stoft, “Power system economics: designing markets for electricity”, John Wiley & Sons, 2002.

****

1.1.3 SUPPORTING DOCUMENTS

1.1.3 Total number of courses having focus on employability/

entrepreneurship/ skill development offered by the University during the year.

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL &

ELECTRONICS ENGINEERING

Skill Development	
Employability	
Entrepreneurship	

PRIST DEEMED TO BE UNIVERSITY
NAAC ACCREDITED
THANJAVUR – 613 403 - TAMIL NADU

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL &

ELECTRONICS ENGINEERING

COURSE STRUCTURE
M.TECH-POWER SYSTEMS
(PART TIME)
[Regulation2022]

[for candidates admitted to M.Tech Power Systemprogram from June2022 onwards]

Skill Development Employability Entrepreneurship

PRIST UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS

ENGINEERING**PROGRAMME: M.TECH-POWER SYSTEMS**

(PART TIME) CURRICULUM -REGULATION 2022

SEMESTER – I

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1.	22248S11DP	Applied Mathematics for Power System Engineering	3	1	0	4
2.	22272C12P	System Theory	3	1	0	4
3.	22272C13P	Advanced Power System Analysis	3	1	0	4
4.	22272L14P	Power System Simulation Laboratory	0	0	3	3
		TOTAL				**15**

SEMESTER – II

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272C21P	EHV power transmission.	3	1	0	4
2	22272C22P	Advanced Power System Protection	3	1	0	4
3	22272E23_P	Elective-I	3	0	0	3
4	222TECWRP	Technical Writing/Seminars	0	0	3	3
		TOTAL				**14**

SEMESTER – III

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272C31P	Economic Operations of Power Systems	3	1	0	4
2	22272C32P	HVDC and FACTS	3	1	0	4
3	22272E33_P	Elective –II	3	0	0	3

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4	22272L34P	Advanced Power System Simulation Laboratory	0	0	3	3
		TOTAL				**14**

SEMESTER – IV

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272C41P	Power System Control	3	1	0	4
2	22272C42P	Electrical Transients in power systems	3	1	0	4
3	22272E43_P	Elective –III	3	0	0	3
4	22272P44P	Project work Phase –I	0	0	10	10
		TOTAL				**21**

SEMESTER – V

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1.	22272E51_P	Elective –IV	3	0	0	3
2.	22272E52_P	Elective –V	3	0	0	3
3.	22272E53_P	Elective –VI	3	0	0	3
		TOTAL				**9**

SEMESTER – VI

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1.	22272P61P	Project work Phase -II	0	0	15	**15**

Total Credits = 88

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Elective –III

Elective –I

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E23AP	Analysis and Design of Power Converters	3	0	0	3
2.	22272E23BP	Modeling and Analysis of Electrical Machines	3	0	0	3
3.	22272E23CP	Advanced Power System Dynamics	3	0	0	3
4.	22272E23DP	Analysis and Computation of Electromagnetic Transients in Power Systems	3	0	0	3

Elective –II

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E33AP	Smart Grid	3	0	0	3
2.	22272E33BP	Solar and Energy Storage Systems	3	0	0	3
3.	22272E33CP	Power System Reliability	3	0	0	3
4.	22272E33DP	Distributed Generation and Microgrid	3	0	0	3

Elective –III

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E43AP	Wind Energy conversion systems	3	0	0	3
2.	22272E43BP	AI Techniques to Power Systems	3	0	0	3
3.	22272E43CP	Electrical Distribution System	3	0	0	3
4.	22272E43DP	Energy Management and Auditing	3	0	0	3

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Elective –IV

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E51AP	Power Electronics applications in Power systems	3	0	0	3
2.	22272E51BP	Power system Dynamics	3	0	0	3
3.	22272E51CP	Electric Vehicles and Power Management	3	0	0	3
4.	22272E51DP	Electromagnetic Interference and Compatibility	3	0	0	3

Elective –V

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22275E52AP	Power Conditioning	3	0	0	3
2.	22275E52BP	Deregulated Power System	3	0	0	3
3.	22275E52CP	Control System Design for Power Electronics	3	0	0	3
4.	22275E52DP	Principles of EHV Transmission	3	0	0	3

Elective –VI

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	22272E53AP	Software for Control system Design	3	0	0	3
2.	22272E53BP	Industrial Power system analysis and design	3	0	0	3
3.	22272E53CP	Soft Computing Techniques	3	0	0	3
4.	22272E53DP	Restructured Power System	3	0	0	3

Skill Development Employability Entrepreneurship

Credit Distribution

Sem.	Core Courses				Elective Courses		Total Credits
	Theory Courses		Practical Courses				
	Nos.	Credits	Nos.	Credits	Nos.	Credits	
I	02	08	01	03	-	-	15
II	02	08	01	03	01	03	14
III	02	08	01	03	01	03	14
IV	02	08	01	10	01	03	21
V	-	-	-	-	03	09	09
VI	-	-	01	15	-	-	15
						Total Credits	**88**

Skill Development Employability Entrepreneurship

22248S11DP -APPLIED MATHEMATICS FOR POWER SYSTEM ENGINEERING

3 1 0 4

1. ADVANCED MATRIX THEORY 9

Matrix norms – Jordan canonical form – Generalized eigenvectors – Singular value decomposition – Pseudo inverse – Least square approximations.

2. RANDOM PROCESSES 9

Random variable, discrete, continuous types - Binomial, Poisson, normal and exponential distributions density & distribution Functions- Moments Moment Generating Functions – Notion of stochastic processes - Auto-correlation – Cross correlation .

3. LINEAR PROGRAMMING 9

Basic concepts – Graphical and Simplex methods –Transportation problem – Assignment problem.

4. DYNAMIC PROGRAMMING 9

Elements of the dynamic programming model – optimality principle – Examples of dynamic programming models and their solutions.

5. INTEGRAL TRANSFORMS 9

Finite Fourier transform - Fourier series - Finite sine Transform - Cosine transform - finite Hankel transform - definition, Transform of df/dx where p is a root of Jn(p) = 0, Transform of

$\frac{d^2f}{dx^2} + \frac{1}{x}\frac{df}{dx}$, and Transform of $\frac{d^2f}{dx^2} + \frac{1}{x}\frac{df}{dx} - \frac{n^2f}{x^2}$

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Lewis.D.W., Matrix Theory ,Allied Publishers, Chennai 1995.
2. Bronson, R, Matrix Operations, Schaums outline Series, McGraw Hill, New York. 1989.
3. Andrews, L.A., and Shivamoggi B.K., “Integral Transforms for Engineers and Applied Mathematicians”, Macmillan , New York ,1988.
4. Taha, H.A., " Operations research - An Introduction ", Mac Millan publishing Co., (1982).
5. Gupta, P.K.and Hira, D.S., " Operations Research ", S.Chand & Co., New Delhi, (1999).6..
6. Ochi, M.K. " Applied Probability and Stochastic Processes ", John Wiley & Sons (1992).
7. Peebles Jr., P.Z., " Probability Random Variables and Random Signal Principles, McGraw Hill Inc., (1993).

22272C12P - SYSTEM THEORY

3 1 0 4

1. PHYSICAL SYSTEMS AND STATE ASSIGNMENT 9

Systems - electrical - mechanical - hydraulic - pneumatic - thermal systems - modelling of some typical systems like D.C. Machines - inverted pendulum.

2. STATE SPACE ANALYSIS 9

Realisation of state models - non-uniqueness - minimal realisation - balanced realisation - solution of state equations - state transition matrix and its properties - free and forced responses - properties - controllability and observability - stabilisability and detectability - Kalman decomposition.

3. MIMO SYSTEMS - FREQUENCY DOMAIN DESCRIPTIONS 9

Properties of transfer functions - impulse response matrices - poles and zeros of transfer function matrices - critical frequencies - resonance - steady state and dynamic response - bandwidth - Nyquist plots - singular value analysis.

4. NON-LINEAR SYSTEMS 9

Types of non-linearity - typical examples - equivalent linearization - phase plane analysis - limit cycles - describing functions - analysis using describing functions - jump resonance.

5. STABILITY 9

Stability concepts - equilibrium points - BIBO and asymptotic stability - direct method of Liapunov - application to non-linear problems - frequency domain stability criteria - Popov's method and its extensions.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. M. Gopal, 'Modern Control Engineering', Wiley, 1996.
2. J.S. Bay, 'Linear State Space Systems', McGraw-Hill, 1999.
3. Eroni-Umez and Eroni, 'System dynamics & Control', Thomson Brooks / Cole, 1998.
4. K. Ogatta, 'Modern Control Engineering', Pearson Education, Low Priced Edition, 1997.
5. G.J. Thaler, 'Automatic control systems', Jaico publishers, 1993.
6. John S. Bay, 'Linear State Space Systems', McGraw-Hill International Edition, 1999.

Skill Development Employability Entrepreneurship

22272C13P - ADVANCED POWER SYSTEM ANALYSIS

3 1 0 4

OBJECTIVES:

- To introduce different techniques of dealing with sparse matrix for large scale power systems.
- To impart in-depth knowledge on different methods of power flow solutions.
- To perform optimal power flow solutions in detail.
- To perform short circuit fault analysis and understand the consequence of different type of faults.
- To Illustrate different numeric al integration methods and factors influencing transient stability

UNIT I SOLUTION TECHNIQUE 9

Sparse Matrix techniques for large scale power systems: Optimal ordering schemes forpreserving sparsity. Flexible packed storage scheme for storing matrix as compact arrays –Factorization by Bifactorization and Gauss elimination methods; Repeat solution using Left and Right factors and L and U matrices.

UNIT II POWER FLOW ANALYSIS 9

Power flow equation in real and polar forms; Review of Newton’s method for solution; Adjustment of P-V buses; Review of Fast Decoupled Power Flow method; Sensitivity factors for P-V bus adjustment..

UNIT III OPTIMAL POWER FLOW 9

Problem statement; Solution of Optimal Power Flow (OPF) – The gradient method, Newton’s method, Linear Sensitivity Analysis; LP methods – With real power variables only – LP method with AC power flow variables and detailed cost functions; Security constrained Optimal Power Flow; Interior point algorithm; Bus Incremental costs.

UNIT IV SHORT CIRCUIT ANALYSIS 9

Formation of bus impedance matrix with mutual coupling (single phase basis and three phase basis)- Computer method for fault analysis using ZBUS and sequence components. Derivation of equations for bus voltages, fault current and line currents, both in sequence and phase – symmetrical and unsymmetrical faults.

UNIT V TRANSIENT STABILITY ANALYSIS 9

Introduction, Numerical Integration Methods: Euler and Fourth Order Runge-Kutta methods, Algorithm for simulation of SMIB and multi-machine system with classical synchronous machine model; Factors influencing transient stability, Numerical stability and implicit Integration methods.

L = 45 T = 15 P = 0 C =4

OUTCOMES:

- Ability to apply the concepts of sparse matrix for large scale power system analysis
- Ability to analyze power system studies that needed for the transmission system planning.

Skill Development Employability Entrepreneurship

REFERENCES:

1. A.J.Wood and B.F.Wollenberg, “Power Generation Operation and Control”, John Wiley and sons, New York, 1996.
2. W.F.Tinney and W.S.Meyer, “Solution of Large Sparse System by Ordered Triangular Factorization” IEEE Trans. on Automatic Control, Vol : AC-18, pp:333346 Aug 1973.
3.K.Zollenkopf, “Bi-Factorization: Basic Computational Algorithm and Programming Techniques ; pp:75-96 ; Book on “Large Sparse Set of Linear Systems” Editor: J.K.Rerd,Academic Press, 1971.
4. M.A.Pai,” Computer Techniques in Power System Analysis”,Tata McGraw-Hill Publishing Company Limited, New Delhi, 2006.
5. G W Stagg , A.H El. Abiad, “Computer Methods in Power System Analysis”, McGraw Hill, 1968.
6. P.Kundur, “Power System Stability and Control”, McGraw Hill, 1994.

22272L14P- POWER SYSTEM SIMULATION LABORATORY **0 0 3 3**

OBJECTIVES:

- To have hands on experience on various system studies and different techniques used
- for system planning using Software packages
- To perform the dynamic analysis of power system
-

LIST OF EXPERIMENTS

1. Power flow analysis by Newton-Raphson method and Fast decoupled method

2. Transient stability analysis of single machine-infinite bus system using classical machine model

3. Contingency analysis: Generator shift factors and line outage distribution factors

4. Economic dispatch using lambda-iteration method

5. Unit commitment: Priority-list schemes and dynamic programming

6. State Estimation (DC)

7. Analysis of switching surge using EMTP: Energisation of a long distributed- parameter line

8. Analysis of switching surge using EMTP : Computation of transient recovery voltage

9. Simulation and Implementation of Voltage Source Inverter

10. Digital Over Current Relay Setting and Relay Coordination using Suitable software packages

11 Co-ordination of over-current and distance relays for radial line protection

TOTAL: 60 PERIODS

OUTCOMES:

- Upon Completion of the course, the students will be able to:
- Analyze the power flow using Newton-Raphson method and Fast decoupled method.
- Perform contingency analysis & economic dispatch
- Set Digital Over Current Relay and Coordinate Relay

22272C21P- EHV POWER TRANSMISSION

3 1 0 4

1. INTRODUCTION 9

Standard transmission voltages – different configurations of EHV and UHV lines – average values of line parameters – power handling capacity and line loss – costs of transmission lines and equipment – mechanical considerations in line performance.

2. CALCULATION OF LINE PARAMETERS 9

Calculation of resistance, inductance and capacitance for multi-conductor lines – calculation of sequence inductances and capacitances – line parameters for different modes of propagation – resistance and inductance of ground return, numerical example involving a typical 400/220kV line using line constant program.

3. VOLTAGE GRADIENTS OF CONDUCTORS 9

Charge-potential relations for multi-conductor lines – surface voltage gradient on conductors – gradient factors and their use – distribution of voltage gradient on sub conductors of bundle - voltage gradients on conductors in the presence of ground wires on towers.

4. CORONA EFFECTS 9

Power losses and audible losses: I R loss and corona loss - audible noise generation and characteristics - limits for audible noise - Day-Night equivalent noise level- radio interference: corona pulse generation and properties - limits for radio interference fields

5. ELECTROSTATIC FIELD OF EHV LINES 9

Effect of EHV line on heavy vehicles - calculation of electrostatic field of AC lines- effect of high field on humans, animals, and plants - measurement of electrostatic fields - electrostatic Induction in unenergised circuit of a D/C line - induced voltages in insulated ground wires - electromagnetic interference

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Rakosh Das Begamudre, “Extra High Voltage AC Transmission Engineering”, Second Edition, New Age International Pvt. Ltd., 1990.
2. Power Engineer’s Handbook, Revised and Enlarged 6th Edition, TNEB Engineers’ Association, October 2002.
3. Microtran Power System Analysis Corporation, Microtran Reference Manual, Vancouver Canada. (Website: www.microtran.com).

22272C22P - ADVANCED POWER SYSTEM PROTECTION 3 1 0 4

OBJECTIVES:

- To illustrate concepts of transformer protection
- To describe about the various schemes of Over current protection
- To analyze distance and carrier protection
- To familiarize the concepts of Generator protection and Numerical protection

UNIT I OVER CURRENT & EARTH FAULT PROTECTION 9

Zones of protection – Primary and Backup protection – operating principles and Relay Construction - Time – Current characteristics-Current setting – Time setting-Over current protective schemes –Concept of Coordination - Protection of parallel / ring feeders – Reverse power or directional relay –Polarisation Techniques – Cross Polarisation – Quadrature Connection -Earth fault and phase fault protection - Combined Earth fault and phase fault protection scheme - Phase fault protective - scheme directional earth fault relay - Static over current relays – Numerical over – current protection; numerical coordination example for a radial feeder

UNIT II TRANSFORMER & BUSBAR PROTECTION 9

Types of transformers –Types of faults in transformers- Types of Differential Protection – High Impedance – External fault with one CT saturation – Actual behaviors of a protective CT – Circuit model of a saturated CT - Need for high impedance – Disadvantages - Percentage Differential Bias Characteristics – Vector group & its impact on differential protection - Inrush phenomenon – Zero Sequence filtering – High resistance Ground Faults in Transformers – Restricted Earth fault Protection - Inter-turn faults in transformers – Incipient faults in transformers - Phenomenon of overfluxing in transformers – Transformer protection application chart. Differential protection of busbars external and internal fault - Supervisory relay-protection of three – Phase busbars – Numerical examples on design of high impedance busbar differential scheme –Biased Differential Characteristics – Comparison between Transformer differential & Busbar differential.

UNIT III DISTANCE AND CARRIER PROTECTION OF TRANSMISSION LINES 9

Drawback of over – Current protection – Introduction to distance relay – Simple impedance relay – Reactance relay – mho relays comparison of distance relay – Distance protection of a three – Phase line-reasons for inaccuracy of distance relay reach - Three stepped distance protection Trip contact configuration for the three - Stepped distance protection - Three-stepped protection f three-phase line against all ten shunt faults - Impedance seen from relay side - Three-stepped protection of double end fed lines-need for carrier – Aided protection – Various options for a carrier –Coupling and trapping the carrier into the desired line section - Unit type carrier aided directional comparison relaying – Carrier aided distance schemes for acceleration of zone II; numerical example for a typical distance protection scheme for a transmission line.

UNIT IV GENERATOR PROTECTION 9

Electrical circuit of the generator –Various faults and abnormal operating conditions – Stator Winding Faults – Protection against Stator (earth) faults – third harmonic voltage protection – Rotor fault – Abnormal operating conditions - Protection against Rotor faults – Potentiometer Method – injection method – Pole slipping – Loss of excitation – Protection against Mechanical faults; Numerical examples for typical generator protection schemes

UNIT V NUMERICAL PROTECTION

Introduction–Block diagram of numerical relay - Sampling theorem- Correlation with a reference (LES) technique-Digital filtering-numerical over - Current protection– Numerical transformer differential protection-Numerical distance protection of transmission line

L = 45 T = 15 P = 0 C =4

OUTCOMES:

- Learners will be able to understand the various schemes available in Transformer
- protection
- Learners will have knowledge on Overcurrent protection.
- Learners will attain knowledge about Distance and Carrier protection in transmission lines.
- Learners will understand the concepts of Generator protection.
- Learners will attain basic knowledge on substation automation.

REFERENCES

1 Y.G. Paithankar and S.R Bhide, "Fundamentals of Power System Protection", Prentice-Hall of India, 2003

2 Badri Ram and D.N. Vishwakarma, "Power System Protection and Switchgear", Tata McGraw- Hill Publishing Company, 2002.

3 T.S.M. Rao, "Digital Relay / Numerical relays", Tata McGraw Hill, New Delhi, 1989.

4 P.Kundur, "Power System Stability and Control", McGraw-Hill, 1993.

22272C31P - ECONOMIC OPERATIONS OF POWER SYSTEMS

3 1 0 4

1. INTRODUCTION 9

Planning and operational problems of power systems – review of economic dispatch and calculation using B matrix loss formula – use of participation factors in on line economic dispatch.

2. OPTIMAL POWER FLOW PROBLEM 9

Real and reactive power control variables – operation and security constraints and their limits – general OPF problem with different objective functions – formulation – cost loss minimization using Dommel and Tinney's method and SLP – development of model and algorithm – MVAR planning – optimal sitting and sizing of capacitors using SLR method – interchange evaluation using SLP.

3. HYDRO THERMAL SCHEDULING 9

Problems definition and mathematical model of long and short term problems – discretization – dynamic and incremental dynamic programming – methods of local variation – hydro thermal system with pumped hydro units – solution by local variation treating pumped hydro unit for load management and spinning reserve.

4. UNIT COMMITMENT 9

Constraints in unit commitment – solution by priority list method – dynamic programming method – backward and forward – restricted search range.

5. MAINTENANCE SCHEDULING 9

Factors considered in maintenance scheduling for generating units – turbines – boilers – introduction to maintenance scheduling using mathematical programming.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Allen J.Wood and Bruce F.Wollenberg, "Power generation and control", John Wiley & Sons, New York, 1984.
2. Krichmayer L., "Economic operation of power systems", John Wiley and sons Inc, New York, 1958.
3. Krichmayer L.K, "Economic control of Interconnected systems", Jhon Wiley and sons Inc, New York, 1959.
4. Elgerd O.I., "Electric energy systems theory – an introduction", McGraw Hill, New Delhi, 1971.

Skill Development Employability Entrepreneurship

22272C32P - HVDC and FACTS

3 1 0 4

OBJECTIVES:

- To emphasis the need for FACTS controllers.
- To learn the characteristics, applications and modeling of series and controllers.
- To analyze the interaction of different FACTS controller and coordination
- To impart knowledge on operation, modelling and control of HVDC link.
- To perform steady state analysis of AC/DC system.

UNIT I INTRODUCTION 9

Review of basics of power transmission networks-control of power flow in AC transmission line- Analysis of uncompensated AC Transmission line- Passive reactive power compensation: Effect of series and shunt compensation at the mid-point of the line on power transfer- Need for FACTS controllers- types of FACTS controllers. Comparison of AC & DC Transmission, Applications of DC Transmission Topologies.

UNIT II SVC & STATCOM 9

Configuration of SVC- voltage regulation by SVC- Modelling of SVC for load flow analysisDesign of SVC to regulate the mid-point voltage of a SMIB system- Applications Static synchronous compensator (STATCOM)- Operation of STATCOM – Voltage regulation – Power flow control with STATCOM.

UNIT III TCSC and SSSC 9

Concepts of Controlled Series Compensation- Operation of TCSC - Analysis of TCSC operation - Modelling of TCSC for load flow studies - Static synchronous series compensator (SSSC)- Operation of SSSC - Modelling of SSSC for power flow – operation of Unified power flow controllers(UPFC).

UNIT IV ANALYSIS OF HVDC LINK 9

Simplified analysis of six pulse Graetz bridge – Charecteristics - Analysis of converter operations – Commutation overlap – Equivalence circuit of bipolar DC transmission link – Modes of operation – Mode ambiguity – Different firing angle controllers – Power flow control.

UNIT V POWER FLOW ANALYSIS IN AC/DC SYSTEMS 9

Per unit system for DC Quantities - Modelling of DC links - Solution of DC load flow - Solution of AC-DC power flow – Unified and Sequential methods.

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will be able to refresh on basics of power transmission networks and need for FACTS controllers
- Learners will understand the significance about different voltage source converter based FACTS controllers
- Learners will understand the significance of HVDC converters and HVDC system control
- Learners will attain knowledge on AC/DC power flow analysis

Skill Development Employability Entrepreneurship

REFERENCES

1. Mohan Mathur, R., Rajiv. K. Varma, “Thyristor – Based Facts Controllers for Electrical Transmission Systems”, IEEE press and John Wiley & Sons, Inc.
2. K.R.Padiyar, “FACTS Controllers in Power Transmission and Distribution”, New Age International (P) Ltd., Publishers, New Delhi, Reprint 2008.
3. K.R.Padiyar, “HVDC Power Transmission Systems”, New Age International (P) Ltd., New Delhi, 2002.
4. J.Arrillaga, “High Voltage Direct Current Transmission”, Peter Pregrinus, London, 1983.
5. V.K.Sood, “HVDC and FACTS controllers- Applications of Static Converters in Power System”, Kluwer Academic Publishers 2004

22272L34P- ADVANCED POWER SYSTEM SIMULATION LABORATORY **LT P C**

0 0 4 2

OBJECTIVES:

- To analyze the effect of FACTS controllers by performing steady state analysis.
- To have hands on experience on different wind energy conversion technologies

LIST OF EXPERIMENTS

1. Small-signal stability analysis of single machine-infinite bus system using classical machine model
2. Small-signal stability analysis of multi-machine configuration with classical machine model
3. Induction motor starting analysis
4. Load flow analysis of two-bus system with STATCOM
5. Transient analysis of two-bus system with STATCOM
6. Available Transfer Capability calculation using an existing load flow program
7. Study of variable speed wind energy conversion system- DFIG
8. Study of variable speed wind energy conversion system- PMSG
9. Computation of harmonic indices generated by a rectifier feeding a R-L load
10. Design of active filter for mitigating harmonics

SEMESTER – IV

22272C41P - POWER SYSTEM CONTROL **3 1 0 4**

1. AUTOMATIC GENERATION CONTROL **9**

Plant and system level control problem – ALFC of single area system modeling state and transient response – EDC control loop – ALFC of multi area system – modeling – static and transient response of two area system development of state variable model – two area system – AGC system design Kalman's method.

2. AUTOMATIC VOLTAGE CONTROL **9**

Modeling of AVR loop – components – dynamic and static analysis – stability compensation – system level voltage control using OLTC, capacitor and generator voltages – expert system application for system voltage control.

3. SECURITY CONTROL CONCEPT **9**

System operating states by security control functions – monitoring evaluation of system state by contingency analysis – corrective controls (preventive, emergency and restorative) – islanding scheme.

4. STATE ESTIMATION **9**

Least square estimation – basic solution – sequential form of solution – static state estimation of power system by different algorithms – tracking state estimation of power system-computation consideration – external equivalency. Treatment of bad data and on line load flow analysis.

5. COMPUTER CONTROL OF POWER SYSTEM 9

Energy control center – various levels – national – regional and state level SCADA system – computer configuration – functions, monitoring, data acquisition and controls – EMS system – software in EMS system. Expert system applications for power system operation.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Kundur.P., “power system stability and control”, McGraw Hill, 1994.
2. Anderson P.M., and Fouad A.A, “power system control and stability”, Galgotia publication, New Delhi, 1981.
3. Taylor C.W., “power systems voltage stability”, McGraw Hill, New Delhi, 1993.
4. IEEE recommended practice for excitation system models for power system stability studies, IEEE standard 421.5, 1992.
5. Kimbark E.W., “power system stability”, Vol.3., Synchronous machines, John Wiley and sons, 1956.
6. T.V Custem, C.Vournas, “voltage stability of power system”, Kluwer Acadamic Publishers, 1998.
7. Elgerd O.L., “Elctric energy systems theory – an introduction”, McGraw Hill, New Delhi, 1971.

22272C42P- ELECTRICAL TRANSIENTS IN POWER SYSTEMS

3 1 0 4

1. TRAVELLING WAVES ON TRANSMISSION LINE 9

Lumped and Distributed Parameters – Wave Equation – Reflection, Refraction, Behavior of Travelling waves at the line terminations – Lattice Diagrams – Attenuation and Distortion – Multi-conductor system and Velocity wave.

2. COMPUTATION OF POWER SYSTEM TRANSIENTS 9

Principle of digital computation – Matrix method of solution, Modal analysis, Z transforms, Computation using EMTP – Simulation of switches and non-linear elements.

3. LIGHTNING, SWITCHING AND TEMPORARY OVERVOLTAGES 9

Lightning: Physical phenomena of lightning – Interaction between lightning and power system – Factors contributing to line design – Switching: Short line or kilometric fault – Energizing transients - closing and re-closing of lines - line dropping, load rejection - Voltage induced by fault – Very Fast Transient Overvoltage (VFTO)

4. BEHAVIOUR OF WINDING UNDER TRANSIENT CONDITION 9

Initial and Final voltage distribution - Winding oscillation - traveling wave solution - Behavior of the transformer core under surge condition – Rotating machine – Surge in generator and motor

5. INSULATION CO-ORDINATION 9

Principle of insulation co-ordination in Air Insulated substation (AIS) and Gas Insulated Substation (GIS), insulation level, statistical approach, co-ordination between insulation and protection level –overvoltage protective devices – lightning arresters, substation earthing.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Pritindra Chowdhari, “Electromagnetic transients in Power System”, John Wiley and Sons Inc., 1996.
2. Allan Greenwood, “Electrical Transients in Power System”, Wiley & Sons Inc. New York, 1991.
3. Klaus Ragaller, “Surges in High Voltage Networks”, Plenum Press, New York, 1980.
4. Rakosh Das Begamudre, “Extra High Voltage AC Transmission Engineering”, (Second edition) Newage International (P) Ltd., New Delhi, 1990.
5. Naidu M S and Kamaraju V, “High Voltage Engineering”, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.
6. IEEE Guide for safety in AC substation grounding IEEE Standard 80-2000.
7. Working Group 33/13-09 (1988), ‘Very fast transient phenomena associated with Gas Insulated System’, CIGRE, 33-13, pp. 1-2

22272E23AP – ANALYSIS AND DESIGN OF POWER CONVERTERS L T P C
3 0 0 3

OBJECTIVES:

- To determine the operation and characteristics of controlled rectifiers.
- To apply switching techniques and basic topologies of DC-DC switching regulators.
- To introduce the design of power converter components.
- To provide an in depth knowledge about resonant converters.
- To comprehend the concepts of AC-AC power converters and their applications.

UNIT I SINGLE PHASE & THREE PHASE CONVERTERS 9

Principle of phase controlled converter operation – single-phase full converter and semi-converter (RL,RLE load)- single phase dual converter – Three phase operation full converter and semi-converter (R,RL,RLE load) – reactive power – power factor improvement techniques – PWM rectifiers.

UNIT II DC-DC CONVERTERS 9

Limitations of linear power supplies, switched mode power conversion, Non-isolated DC-DC converters: operation and analysis of Buck, Boost, Buck-Boost, Cuk& SEPIC – under continuous and discontinuous operation – Isolated converters: basic operation of Flyback, Forward and Push-pull topologies.

UNIT III DESIGN OF POWER CONVERTER COMPONENTS 9

Introduction to magnetic materials- hard and soft magnetic materials –types of cores , copper windings – Design of transformer –Inductor design equations –Examples of inductor design for buck/flyback converter-selection of output filter capacitors – selection of ratings for devices – input filter design.

UNIT IV RESONANT DC-DC CONVERTERS 9

Switching loss, hard switching, and basic principles of soft switching- classification of resonant converters- load resonant converters – series and parallel – resonant switch converters – operation and analysis of ZVS, ZCS converters comparison of ZCS/ZVS-Introduction to ZVT/ZCT PWM converters.

UNIT V AC-AC CONVERTERS 9

Principle of on-off and phase angle control – single phase ac voltage controller – analysis with R & RL load – Three phase ac voltage controller – principle of operation of cyclo converter – single phase and three phase cyclo converters – Introduction to matrix converters.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course the student will be able to:

- Analyze various single phase and three phase power converters
- Select and design dc-dc converter topologies for a broad range of power conversion

applications.

- Develop improved power converters for any stringent application requirements.
- Design ac-ac converters for variable frequency applications.

TEXT BOOKS:

1 Ned Mohan,T.MUndeland and W.P Robbin, “Power Electronics: converters, Application and design” John Wiley and sons.Wiley India edition, 2006.

2 Rashid M.H., “Power Electronics Circuits, Devices and Applications ", Prentice Hall India, Third Edition, New Delhi, 2004.

3 P.C. Sen, “Modern Power Electronics”, Wheeler Publishing Co, First Edition, New Delhi, 1998.

4 P.S.Bimbra, “Power Electronics”, Khanna Publishers, Eleventh Edition, 2003

5 Simon Ang, Alejandro Oliva, “Power-Switching Converters, Second Edition, CRC Press, Taylor & Francis Group, 2010

6 V.Ramanarayanan, “Course material on Switched mode power conversion”, 2007

7 Alex Van den Bossche and VencislavCekovValchev, “Inductors and TransformersforPowerElectronics”, CRC Press, Taylor & Francis Group, 2005

8 W. G. Hurley and W. H.Wolfle, “Transformers and Inductors for Power Electronics Theory, Design and Applications”, 2013 John Wiley & Sons Ltd.

9 Marian.K.Kazimierczuk and DariuszCzarkowski, “Resonant Power Converters”, John Wiley & Sons limited, 2011

22272E23BP - MODELING AND ANALYSIS OF ELECTRICAL MACHINES

3 1 0 4

UNIT I PRINCIPLES OF ELECTROMAGNETIC ENERGY CONVERSION

General expression of stored magnetic energy - co-energy and force/torque - example using single and doubly excited system.

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UNIT II BASIC CONCEPTS OF ROTATING MACHINES

Calculation of air gap M.M.F. - per phase machine inductance using physical machine data - voltage and torque equation of D.C. machine - three phase symmetrical induction machine and salient pole synchronous machines in phase variable form.

UNIT III INTRODUCTION TO REFERENCE FRAME THEORY

Static and rotating reference frames - transformation relationships - examples using static symmetrical three phase R, R-L, R-L-M and R-L-C circuits - application of reference frame theory to three phase symmetrical induction and synchronous machines - dynamic direct and quadrature axis model in arbitrarily rotating reference frames - voltage and torque equations - derivation of steady state phasor relationship from dynamic model - generalized theory of rotating electrical machine and Kron's primitive machine.

UNIT IVD ETERMINATIONOF SYNCHRONOUS MACHINE DYNAMIC EQUIVALENT CIRCUIT PARAMETERS

Standard and derived machine time constants - frequency response test - analysis and dynamic modeling of two phase asymmetrical induction machine and single phase induction machine.

UNIT V SPECIAL MACHINES

Permanent magnet synchronous machine - surface permanent magnet (square and sinusoidal back E.M.F. type) and interior permanent magnet machines - construction and operating principle - dynamic modeling and self controlled operation - analysis of switch reluctance motors.

L = 45 T = 15 P = 0 C =4

TEXT BOOKS

1. Charles Kingsley, A.E. Fitzgerald Jr. and Stephen D. Umans, 'Electric Machinery', Tata McGraw-Hill, Fifth Edition, 1992.
2. R. Krishnan, 'Electric Motor & Drives: Modelling, Analysis and Control', Prentice Hall of India, 2001.

REFERENCES

1. C.V. Jones, 'The Unified Theory of Electrical Machines', Butterworth, 1967.
2. T.J.E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives' Clarendon Press, 1989.

Skill Development Employability Entrepreneurship

22272E51BP ADVANCED POWER SYSTEM DYNAMICS L T P C
OBJECTIVES: 3 0 0 3

- To perform transient stability analysis using unified algorithm.
- To impart knowledge on sub-synchronous resonance and oscillations
- To analyze voltage stability problem in power system.
- To familiarize the methods of transient stability enhancement

UNIT ITRANSIENT STABILITY ANALYSIS 9

Review of numerical integration methods: Euler and Fourth Order Runge-Kutta methods, Numerical stability and implicit methods, Interfacing of Synchronous machine (variable voltage) model to the transient stability algorithm (TSA) with partitioned – explicit and implicit approaches – Interfacing SVC with TSA-methods to enhance transient stability

UNIT II UNIFIED ALGORITHM FOR DYNAMIC ANALYSIS OF POWER SYSTEMS 9

Need for unified algorithm- numerical integration algorithmic steps-truncation error-variable step size – handling the discontinuities- numerical stability- application of the algorithm for transient. Mid-term and long-term stability simulations

UNIT III SUBSYSNCHRONOUS RESONANCE (SSR) AND OSCILLATIONS 9

Subsynchronous Resonance (SSR) – Types of SSR - Characteristics of series –Compensated transmission systems –Modeling of turbine-generator-transmission network- Self-excitation due to induction generator effect – Torsional interaction resulting in SSR – Methods of analyzing SSR – Numerical examples illustrating instability of subsynchronous oscillations – time-domain simulation of subsynchronous resonance – EMTP with detailed synchronous machine model- Turbine Generator Torsional Characteristics: Shaft system model – Examples of torsional characteristics – Torsional Interaction with Power System Controls: Interaction with generator excitation controls – Interaction with speed governors – Interaction with nearby DC converters

UNIT IV TRANSMISSION, GENERATION AND LOAD ASPECTS OF VOLTAGE STABILITY ANALYSIS 9

Review of transmission aspects – Generation Aspects: Review of synchronous machine theory – Voltage and frequency controllers – Limiting devices affecting voltage stability – Voltage-reactive power characteristics of synchronous generators – Capability curves – Effect of machine limitation on deliverable power – Load Aspects – Voltage dependence of loads – Load restoration dynamics – Induction motors – Load tap changers – Thermostatic load recovery – General aggregate load models.

UNIT V ENHANCEMENT OF TRANSIENT STABILITY AND COUNTER MEASURES FOR SUB SYNCHRONOUS RESONANCE 9

Principle behind transient stability enhancement methods: high-speed fault clearing, reduction of transmission system reactance, regulated shunt compensation, dynamic braking, reactor switching, independent pole-operation of circuit-breakers, single-pole switching, fast-valving, high-speed excitation systems; NGH damper scheme.

TOTAL : 45 PERIODS

Skill Development Employability Entrepreneurship

OUTCOMES:

- Learners will be able to understand the various schemes available in Transformer protection
- Learners will have knowledge on Over current protection.
- Learners will attain knowledge about Distance and Carrier protection in transmission lines.
- Learners will understand the concepts of Busbar protection.
- Learners will attain basic knowledge on numerical protection techniques

REFERENCES

1 R.Ramnujam," Power System Dynamics Analysis and Simulation", PHI Learning Private Limited, New Delhi, 2009

2 T.V. Cutsem and C.Vournas, "Voltage Stability of Electric Power Systems", Kluwer publishers,1998

3 P. Kundur, "Power System Stability and Control", McGraw-Hill, 1993.

4 H.W. Dommel and N.Sato, "Fast Transient Stability Solutions," IEEE Trans., Vol. PAS-91, pp, 1643-1650, July/August 1972.

5 Roderick J . Frowd and J. C. Giri, "Transient stability and Long term dynamics unified", IEEE Trans., Vol 101, No. 10, October 1982.

6 M.Stubbe, A.Bihain,J.Deuse, J.C.Baader, "A New Unified software program for the study of the dynamic behaviour of electrical power system" IEEE Transaction, Power Systems, Vol.4.No.1,Feb:1989 Pg.129 to 138

22272E23DP **ANALYSIS AND COMPUTATION OF ELECTROMAGNETIC TRANSIENTS IN POWER SYSTEMS**

L T P C
3 0 0 3

OBJECTIVES:

- To understand the various types of transients and its analysis in power system.
- To learn about modeling and computational aspects transients computation

UNIT I REVIEW OF TRAVELLING WAVE PHENOMENA 9

Lumped and Distributed Parameters – Wave Equation – Reflection, Refraction, Behaviour of Travelling waves at the line terminations – Lattice Diagrams – Attenuation and Distortion.

UNIT II LIGHTNING, SWITCHING AND TEMPORARY OVERVOLTAGES 9

Lightning overvoltages: interaction between lightning and power system- ground wire voltage and voltage across insulator; switching overvoltage: Short line or kilometric fault, energizing transients - closing and re-closing of lines, methods of control; temporary overvoltages: line dropping, load rejection; voltage induced by fault; very fast transient overvoltage (VFTO).

UNIT III PARAMETERS AND MODELING OF OVERHEAD LINES 9

Review of line parameters for simple configurations: series resistance, inductance and shunt capacitance; bundle conductors : equivalent GMR and equivalent radius; modal propagation in transmission lines: modes on multi-phase transposed transmission lines, α-β-0 transformation and symmetrical components transformation, modal impedances; analysis of modes on untransposed lines; effect of ground return and skin effect; transposition schemes;

UNIT V FAST TRANSIENTS PHENOMENON IN AIS AND GIS 9

Digital computation of line parameters: why line parameter evaluation programs? Salient features of a typical line parameter evaluation program; constructional features of that affect transmission line parameters; line parameters for physical and equivalent phase conductors elimination of ground wires bundling of conductors; principle of digital computation of transients: features and capabilities of electromagnetic transients program; steady state and time step solution modules: basic solution methods; case studies on simulation of various types of transients

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will be able to model over head lines, cables and transformers.
- Learners will be able to analyze power system transients.

REFERENCES

1 Allan Greenwood, "Electrical Transients in Power System", Wiley & Sons Inc. New York, 1991.

Skill Development Employability Entrepreneurship

2 R. Ramanujam, “Computational Electromagnetic Transients: Modeling, Solution Methods and Simulation”, I.K. International Publishing House Pvt. Ltd, New Delhi, 2014.
3 Naidu M S and Kamaraju V, “High Voltage Engineering”, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.

22272E33AP SMART GRID LTPC

3003

OBJECTIVES:

- To Study about Smart Grid technologies, different smart meters and advanced metering infrastructure.
- To familiarize the power quality management issues in Smart Grid.
- To familiarize the high performance computing for Smart Grid applications

UNIT IINTRODUCTION TO SMART GRID 9

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, National and International Initiatives in Smart Grid.

UNIT II SMART GRID TECHNOLOGIES 9

Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/Var control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV).

UNIT III SMART METERS AND ADVANCED METERING INFRASTRUCTURE 9

Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU), Intelligent Electronic Devices (IED) & their application for monitoring & protection.

UNIT IV POWER QUALITY MANAGEMENT IN SMART GRID 9

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

UNIT V HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS 9

Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

TOTAL : 45 PERIODS

Skill Development Employability Entrepreneurship

OUTCOMES:

- Learners will develop more understanding on the concepts of Smart Grid and its present developments.
- Learners will study about different Smart Grid technologies.
- Learners will acquire knowledge about different smart meters and advanced metering infrastructure.
- Learners will have knowledge on power quality management in Smart Grids
- Learners will develop more understanding on LAN, WAN and Cloud Computing for Smart Grid application

REFERENCES

1 Stuart Borlase "Smart Grid :Infrastructure, Technology and Solutions", CRC Press 2012.

2 Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley 2012.

3 Vehbi C. Güngör, DilanSahin, TaskinKocak, Salih Ergüt, Concettina Buccella, Carlo Cecati, and Gerhard P. Hancke, "Smart Grid Technologies: Communication Technologies and Standards" IEEE Transactions On Industrial Informatics, Vol. 7, No. 4, November 2011.

4 Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang "Smart Grid – The New and Improved Power Grid: A Survey" , IEEE Transaction on Smart Grids, vol. 14, j2012.

22272E33BP SOLAR AND ENERGY STORAGE SYSTEMS LTPC

3003

OBJECTIVES:

- To Study about solar modules and PV system design and their applications
- To Deal with grid connected PV systems
- To Discuss about different energy storage systems

UNIT IINTRODUCTION 9

Characteristics of sunlight – semiconductors and P-N junctions –behavior of solar cells – cell properties – PV cell interconnection

UNIT II STAND ALONE PV SYSTEM 9

Solar modules – storage systems – power conditioning and regulation - MPPT- protection – stand alone PV systems design – sizing

UNIT III GRID CONNECTED PV SYSTEMS 9

PV systems in buildings – design issues for central power stations – safety – Economic aspect – Efficiency and performance - International PV programs

UNIT IV ENERGY STORAGE SYSTEMS 9

Impact of intermittent generation – Battery energy storage – solar thermal energy storage – pumped hydroelectric energy storage

UNIT V APPLICATIONS 9

Water pumping – battery chargers – solar car – direct-drive applications –Space – Telecommunications.

TOTAL : 45 PERIODS

OUTCOMES:

- Students will develop more understanding on solar energy storage systems
- Students will develop basic knowledge on standalone PV system
- Students will understand the issues in grid connected PV systems
- Students will study about the modeling of different energy storage systems and their performances
- Students will attain more on different applications of solar energy

Skill Development Employability Entrepreneurship

REFERENCES

1 Solanki C.S., “Solar Photovoltaics: Fundamentals, Technologies And Applications”, PHI Learning Pvt. Ltd.,2015.

2 Stuart R.Wenham, Martin A.Green, Muriel E. Watt and Richard Corkish, "Applied Photovoltaics", 2007,Earthscan, UK. Eduardo Lorenzo G. Araujo, "Solar electricity engineering of photovoltaic systems", Progensa,1994.

3 Frank S. Barnes & Jonah G. Levine, "Large Energy storage Systems Handbook", CRC Press, 2011.

4 McNeils, Frenkel, Desai, "Solar & Wind Energy Technologies", Wiley Eastern, 1990

5 S.P. Sukhatme , "Solar Energy", Tata McGraw Hill,1987.

22272E33CP POWER SYSTEM RELIABILITY L T P C

OBJECTIVES: 3 0 0 3

- To introduces the objectives of Load forecasting.
- To study the fundamentals of Generation system, transmission system and Distribution system reliability analysis
- To illustrate the basic concepts of Expansion planning

UNIT I LOAD FORECASTING 9

Objectives of forecasting - Load growth patterns and their importance in planning - Load forecasting Based on discounted multiple regression technique-Weather sensitive load forecasting-Determination of annual forecasting-Use of AI in load forecasting.

UNIT II GENERATION SYSTEM RELIABILITY ANALYSIS 9

Probabilistic generation and load models- Determination of LOLP and expected value of demand not served –Determination of reliability of ISO and interconnected generation systems

UNIT III TRANSMISSION SYSTEM RELIABILITY ANALYSIS 9

Deterministic contingency analysis-probabilistic load flow-Fuzzy load flow probabilistic transmission system reliability analysis-Determination of reliability indices like LOLP and expected value of demand not served

UNIT IV EXPANSION PLANNING 9

Basic concepts on expansion planning-procedure followed for integrate transmission system planning, current practice in India-Capacitor placer problem in transmission system and radial distributions system.

UNIT V DISTRIBUTION SYSTEM PLANNING OVERVIEW 9

Introduction, sub transmission lines and distribution substations-Design primary and secondary systems-distribution system protection and coordination of protective devices.

TOTAL: 45 PERIODS

OUTCOMES:

- Students will develop the ability to learn about load forecasting.
- Students will learn about reliability analysis of ISO and interconnected systems.
- Students will understand the concepts ot Contingency analysis and Probabilistic Load flow Analysis
- Students will be able to understand the concepts of Expansion planning

Skill Development Employability Entrepreneurship

- Students will have knowledge on the fundamental concepts of the Distribution system planning

REFERENCES

1 Roy Billinton & Ronald N. Allan, "Reliability Evaluation of Power Systems" Springer Publication,

2 R.L. Sullivan, "Power System Planning", Tata McGraw Hill Publishing Company Ltd 1977.

3 X. Wang & J.R. McDonald, "Modern Power System Planning", McGraw Hill Book Company 1994.

4 T. Gonen, "Electrical Power Distribution Engineering", McGraw Hill Book Company 1986.

5 B.R. Gupta, "Generation of Electrical Energy",S.Chand Publications 1983.

22272E33DP DISTRIBUTED GENERATION AND MICROGRID **L T P C**

OBJECTIVES: **3 0 0 3**

- To illustrate the concept of distributed generation
- To analyze the impact of grid integration.
- To study concept of Microgrid and its configuration

UNIT I INTRODUCTION 9

Conventional power generation: advantages and disadvantages, Energy crises, Non-conventional energy (NCE) resources: review of Solar PV, Wind Energy systems, Fuel Cells, micro-turbines, biomass, and tidal sources.

UNIT II DISTRIBUTED GENERATIONS (DG) 9

Concept of distributed generations, topologies, selection of sources, regulatory standards/ framework, Standards for interconnecting Distributed resources to electric power systems: IEEE 1547. DG installation classes, security issues in DG implementations. Energy storage elements: Batteries, ultra-capacitors, flywheels. Captive power plants

UNIT III IMPACT OF GRID INTEGRATION 9

Requirements for grid interconnection, limits on operational parameters,: voltage, frequency, THD, response to grid abnormal operating conditions, islanding issues. Impact of grid integration with NCE sources on existing power system: reliability, stability and power quality issues.

UNIT IV BASICS OF A MICROGRID 9

Concept and definition of microgrid, microgrid drivers and benefits, review of sources of microgrids, typical structure and configuration of a microgrid, AC and DC microgrids, Power Electronics interfaces in DC and AC microgrids

UNIT V CONTROL AND OPERATION OF MICROGRID 9

Modes of operation and control of microgrid: grid connected and islanded mode, Active and reactive power control, protection issues, anti-islanding schemes: passive, active and communication based techniques, microgrid communication infrastructure, Power quality issues in microgrids, regulatory standards, Microgrid economics, Introduction to smart microgrids.

TOTAL : 45 PERIODS

Skill Development Employability Entrepreneurship

OUTCOMES:

- Learners will attain knowledge on the various schemes of conventional and nonconventional power generation.

Skill Development Employability Entrepreneurship

- Learners will have knowledge on the topologies and energy sources of distributed generation.
- Learners will learn about the requirements for grid interconnection and its impact with NCE sources
- Learners will understand the fundamental concept of Microgrid.

REFERENCES

1 Amirnaser Yezdani, and Reza Iravani, “Voltage Source Converters in Power Systems: Modeling, Control and Applications”, IEEE John Wiley Publications, 2010.

2 DorinNeacsu, “Power Switching Converters: Medium and High Power”, CRC Press, Taylor & Francis, 2006

3 Chetan Singh Solanki, “Solar Photo Voltaics”, PHI learning Pvt. Ltd., New Delhi,2009

4 J.F. Manwell, J.G. McGowan “Wind Energy Explained, theory design and applications”, Wiley publication 2010.

5 D. D. Hall and R. P. Grover, “Biomass Regenerable Energy”, John Wiley, New York, 1987.

6 John Twidell and Tony Weir, “Renewable Energy Resources” Tyalor and Francis Publications, Second edition 2006.

22272E43AP - WIND ENERGY CONVERSION SYSTEMS

3 1 0 4

UNIT-I INTRODUCTION: **9**

History of wind Electric generation - Darrieus wind - Horizontal and vertical axis-Wind turbine - other modern developments - Future possibilities.

UNIT-II WIND RESOURCE AND ITS POTENTIAL FOR ELECVTRIC POWER GENERATION: **9**

Power Extracted By A Wind Driven Machine - Nature and occurrence of wind characteristics and power production - variation of mean wind speed with time.

UNIT-III WIND POWER SITES AND WIND MEASUREMENTS: **9**

Average wind speed and other factors affecting choice of the site - Effect of wind direction - Measurement of wind velocity - Personal estimation without instruments- anemometers - Measurement of wind direction.

UNIT-IV WIND TURBINES WITH ASYNCHRONOUS GENERATORS AND CONTROL ASPECTS: **9**

Asynchronous systems - Ac Generators - Self excitation of Induction Generator - Single Phase operation of Induction Generator - Permanenet magnet Generators - Basic control aspects - fixed speed ratio control scheme - fixed vs variable speed operation of WECS.

UNIT-V GENERATION OF ELECTRICITY **9**

Active and reactive power - P and Q transfer in power systems - Power converters - Characteristics of Generators - Variable Speed options - Economics.

L = 45 T = 15 P = 0 C =4

REFERENCES:

1. N.G.Calvert, 'Wind Power Principles: Their Application on small scale', Charles Friffin& co. Ltd, London, 1979.
2. Gerald W.Koeppel, "Pirnam's and Power from the wind", Van Nastran Reinhold Co., London, 1979.
3. Gary L. Johnson, "Wind Energy System", Prentice hall Inc., Englewood Cliffs, New Jersey, 1985.
4. Wind energy conversion system by L. Lfreris, Prentice hall (U.K) Ltd., 1990.

22272E43BP - AI TECHNIQUES TO POWER SYSTEMS

3 1 0 4

1. INTRODUCTION TO NEURAL NETWORKS 9

Basics of ANN - perceptron - delta learning rule - back propagation algorithm - multilayer feed forward network - memory models - bi-directional associative memory - Hopfield network.

2. APPLICATIONS TO POWER SYSTEM PROBLEMS 9

Application of neural networks to load forecasting - contingency analysis - VAR control - economic load dispatch.

3. INTRODUCTION TO FUZZY LOGIC 9

Crispness - vagueness - fuzziness - uncertainty - fuzzy set theory fuzzy sets - fuzzy set operations - fuzzy measures - fuzzy relations - fuzzy function - structure of fuzzy logic controller – fuzzification models - data base - rule base - inference engine defuzzification module.

4. APPLICATIONS TO POWER SYSTEMS 9

Decision making in power system control through fuzzy set theory - use of fuzzy set models of LP in power systems scheduling problems - fuzzy logic based power system stabilizer.

5. GENETIC ALGORITHM AND ITS APPLICATIONS TO POWER SYSTEMS 9

Introduction - simple genetic algorithm - reproduction - crossover - mutation – advanced operators in genetic search - applications to voltage control and stability studies.

L = 45 T = 15 P = 0 C =4

REFERENCES:

1. James A. Freeman and Skapura.B.M „Neural Networks - Algorithms Applications and Programming Techniques‟, Addison Wesley, 1990.
2. George Klir and Tina Folger.A, „Fuzzy sets, Uncertainty and Information‟, Prentice Hall of India, 1993.
3. Zimmerman.H.J„„Fuzzy Set Theory and its Applications‟, Kluwer Academic Publishers 1994.
4. IEEE tutorial on „Application of Neural Network to Power Systems‟, 1996.
5. Loi Lei Lai, „Intelligent System Applications in Power Engineering‟, John Wiley & SonsLtd.,1998.

Skill Development Employability Entrepreneurship

22272E43CP ELECTRICAL DISTRIBUTION SYSTEM L T P C

OBJECTIVES: 3 0 0 3

- To provide knowledge about the distribution system electrical characteristics
- To gain knowledge about planning and designing of distribution system
- To analyze power quality in distribution system
- To analyze the power flow in balanced and unbalanced system

UNIT I INTRODUCTION 9

Distribution System-Distribution Feeder Electrical Characteristics-Nature of Loads : Individual Customer Load, Distribution Transformer Loading and Feeder Load -Approximate Method of Analysis: Voltage Drop, Line Impedance, “K” Factors, Uniformly Distributed Loads and Lumping Loads in Geometric Configurations.

UNIT II DISTRIBUTION SYSTEM PLANNING 9

Factors effecting planning, present techniques, planning models(Short term planning, long term planning and dynamic planning), planning in the future, future nature of distribution planning, Role of computer in Distribution planning. Load forecast, Load characteristics and Load models.

UNIT III DISTRIBUTION SYSTEM LINE MODEL 9

Exact Line Segment Model-Modified Line Model- Approximate Line Segment Model-Modified “Ladder” Iterative Technique-General Matrices for Parallel Lines.

UNIT IV VOLTAGE REGULATION 9

Standard Voltage Ratings-Two-Winding Transformer Theory-Two-Winding Autotransformer-Step-Voltage Regulators: Single-Phase Step-Voltage Regulators-Three-Phase Step-Voltage Regulators- Application of capacitors in Distribution system.

UNIT V DISTRIBUTION FEEDER ANALYSIS 9

Power-Flow Analysis- Ladder Iterative Technique -Unbalanced Three-Phase Distribution Feeder- Modified Ladder Iterative Technique- Load Allocation- Short-Circuit Studies.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to apply the concepts of planning and design of distribution system for utility systems
- Ability to implement the concepts of volatage control in distribution system.
- Ability to analyze the power flow in balanced and unbalanced system

Skill Development Employability Entrepreneurship

REFERENCES

1. William H. Kersting," Distribution System Modeling and Analysis " CRC press 3rd edition,2012.
2. Turan Gonen, "Electric Power Distribution System Engineering", McGraw Hill Company. 1986
3. James Northcote – Green, Robert Wilson, "Control and Automation of Electrical Power Distribution Systems", CRC Press, New York, 2007.
4. Pabla H S, "Electrical Power Distribution Systems", Tata McGraw Hill. 2004

22272E43DP- ENERGY MANAGEMENT AND AUDITING L T P C

OBJECTIVES: 3 0 0 3

- To study the concepts behind economic analysis and Load management.
- To emphasize the energy management on various electrical equipments and metering.
- To illustrate the concept of lighting systems and cogeneration.

UNIT I INTRODUCTION 9

Need for energy management - energy basics- designing and starting an energy management program – energy accounting -energy monitoring, targeting and reporting-energy audit process.

UNIT II ENERGY COST AND LOAD MANAGEMENT 9

Important concepts in an economic analysis - Economic models-Time value of money-Utility rate structures- cost of electricity-Loss evaluation- Load management: Demand control techniques-Utility monitoring and control system-HVAC and energy management-Economic justification.

UNIT III ENERGY MANAGEMENT FOR MOTORS, SYSTEMS, AND ELECTRICAL EQUIPMENT 9

Systems and equipment- Electric motors-Transformers and reactors-Capacitors and synchronous machines.

UNIT IV METERING FOR ENERGY MANAGEMENT 9

Relationships between parameters-Units of measure-Typical cost factors- Utility meters - Timing of meter disc for kilowatt measurement - Demand meters - Paralleling of current transformers - Instrument transformer burdens-Multitasking solid-state meters - Metering location vs. requirements- Metering techniques and practical examples.

UNIT V LIGHTING SYSTEMS & COGENERATION 9

Concept of lighting systems - The task and the working space -Light sources - Ballasts - Luminaries - Lighting controls-Optimizing lighting energy - Power factor and effect of harmonics on power quality - Cost analysis techniques-Lighting and energy standards Cogeneration: Forms of cogeneration - feasibility of cogeneration- Electrical interconnection.

TOTAL : 45 PERIODS

OUTCOMES:

- Students will develop the ability to learn about the need for energy management and auditing process

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22272E43DP- ENERGY MANAGEMENT AND AUDITING L T P C

- Learners will learn about basic concepts of economic analysis and load management.
- Students will understand the energy management on various electrical equipments.
- Students will have knowledge on the concepts of metering and factors influencing cost function

Skill Development Employability Entrepreneurship

- Students will be able to learn about the concept of lighting systems, light sources and various forms of cogeneration

REFERENCES

1 Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, “Guide to Energy Management”, Fifth Edition, The Fairmont Press, Inc., 2006
2 Eastop T.D & Croft D.R, “Energy Efficiency for Engineers and Technologists”, Logman Scientific & Technical, 1990.
3 Reay D.A, “Industrial Energy Conservation”, 1st edition, Pergamon Press, 1977.
4 “IEEE Recommended Practice for Energy Management in Industrial and Commercial Facilities”, IEEE, 1996
5 Amit K. Tyagi, “Handbook on Energy Audits and Management”, TERI, 2003.

22272E51AP- POWER ELECTRONICS APPLICATIONS IN POWER SYSTEMS LTPC

3 1 0 4

UNIT: I STATIC COMPENSATOR CONTROL 9

Theory of load compensation - voltage regulation and power factor correction - phase balance and PF correction of unsymmetrical loads - Property of static compensator - Thyristor controlled rectifier (TCR) - Thyristor Controlled Capacitor (TSC) -Saturable core reactor - Control Strategies.

UNIT: II HARMONIC CONTROL AND POWER FACTOR IMPROVEMENT 9

Input power factor for different types of converters - power factor improvement using Load and forced commutated converters.

UNIT: III VOLTAGE CONTROL USING STATIC TAP-CHANGERS 9

Conventional tap changing methods, static tap changers using Thyristor, different schemes - comparison.

UNIT: IV STATIC EXCITATION CONTROL 9

Solid state excitation of synchronous generators - Different schemes - Generex excitation systems.

UNIT: V UNINTERRUPTABLE POWER SUPPLY SYSTEM 9

Parallel, Redundant and non- redundant UPS - Ups using resonant power converters - Switch mode power supplies.

L = 45 T = 15 P = 0 C =4

TEXT BOOK

Miller. T.J.E, “Reactive power control in Electric systems”. Wiley inter science, New York, 1982.

REFRENCES

1. “Static Compensator for AC power systems”, Proc. IEE vol.128 Nov. 1981. pp 362-406.
2 “A Static alternative to the transformer on load tap changing”, IEEE Trans. On Pas, Vol.PAS-99, Jan. /Feb. 1980, pp86-89.
3. “Improvements in Thyristor controlled static on- load tap controllers for transformers”, IEEE Trans. on PAS, Vol.PAS-101, Sept.1982, pp3091-3095.
4. “Shunt Thyristor rectifiers for the Generex Excitation systems”, IEEE Trans. On PAS. PAS -96, July/August, 1977, pp1219-1325.

Skill Development Employability Entrepreneurship

22272E32B- POWER SYSTEM DYNAMICS

3 1 0 4

1. SYNCHRONOUS MACHINE MODELLING 9

Schematic Diagram, Physical Description: armature and field structure, machines with multiple pole pairs, mmf waveforms, direct and quadrature axes, Mathematical Description of a Synchronous Machine: Basic equations of a synchronous machine: stator circuit equations, stator self, stator mutual and stator to rotor mutual inductances, dq0 Transformation: flux linkage and voltage equations for stator and rotor in dq0 coordinates, electrical power and torque, physical interpretation of dq0 transformation, Per Unit Representations: L_{ad}-reciprocal per unit system and that from power-invariant form of Park's transformation; Equivalent Circuits for direct and quadrature axes, Steady-state Analysis: Voltage, current and flux-linkage relationships, Phasor representation, Rotor angle, Steady-state equivalent circuit, Computation of steady-state values, Equations of Motion: Swing Equation, calculation of inertia constant, Representation in system studies, Synchronous Machine Representation in Stability Studies: Simplifications for large-scale studies : Neglect of stator $p\Psi$ terms and speed variations, Simplified model with amortisseurs neglected: two-axis model with amortisseur windings neglected, classical model.

2. MODELLING OF EXCITATION AND SPEED GOVERNING SYSTEMS 9

Excitation System Requirements; Elements of an Excitation System; Types of Excitation System;Control and protective functions;IEEE (1992) block diagram for simulation of excitation systems. Turbine and Governing System Modelling: Functional Block Diagram of Power Generation and Control, Schematic of a hydroelectric plant, classical transfer function of a hydraulic turbine (no derivation), special characteristic of hydraulic turbine, electrical analogue of hydraulic turbine, Governor for Hydraulic Turbine: Requirement for a transient droop, Block diagram of governor with transient droop compensation, Steam turbine modelling: Single reheat tandem compounded type only and IEEE block diagram for dynamic simulation; generic speed-governing system model for normal speed/load control function.

3. SMALL-SIGNAL STABILITY ANALYSIS WITHOUT CONTROLLERS 9

Classification of Stability, Basic Concepts and Definitions: Rotor angle stability, The Stability Phenomena. Fundamental Concepts of Stability of Dynamic Systems: State-space representation, stability of dynamic system, Linearisation, Eigen properties of the state matrix: Eigen values and eigenvectors, modal matrices, eigen value and stability, mode shape and participation factor. Single-Machine Infinite Bus (SMIB) Configuration: Classical Machine Model stability analysis with numerical example, Effects of Field Circuit Dynamics: synchronous machine, network and linearised system equations, block diagram representation with K-constants; expression for K-constants (no derivation), effect of field flux variation on system stability: analysis with numerical example,

4. SMALL-SIGNAL STABILITY ANALYSIS WITH CONTROLLERS 9

Effects Of Excitation System: Equations with definitions of appropriate K-constants and simple thyristor excitation system and AVR, block diagram with the excitation system, analysis of effect of AVR on synchronizing and damping components using a numerical example, Power System Stabiliser: Block diagram with AVR and PSS, Illustration of principle of PSS application with numerical example, Block diagram of PSS with description, system state matrix including PSS,

Skill Development Employability Entrepreneurship

analysis of stability with numerical a example. Multi-Machine Configuration: Equations in a common reference frame, equations in individual machine rotor coordinates, illustration of formation of system state matrix for a two-machine system with classical models for synchronous machines, illustration of stability analysis using a numerical example. Principle behind small-signal stability improvement methods: delta-omega and delta P-omega stabilizers.

5. ENHANCEMENT OF SMALL SIGNAL STABILITY 9

Power System Stabilizer – Stabilizer based on shaft speed signal (delta omega) – Delta –P-Omega stabilizer-Frequency-based stabilizers – Digital Stabilizer – Excitation control design – Exciter gain – Phase lead compensation – Stabilizing signal washout stabilizer gain – Stabilizer limits

L = 45 T = 15 P = 0 C =4

REFERENCES

1. P. Kundur, "Power System Stability and Control", McGraw-Hill, 1993.
2. IEEE Committee Report, "Dynamic Models for Steam and Hydro Turbines in Power System Studies", IEEE Trans., Vol.PAS-92, pp 1904-1915, November/December, 1973. on Turbine-Governor Model.
3. P.M Anderson and A.A Fouad, "Power System Control and Stability", Iowa State University Press, Ames, Iowa, 1978.

Skill Development Employability Entrepreneurship

22272E51CP ELECTRIC VEHICLES AND POWER MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the concept of electrical vehicles and its operations
- To understand the need for energy storage in hybrid vehicles
- To provide knowledge about various possible energy storage technologies that can be
- used in electric vehicles

UNIT I ELECTRIC VEHICLES AND VEHICLE MECHANICS 9

Electric Vehicles (EV), Hybrid Electric Vehicles (HEV), Engine ratings, Comparisons of EV with internal combustion Engine vehicles, Fundamentals of vehicle mechanics

UNIT II ARCHITECTURE OF EV's AND POWER TRAIN COMPONENTS 9

Architecture of EV's and HEV's – Plug-n Hybrid Electric Vehicles (PHEV)- Power train components and sizing, Gears, Clutches, Transmission and Brakes

UNIT III CONTROL OF DC AND AC DRIVES 9

DC/DC chopper based four quadrant operations of DC drives – Inverter based V/f Operation (motoring and braking) of induction motor drive system – Induction motor and permanent motor based vector control operation – Switched reluctance motor (SRM) drives

UNIT IV BATTERY ENERGY STORAGE SYSTEM 9

Battery Basics, Different types, Battery Parameters, Battery modeling, Traction Batteries

UNIT V ALTERNATIVE ENERGY STORAGE SYSTEMS 9

Fuel cell – Characteristics- Types – hydrogen Storage Systems and Fuel cell EV – Ultra capacitors

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will understand the operation of Electric vehicles and various energy storage technologies for electrical vehicles

REFERENCES

1 Iqbal Hussain, "**Electric and Hybrid Vehicles: Design Fundamentals, Second Edition"** CRC Press, Taylor & Francis Group, Second Edition (2011).

2 Ali Emadi, Mehrdad Ehsani, John M.Miller, "Vehicular Electric Power Systems", Special Indian Edition, Marcel dekker, Inc 2010.

Skill Development Employability Entrepreneurship

22272E51DP	ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide fundamental knowledge on electromagnetic interference and electromagnetic compatibility.
- To study the important techniques to control EMI and EMC.
- To expose the knowledge on testing techniques as per Indian and international standards in EMI measurement.

UNIT I INTRODUCTION 9

Definitions of EMI/EMC -Sources of EMI- Intersystems and Intrasystem- Conducted and radiated interference- Characteristics - Designing for electromagnetic compatibility (EMC)- EMC regulationtypical noise path- EMI predictions and modeling, Cross talk - Methods of eliminating interferences.

UNIT II GROUNDING AND CABLING 9

Cabling- types of cables, mechanism of EMI emission / coupling in cables –capacitive couplinginductive coupling- shielding to prevent magnetic radiation- shield transfer impedance, Grounding – safety grounds – signal grounds- single point and multipoint ground systemshybrid grounds- functional ground layout –grounding of cable shields- -guard shields- isolation, neutralizing transformers, shield grounding at high frequencies, digital grounding- Earth measurement Methods

UNIT III BALANCING, FILTERING AND SHIELDING 9

Power supply decoupling- decoupling filters-amplifier filtering –high frequency filtering- EMI filters characteristics of LPF, HPF, BPF, BEF and power line filter design -Choice of capacitors, inductors, transformers and resistors, EMC design components -shielding – near and far fieldsshielding effectiveness - absorption and reflection loss- magnetic materials as a shield, shield discontinuities, slots and holes, seams and joints, conductive gaskets-windows and coatings - grounding of shields

UNIT IVEMI IN ELEMENTS AND CIRCUITS 9

Electromagnetic emissions, noise from relays and switches, non- linearities in circuits, passive inter modulation, transients in power supply lines, EMI from power electronic equipment, EMI as combination of radiation and conduction

UNIT V ELECTROSTATIC DISCHARGE, STANDARDS AND TESTING TECHNIQUES 9

Static Generation- human body model- static discharges- ESD versus EMC, ESD protection in equipments- standards – FCC requirements – EMI measurements – Open area test site measurements and precautions- Radiated and conducted interference measurements, Control requirements and testing methods

TOTAL: 45 PERIODS

OUTCOMES:

- Recognize the sources of Conducted and radiated EMI in Power Electronic Converters and consumer appliances and suggest remedial measures to mitigate the problems
- Assess the insertion loss and design EMI filters to reduce the loss
- Design EMI filters, common-mode chokes and RC-snubber circuits measures to keep the interference within tolerable limits

REFERENCES

1. V.P. Kodali, “Engineering Electromagnetic Compatibility”, S. Chand, 1996
2. Henry W.Ott, “ Noise reduction techniques in electronic systems”, John Wiley & Sons, 1989
3. Bernhard Keiser, “Principles of Electro-magnetic Compatibility”, Artech House, Inc. (685 canton street, Norwood, MA 020062 USA) 1987
4. Bridges, J.E Milleta J. and Ricketts.L.W., “EMP Radiation and Protective techniques”, John Wiley and sons, USA 1976
5. William Duff G., & Donald White R. J, “Series on Electromagnetic Interference and Compatibility”, Vol.
6. Weston David A., “Electromagnetic Compatibility, Principles and Applications”, 1991.

ELECTIVES – V (semester-III)

22275E52AP - POWER CONDITIONING

3 1 0 4

1. INTRODUCTION 9

Introduction – Characterization of Electric Power Quality: Transients, short duration and long duration voltage variations, Voltage imbalance, waveform distortion, Voltage fluctuations, Power frequency variation, Power acceptability curves – power quality problems: poor load power factor, Non linear and unbalanced loads, DC offset in loads, Notching in load voltage, Disturbance in supply voltage – Power quality standards.

2. NON-LINEAR LOADS 9

Single phase static and rotating AC/DC converters, Three phase static AC/DC converters, Battery chargers, Arc furnaces, Fluorescent lighting, pulse modulated devices, Adjustable speed drives.

3. MEASUREMENT AND ANALYSIS METHODS 9

Voltage, Current, Power and Energy measurements, power factor measurements and definitions, event recorders, Measurement Error – Analysis: Analysis in the periodic steady state, Time domain methods, Frequency domain methods: Laplace′s, Fourier and Hartley transform – The Walsh Transform – Wavelet Transform.

4. ANALYSIS AND CONVENTIONAL MITIGATION METHODS 9

Analysis of power outages, Analysis of unbalance: Symmetrical components of phasor quantities, Instantaneous symmetrical components, Instantaneous real and reactive powers, Analysis of distortion: On–line extraction of fundamental sequence components from measured samples – Harmonic indices – Analysis of voltage sag: Detorit Edison sag score, Voltage sag energy, Voltage Sag Lost Energy Index (VSLEI)- Analysis of voltage flicker, Reduced duration and customer impact of outages, Classical load balancing problem: Open loop balancing, Closed loop balancing, current balancing, Harmonic reduction, Voltage sag reduction.

5. POWER QUALITY IMPROVEMENT 9

Utility-Customer interface –Harmonic filters: passive, Active and hybrid filters –Custom power devices: Network reconfiguring Devices, Load compensation using DSTATCOM, Voltage regulation using DSTATCOM, protecting sensitive loads using DVR, UPQC – control strategies: P- Q theory, Synchronous detection method – Custom power park – Status of application of custom power devices

L = 45 T = 15 P = 0 C =4

REFERENCES:

1. Arindam Ghosh “Power Quality Enhancement Using Custom Power Devices”, Kluwer Academic Publishers, 2002.
2. Heydt.G.T, “Electric Power Quality”, Stars in a Circle Publications, 1994(2nd edition)
3. Dugan.R.C, “ Electrical Power System Quality”,TMH,2008.
4.Arrillga.A.J and Neville R.Watson, Power System Harmonics, John Wiley second Edition,2003.
5. Derek A. Paice, “Power electronic converter harmonics”,John Wiley & sons, 1999.

Skill Development Employability Entrepreneurship

ELECTIVES – V (semester-III)

22275E52BP – DEREGULATED POWER SYSTEM

3 1 0 4

1. FUNDAMENTALS AND ARCHITECTURE OF POWERMARKETS 9

Deregulation of Electric utilities: Introduction-Unbundling-Wheeling- Reform motivations- Fundamentals of Deregulated Markets – Types (Future, Day-ahead and Spot) – Participating in Markets (Consumer and Producer Perspective) – bilateral markets – pool markets. Independent System Operator (ISO)-components-types of ISO - role of ISO - Lessons and Operating Experiences of Deregulated Electricity Markets in various Countries (UK, Australia, Europe, US, Asia).

2. TECHNICAL CHALLENGES 9

Total Transfer Capability – Limitations - Margins – Available transfer capability (ATC) – Procedure - Methods to compute ATC – Static and Dynamic ATC – Effect of contingency analysis – Case Study. Concept of Congestion Management – Bid, Zonal and Node Congestion Principles – Inter and Intra zonal congestion – Generation Rescheduling - Transmission congestion contracts – Case Study.

3. TRANSMISSION NETWORKS AND SYSTEM SECURITY SERVICES 9

Transmission expansion in the New Environment – Introduction – Role of transmission planning – Physical Transmission Rights – Limitations – Flow gate - Financial Transmission Rights – Losses – Managing Transmission Risks – Hedging – Investment. Ancillary Services – Introduction – Describing Needs – Compulsory and Demand-side provision – Buying and Selling Ancillary Services – Standards.

4. MARKET PRICING 9

Transmission pricing in open access system – Introduction – Spot Pricing – Uniform Pricing – Zonal Pricing – Locational Marginal Pricing – Congestion Pricing – Ramping and Opportunity Costs. Embedded cost based transmission pricing methods (Postage stamp, Contract path and MW-mile) – Incremental cost based transmission pricing methods (Short run marginal cost, Long run marginal cost) - Pricing of Losses on Lines and Nodes.

5. INDIAN POWER MARKET 9

Current Scenario – Regions – Restructuring Choices – Statewise Operating Strategies – Salient features of Indian Electricity Act 2003 – Transmission System Operator – Regulatory and Policy development in Indian power Sector – Opportunities for IPP and Capacity Power Producer. Availability based tariff – Necessity – Working Mechanism – Beneficiaries – Day Scheduling Process – Deviation from Schedule – Unscheduled Interchange Rate – System Marginal Rate – Trading Surplus Generation – Applications.

L = 45 T = 15 P = 0 C =4

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REFERENCES

1. Kankar Bhattacharya, Math H.J. Bollen and Jaap E. Daalder, “Operation of Restructured Power Systems”, Kluwer Academic Publishers, 2001
2. Loi Lei Lai, “Power system Restructuring and Regulation”, John Wiley sons, 2001.
3. Shahidehpour.M and Alomoush.M, “Restructuring Electrical Power Systems”, Marcel Decker Inc., 2001.
4. Steven Stoft, “ Power System Economics”, Wiley – IEEE Press, 2002
5. Daniel S. Kirschen and Goran Strbac, “ Fundamentals of Power System Economics”, John Wiley & Sons Ltd., 2004.
6. Scholarly Transaction Papers and Utility web sites

22275E52CP	CONTROL SYSTEM DESIGN FOR POWER ELECTRONICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explore conceptual bridges between the fields of Control Systems and Power Electronics
- To Study Control theories and techniques relevant to the design of feedback controllers in Power Electronics.

UNIT I MODELLING OF DC-TO-DC POWER CONVERTERS 9

Modelling of Buck Converter , Boost Converter ,Buck- Boost Converter, Cuk Converter ,Sepic Converter, Zeta Converter, Quadratic Buck Converter ,Double Buck-Boost Converter, Boost-Boost Converter General Mathematical Model for Power Electronics Devices.

UNIT II SLIDING MODE CONTROLLER DESIGN 9

Variable Structure Systems. Single Switch Regulated Systems Sliding Surfaces, Accessibility of the Sliding Surface Sliding Mode Control Implementation of Boost Converter ,Buck-Boost Converter, Cuk Converter ,Sepic Converter, Zeta Converter, Quadratic Buck Converter ,Double Buck-Boost Converter, Boost-Boost Converter.

UNIT III APPROXIMATE LINEARIZATION CONTROLLER DESIGN 9

Linear Feedback Control, Pole Placement by Full State Feedback , Pole Placement Based on Observer Design ,Reduced Order Observers , Generalized Proportional Integral Controllers, Passivity Based Control , Sliding Mode Control Implementation of Buck Converter , Boost Converter ,Buck-Boost Converter.

UNIT IV NONLINEAR CONTROLLER DESIGN 9

Feedback Linearization Isidori's Canonical Form, Input-Output Feedback Linearization, State Feedback Linearization, Passivity Based Control , Full Order Observers , Reduced Order Observers.

UNIT V PREDICTIVE CONTROL OF POWER CONVERTERS 9

Basic Concepts, Theory, and Methods, Application of Predictive Control in Power Electronics, AC-DC-AC Converter System, Faults and Diagnosis Systems in Power Converters.

TOTAL:45 PERIODS

OUTCOMES:

- Ability to understand an overview on modern linear and nonlinear control strategies for power electronics devices
- Ability to model modern power electronic converters for industrial applications
- Ability to design appropriate controllers for modern power electronics devices.

REFERENCES

1. Hebertt Sira-Ramírez, Ramón Silva-Ortigoza, "Control Design Techniques in Power Electronics Devices", Springer 2012

2. Mahesh Patil, Pankaj Rodey, "Control Systems for Power Electronics: A Practical Guide", Springer India, 2015.

Skill Development Employability Entrepreneurship

3. Blaabjerg José Rodríguez, "Advanced and Intelligent Control in Power Electronics and Drives" , Springer, 2014
4. Enrique Acha, Vassilios Agelidis, Olimpo Anaya, TJE Miller, "Power Electronic Control in Electrical Systems", Newnes, 2002
5. Marija D. Aranya Chakrabortty, Marija , "Control and Optimization Methods for Electric Smart Grids", Springer, 2012.

22275E52DP PRINCIPLES OF EHV TRANSMISSION **L T P C 3 0 0 3**

OBJECTIVES:

To impart knowledge on,

- Types of power transmission and configurations various parameters and voltage gradients of transmission line conductors.
- The design requirements of EHV AC and DC lines.

UNIT I INTRODUCTION 9

Standard transmission voltages-AC and DC – different line configurations– average values of line parameters – power handling capacity and line loss – costs of transmission lines and equipment – mechanical considerations in line performance.

UNIT II CALCULATION OF LINE PARAMETERS 9

Calculation of resistance, inductance and capacitance for multi-conductor lines – calculation of sequence inductances and capacitances – line parameters for different modes of propagation – effect of ground return.

UNIT III VOLTAGE GRADIENTS OF CONDUCTORS 9

Charge-potential relations for multi-conductor lines – surface voltage gradient on conductors – gradient factors and their use – distribution of voltage gradient on sub conductors of bundle - voltage gradients on conductors in the presence of ground wires on towers-I2R loss and corona loss-RIV.

UNIT IV ELECTROSTATIC FIELD AND DESIGN OF EHV LINES 9

Effect of EHV line on heavy vehicles - calculation of electrostatic field of AC lines- effect of high field on humans, animals, and plants - measurement of electrostatic fields – electrostatic Induction in unenergised circuit of a D/C line - induced voltages in insulated ground wires - electromagnetic interference, Design of EHV lines.

UNIT V HVDC LINES

Introduction- Reliability and failure issues-Design-tower, ROW, clearances, insulators, electrical and mechanical protection-Maintenance-Control and protection-D.C Electric field and Magnetic field -Regulations and guide lines-underground line design.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to model the transmission lines and estimate the voltage gradients and losses
- Ability to design EHV AC and DC transmission lines

REFERENCES

1 Rakosh Das Begamudre, "Extra High Voltage AC Transmission Engineering", Second Edition, New Age International Pvt. Ltd., 2006.
2 Pritindra Chowdhari, "Electromagnetic transients in Power System", John Wiley and Sons Inc., 2009.
3 Sunil S.Rao, "EHV-AC, HVDC Transmission & Distribution Engineering", Third Edition, Khanna Publishers, 2008.
4 William H. Bailey, Deborah E. Weil and James R. Stewart, "A Review on HVDC Power Transmission Environmental Issues", Oak Ridge National Laboratory.

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5 J.C Molburg, J.A. Kavicky, and K.C. Picel ,"A report on The design, Construction and operation of Long-distance High-Voltage Electricity Transmission Technologies" Argonne (National Laboratory) 2007.
6 "Power Engineer's Handbook", Revised and Enlarged 6th Edition, TNEB Engineers' Association, October 2002.

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ELECTIVES – VI (semester-III)

22272E53AP- SOFTWARE FOR CONTROL SYSTEM DESIGN

3 1 0 4

1. INTRODUCTION TO DESIGN AND CLASSICAL PID CONTROL

Systems performance and specifications –Proportional, Integral and Derivative Controllers – Structure – Empirical tuning- Zeigler Nichols-Cohen Coon – Root Locus method – Open loop inversion-– Tuning using ISE, IAE and other performance indices.

2. COMPENSATOR DESIGN

Design of lag, lead, lead-lag compensators – Design using bode plots – Polar plots – Nichols charts – root locus and Routh Hurwitz criterion.

3. MATLAB

Introduction – function description – Data types – Tool boxes – Graphical Displays – Programs for solution of state equations – Controller design – Limitations.- simulink-Introduction – Graphical user interface – Starting – Selection of objects – Blocks – Lines - simulation – Application programs – Limitations.

4. MAPLE

Introduction – symbolic programming – Programming constructs – Data structure computation with formulae – Procedures – Numerical Programming.

5. MATLAB

Programs using MATLAB software

L = 45 T = 15 P = 0 C =4

REFERENCES

1. MAPLE V Programming guide.
2. MATLAB user manual.
3. SIMULINK user manual.
4. K.Ogatta ,"Modern Control Engineering",PHI,1997.
5. Dorf and Bishop,"Modern control Engineering', Addison Wesley, 1998.

Skill Development Employability Entrepreneurship

ELECTIVES – VI (semester-III)

22272E53BP - INDUSTRIAL POWER SYSTEM ANALYSIS AND DESIGN

LTPC 3 1 0 4

UNIT I MOTOR STARTING STUDIES 9

Introduction-Evaluation Criteria-Starting Methods-System Data-Voltage Drop Calculations-Calculation of Acceleration time-Motor Starting with Limited-Capacity Generators-Computer-Aided Analysis-Conclusions.

UNIT II POWER FACTOR CORRECTION STUDIES 9

Introduction-System Description and Modeling-Acceptance Criteria-Frequency Scan Analysis-Voltage Magnification Analysis-Sustained Overvoltages-Switching Surge Analysis-Back-to-Back Switching-Summary and Conclusions.

UNIT III HARMONIC ANALYSIS 9

Harmonic Sources-System Response to Harmonics-System Model for Computer-Aided Analysis-Acceptance Criteria-Harmonic Filters-Harmonic Evaluation-Case Study-Summary and Conclusions.

UNIT IV FLICKER ANALYSIS 9

Sources of Flicker-Flicker Analysis-Flicker Criteria-Data for Flicker analysis- Case Study-Arc Furnace Load-Minimizing the Flicker Effects-Summary.

UNIT V GROUND GRID ANALYSIS 9

Introduction-Acceptance Criteria-Ground Grid Calculations-Computer-Aided Analysis - Improving the Performance of the Grounding Grids-Conclusions.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Ramasamy Natarajan, "Computer-Aided Power System Analysis", Marcel Dekker Inc., 2002.

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22272E53CP- SOFT COMPUTING TECHNIQUES **L T P C**

OBJECTIVES: **3 0 0 3**

- To expose the concepts of feed forward neural networks.
- To provide adequate knowledge about feed back neural networks.
- To teach about the concept of fuzziness involved in various systems.
- To expose the ideas about genetic algorithm
- To provide adequate knowledge about of FLC and NN toolbox

UNIT I INTRODUCTION AND ARTIFICIAL NEURAL NETWORKS 9

Introduction to intelligent systems- Soft computing techniques- Conventional Computing versus Swarm Computing - Classification of meta-heuristic techniques - Properties of Swarm intelligent Systems - Application domain - Discrete and continuous problems - Single objective and multi-objective problems -Neuron- Nerve structure and synapse- Artificial Neuron and its model- activation functions- Neural network architecture- single layer and multilayer feed forward networks- Mc Culloch Pitts neuron model- perceptron model- Adaline and Madaline- multilayer perception model- back propogation learning methods- effect of learning rule coefficient -back propagation algorithm- factors affecting back propagation training- applications.

UNIT II ARTIFICIAL NEURAL NETWORKS AND ASSOCIATIVE MEMORY 9

Counter propagation network- architecture- functioning & characteristics of counter Propagation network- Hopfield/ Recurrent network configuration - stability constraints associative memory and characteristics- limitations and applications- Hopfield v/s Boltzman machine- Adaptive Resonance Theory- Architecture- classifications- Implementation and training - Associative Memory.

UNIT III FUZZY LOGIC SYSTEM 9

Introduction to crisp sets and fuzzy sets- basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modeling and control- Fuzzification inferencing and defuzzification-Fuzzy knowledge and rule bases-Fuzzy modeling and control schemes for nonlinear systems. Self organizing fuzzy logic control- Fuzzy logic control for nonlinear time delay system.

UNIT IV GENETIC ALGORITHM 9

Evolutionary programs – Genetic algorithms, genetic programming and evolutionary programming - Genetic Algorithm versus Conventional Optimization Techniques - Genetic representations and selection mechanisms; Genetic operators- different types of crossover and mutation operators - Optimization problems using

GA-discrete and continuous - Single objective and multi-objective problems - Procedures in evolutionary programming.

UNIT V HYBRID CONTROL SCHEMES 9

Fuzzification and rule base using ANN–Neuro fuzzy systems-ANFIS – Fuzzy Neuron - Optimization of membership function and rule base using Genetic Algorithm – Introduction to Support Vector Machine - Evolutionary Programming-Particle Swarm Optimization - Case study – Familiarization of NN, FLC and ANFIS Tool Box.

TOTAL : 45 PERIODS

OUTCOMES:

- Will be able to know the basic ANN architectures, algorithms and their limitations.
- Also will be able to know the different operations on the fuzzy sets.
- Will be capable of developing ANN based models and control schemes for non-linear system.
- Will get expertise in the use of different ANN structures and online training algorithm.
- Will be knowledgeable to use Fuzzy logic for modeling and control of non-linear systems.
- Will be competent to use hybrid control schemes and P.S.O and support vector Regressive.

TEXT BOOKS:

1. Laurene V. Fausett, "Fundamentals of Neural Networks: Architectures, Algorithms And Applications", Pearson Education.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India, 2008.
3. Zimmermann H.J. "Fuzzy set theory and its Applications" Springer international edition, 2011.
4. David E.Goldberg, "Genetic Algorithms in Search, Optimization, and Machine Learning", Pearson Education, 2009.
5. W.T.Miller, R.S.Sutton and P.J.Webrose, "Neural Networks for Control" MIT Press", 1996.
6. T. Ross, "Fuzzy Logic with Engineering Applications", Tata McGraw Hill, New Delhi, 1995.
7. Ethem Alpaydin, "Introduction to Machine Learning (Adaptive Computation and Machine Learning Series)", MIT Press, 2004.
8. Corinna Cortes and V. Vapnik, " Support - Vector Networks, Machine Learning " 1995.

22272E53DP RESTRUCTURED POWER SYSTEM LTPC
OBJECTIVES: 3003

- To introduce the restructuring of power industry and market models.
- To impart knowledge on fundamental concepts of congestion management.
- To analyze the concepts of locational marginal pricing and financial transmission rights.
- To Illustrate about various power sectors in India

UNIT I INTRODUCTION TO RESTRUCTURING OF POWER INDUSTRY 9

Introduction: Deregulation of power industry, Restructuring process, Issues involved in deregulation, Deregulation of various power systems – Fundamentals of Economics: Consumer behavior, Supplier behavior, Market equilibrium, Short and long run costs, Various costs of production – Market models: Market models based on Contractual arrangements, Comparison of various market models, Electricity vis – a – vis other commodities, Market architecture, Case study.

UNIT II TRANSMISSION CONGESTION MANAGEMENT 9

Introduction: Definition of Congestion, reasons for transfer capability limitation, Importance of congestion management, Features of congestion management – Classification of congestion management methods – Calculation of ATC - Non – market methods – Market methods – Nodal pricing – Inter zonal and Intra zonal congestion management – Price area congestion management – Capacity alleviation method.

UNIT III LOCATIONAL MARGINAL PRICES AND FINANCIAL TRANSMISSION RIGHTS 9

Mathematical preliminaries: - Locational marginal pricing– Lossless DCOPF model for LMP calculation – Loss compensated DCOPF model for LMP calculation – ACOPF model for LMP calculation – Financial Transmission rights – Risk hedging functionality -Simultaneous feasibility test and revenue adequency – FTR issuance process: FTR auction, FTR allocation – Treatment of revenue shortfall – Secondary trading of FTRs – Flow gate rights – FTR and market power - FTR and merchant transmission investment.

UNIT IV ANCILLARY SERVICE MANAGEMENT AND PRICING OF TRANSMISSION NETWORK 9

Introduction of ancillary services – Types of Ancillary services – Classification of Ancillary services – Load generation balancing related services – Voltage control and reactive power support devices – Black start capability service - How to obtain ancillary service –Co-optimization of energy and reserve services - Transmission pricing – Principles – Classification – Rolled in transmission pricing methods –

Marginal transmission pricing paradigm – Composite pricing paradigm – Merits and demerits of different paradigm.

UNIT V REFORMS IN INDIAN POWER SECTOR 9

Introduction – Framework of Indian power sector – Reform initiatives - Availability based tariff – Electricity act 2003 – Open access issues – Power exchange – Reforms in the near future

TOTAL : 45 PERIODS

OUTCOMES:

- Learners will have knowledge on restructuring of power industry
- Learners will understand basics of congestion management
- Learners will attain knowledge about locational margin prices and financial transmission rights
- Learners will understand the significance ancillary services and pricing of transmission network
- Learners will have knowledge on the various power sectors in India

REFERENCES

1 Mohammad Shahidehpour, Muwaffaq Alomoush, Marcel Dekker, “Restructured electrical power systems: operation, trading and volatility” Pub., 2001.
2 Kankar Bhattacharya, Jaap E. Daadler, Math H.J. Boolen, “Operation of restructured power systems”, Kluwer Academic Pub., 2001.
3 Paranjothi, S.R. , “Modern Power Systems” Paranjothi, S.R. , New Age International, 2017.
4 Sally Hunt,” Making competition work in electricity”, John Willey and Sons Inc. 2002.
5 Steven Stoft, “Power system economics: designing markets for electricity”, John Wiley & Sons, 2002.

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PRIST UNIVERSITY

VALLAM, THANJAVUR.

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF EEE

M.TECH-POWER SYSTEMS (PART TIME)

COURSE STRUCTURE -R2019

Skill Development Employability Entrepreneurship

PRIST UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

PROGRAMME: M.TECH-POWER SYSTEMS (PART TIME)

CURRICULUM -REGULATION 2019

SEMESTER – I

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1.	19248S11DP	Applied Mathematics For Electrical &Electronics Engineering	3	1	0	4
2.	19272C12P	System Theory	3	1	0	4
3.	19272C13P	Power System Modeling and Analysis	3	1	0	4
4.	19272L14P	Power System Simulation Lab-I	0	0	3	3
Research Skill development course (RSD course)						
5.	19272CRSP	Research Led Seminar	1	0	0	1
		TOTAL				16

SEMESTER – II

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	19272C21P	EHV power transmission.	3	1	0	4
2	19272C22P	Power System Protection	3	1	0	4
3	19272E23_P	Elective-I	3	0	0	3
4	192TECWRP	Technical Writing/Seminars	0	0	3	3
Research Skill development course (RSD course)						
5	19272CRMP	Research Methodology	3	0	0	3
6	19272CBRP	Participation in Bounded Research	2	0	0	2
		TOTAL				19

SEMESTER – III

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	19272C31P	Economic Operations of Power Systems-I	3	1	0	4
2	19272C32P	High Voltage Direct Current Transmission System	3	1	0	4
3	19272E33_P	Elective -II	3	0	0	3
4	19272L34P	Power System Simulation Lab-II	0	0	3	3
Research Skill development course (RSD course)						
5	19272CSRP	Design Project / Socio Technical Project	0	0	6	6
		TOTAL				20

SEMESTER – IV

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	19272C41P	Economic Operations Of Power Systems-II	3	1	0	4
2	19272C42P	Electrical Transients in power systems	3	1	0	4
3	19272E43_P	Elective -III	3	0	0	3
4	19272P44P	Project work Phase -I	0	0	10	10
		TOTAL				21

SEMESTER – V

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1.	19272E51_P	Elective –IV	3	0	0	3
2.	19272E52_P	Elective –V	3	0	0	3
3.	19272E53_P	Elective –VI	3	0	0	3
		TOTAL				9

SEMESTER – VI

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1.	19272P61P	Project work Phase -II	0	0	15	15

Total Credits = 100

Elective –I

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	19272E23AP	Analysis and Design of Power Converters	3	0	0	3
2.	19272E23BP	Modeling and Analysis of Electrical Machines	3	0	0	3
3.	19272E23CP	Advanced Power System Dynamics	3	0	0	3
4.	19272E23DP	Design of Substations	3	0	0	3

Elective –II

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	19272E33AP	Smart Grid	3	0	0	3
2.	19272E33BP	Solar and Energy Storage Systems	3	0	0	3
3.	19272E33CP	Power System Reliability	3	0	0	3
4.	19272E33DP	Distributed Generation and Microgrid	3	0	0	3

Elective –III

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	19272E43AP	Wind Energy conversion systems	3	0	0	3
2.	19272E43BP	AI Techniques to Power Systems	3	0	0	3
3.	19272E43CP	Electrical Distribution System	3	0	0	3
4.	19272E43DP	Energy Management and Auditing	3	0	0	3

Elective –IV

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	19272E51AP	Power Electronics applications in Power systems	3	0	0	3
2.	19272E51BP	Power system Dynamics	3	0	0	3

3.	19272E51CP	Electric Vehicles and Power Management	3	0	0	3
4.	19272E51DP	Electromagnetic Interference and Compatibility	3	0	0	3

Elective –V

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	19272E52AP	Power Conditioning	3	0	0	3
2.	19272E52BP	Power system restructuring and deregulation	3	0	0	3
3.	19272E52CP	Control System Design for Power Electronics	3	0	0	3
4.	19272E52DP	Advanced Digital Signal Processing	3	0	0	3

Elective –VI

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	19272E53AP	Software for Control system Design	3	0	0	3
2.	19272E53BP	Industrial Power system analysis and design	3	0	0	3
3.	19272E53CP	Soft Computing Techniques	3	0	0	3
4.	19272E53DP	Restructured Power System	3	0	0	3

Credit Distribution

Sem.	Core Courses						Elective Courses		Foundation Courses		Total Credits
	Theory Courses		Practical Courses		Courses on *RSD						
	Nos.	Credits	Nos.	Credits	Nos.	Credits	Nos.	Credits	Nos.	Credits	
I	02	08	01	03	01	01	-	-	01	04	16
II	02	08	01	03	02	05	01	03	-	-	19
III	02	08	01	03	01	06	01	03	-	-	20
IV	02	08	01	10	-	-	01	03	-	-	21
V	-	-	-	-	-	-	03	09	-	-	09
VI	-	-	01	15	-	-	-	-	-	-	15
										Total Credits	**100**

*RSD-Research Skill Development

SYLLABUS

19248S11DP -APPLIED MATHEMATICS FOR ELECTRICAL & LECTRONICS ENGINEERING

3 1 0 4

1. ADVANCED MATRIX THEORY 9

Matrix norms – Jordan canonical form – Generalized eigenvectors – Singular value decomposition – Pseudo inverse – Least square approximations.

2. RANDOM PROCESSES 9

Random variable, discrete, continuous types - Binomial, Poisson, normal and exponential distributions density & distribution Functions- Moments Moment Generating Functions – Notion of stochastic processes - Auto-correlation – Cross correlation .

3. LINEAR PROGRAMMING 9

Basic concepts – Graphical and Simplex methods –Transportation problem –Assignment problem.

4. DYNAMIC PROGRAMMING 9

Elements of the dynamic programming model – optimality principle – Examples of dynamic programming models and their solutions.

5. INTEGRAL TRANSFORMS 9

Finite Fourier transform - Fourier series - Finite sine Transform - Cosine transform - finite Hankel transform - definition, Transform of df/dx where p is a root of Jn(p) = 0, Transform of

$$\frac{d2f}{dx2} + \frac{1}{x}\,\frac{df}{dx}, \text{ and Transform of } \frac{d2f}{dx2} + \frac{1}{x}\,\frac{df}{dx} - \frac{n2f}{x2}$$

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Lewis.D.W., Matrix Theory ,Allied Publishers, Chennai 1995.
2. Bronson, R, Matrix Operations, Schaums outline Series, McGraw Hill, New York. 1989.
3. Andrews, L.A., and Shivamoggi B.K., “Integral Transforms for Engineers and Applied Mathematicians”, Macmillan , New York ,1988.
4. Taha, H.A., " Operations research - An Introduction ", Mac Millan publishing Co., (1982).
5. Gupta, P.K.and Hira, D.S., " Operations Research ", S.Chand & Co., New Delhi, (1999).6..
6. Ochi, M.K. " Applied Probability and Stochastic Processes ", John Wiley & Sons (1992).
7. Peebles Jr., P.Z., " Probability Random Variables and Random Signal Principles, McGraw Hill Inc., (1993).

SEMESTER – I

19272C12P - SYSTEM THEORY

3 1 0 4

1. PHYSICAL SYSTEMS AND STATE ASSIGNMENT **9**

Systems - electrical - mechanical - hydraulic - pneumatic - thermal systems - modelling of some typical systems like D.C. Machines - inverted pendulum.

2. STATE SPACE ANALYSIS **9**

Realisation of state models - non-uniqueness - minimal realisation - balanced realisation - solution of state equations - state transition matrix and its properties - free and forced responses - properties - controllability and observability - stabilisability and detectability - Kalman decomposition.

3. MIMO SYSTEMS - FREQUENCY DOMAIN DESCRIPTIONS **9**

Properties of transfer functions - impulse response matrices - poles and zeros of transfer function matrices - critical frequencies - resonance - steady state and dynamic response - bandwidth - Nyquist plots - singular value analysis.

4. NON-LINEAR SYSTEMS **9**

Types of non-linearity - typical examples - equivalent linearization - phase plane analysis - limit cycles - describing functions - analysis using describing functions - jump resonance.

5. STABILITY **9**

Stability concepts - equilibrium points - BIBO and asymptotic stability - direct method of Liapunov - application to non-linear problems - frequency domain stability criteria - Popov's method and its extensions.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. M. Gopal, 'Modern Control Engineering', Wiley, 1996.
2. J.S. Bay, 'Linear State Space Systems', McGraw-Hill, 1999.
3. Eroni-Umez and Eroni, 'System dynamics & Control', Thomson Brooks / Cole, 1998.
4. K. Ogatta, 'Modern Control Engineering', Pearson Education, Low Priced Edition, 1997.
5. G.J. Thaler, 'Automatic control systems', Jaico publishers, 1993.
6. John S. Bay, 'Linear State Space Systems', McGraw-Hill International Edition, 1999.

SEMESTER – I

19272C13P - POWER SYSTEM MODELLING AND ANALYSIS

3 1 0 4

1. SOLUTION TECHNIQUE **9**

Sparse Matrix techniques for large scale power systems: Optimal ordering schemes for preserving sparsity. Flexible packed storage scheme for storing matrix as compact arrays – Factorization by Bifactorization and Gauss elimination methods; Repeat solution using Left and Right factors and L and U matrices.

2. POWER FLOW ANALYSIS **9**

Power flow equation in real and polar forms; Review of Newton's method for solution; Adjustment of P-V buses; Review of Fast Decoupled Power Flow method; Sensitivity factors for P-V bus adjustment; Net Interchange power control in Multi-area power flow analysis: ATC, Assessment of Available Transfer Capability (ATC) using Repeated Power Flow method; Continuation Power Flow method.

3. OPTIMAL POWER FLOW **9**

Problem statement; Solution of Optimal Power Flow (OPF) – The gradient method, Newton's method, Linear Sensitivity Analysis; LP methods – With real power variables only – LP method with AC power flow variables and detailed cost functions; Security constrained Optimal Power Flow; Interior point algorithm; Bus Incremental costs.

4. SHORT CIRCUIT ANALYSIS **9**

Fault calculations using sequence networks for different types of faults. Bus impedance matrix (ZBUS) construction using Building Algorithm for lines with mutual coupling; Simple numerical problems. Computer method for fault analysis using ZBUS and sequence components. Derivation of equations for bus voltages, fault current and line currents, both in sequence and phase domain using Thevenin's equivalent and ZBUS matrix for different faults.

5. TRANSIENT STABILITY ANALYSIS **9**

Introduction, Numerical Integration Methods: Euler and Fourth Order Runge-Kutta methods, Algorithm for simulation of SMIB and multi-machine system with classical synchronous machine model; Factors influencing transient stability, Numerical stability and implicit Integration methods.

L = 45 T = 15 P = 0 C =4

REFERENCES:

1. G W Stagg , A.H El. Abiad "Computer Methods in Power System Analysis", McGraw Hill 1968.
2. P.Kundur, "Power System Stability and Control", McGraw Hill, 1994.
3. A.J.Wood and B.F.Wollenberg, "Power Generation Operation and Control", John Wiley and sons, New York, 1996.
4. W.F.Tinney and W.S.Meyer, "Solution of Large Sparse System by Ordered Triangular Factorization" IEEE Trans. on Automatic Control, Vol : AC-18, pp:333-346, Aug 1973.
5. K.Zollenkopf, "Bi-Factorization : Basic Computational Algorithm and Programming Techniques ; pp:75-96 ; Book on "Large Sparse Set of Linear Systems" Editor: J.K.Rerd,Academic Press, 1971.

SEMESTER – I

19272L14P- POWER SYSTEM SIMULATION LAB – I

0 0 3 3

EXPERIMENTS

1. Formation of Y bus, Z bus, line parameters and modeling of transmission lines.
2. Power flow analysis: Gauss – Seidel Method.
3. Power flow analysis: Newton Raphson method.
4. Plain Decoupled and Fast Decoupled methods.
5. Contingency analysis – single and multiple symmetrical and unsymmetrical faults.

P=3 C=3

SEMESTER -II

19272C21P - EHV POWER TRANSMISSION

3 1 0 4

1. INTRODUCTION 9

Standard transmission voltages – different configurations of EHV and UHV lines – average values of line parameters – power handling capacity and line loss – costs of transmission lines and equipment – mechanical considerations in line performance.

2. CALCULATION OF LINE PARAMETERS 9

Calculation of resistance, inductance and capacitance for multi-conductor lines – calculation of sequence inductances and capacitances – line parameters for different modes of propagation – resistance and inductance of ground return, numerical example involving a typical 400/220kV line using line constant program.

3. VOLTAGE GRADIENTS OF CONDUCTORS 9

Charge-potential relations for multi-conductor lines – surface voltage gradient on conductors – gradient factors and their use – distribution of voltage gradient on sub conductors of bundle - voltage gradients on conductors in the presence of ground wires on towers.

4. CORONA EFFECTS 9

Power losses and audible losses: I R loss and corona loss - audible noise generation and characteristics - limits for audible noise - Day-Night equivalent noise level- radio interference: corona pulse generation and properties - limits for radio interference fields

5. ELECTROSTATIC FIELD OF EHV LINES 9

Effect of EHV line on heavy vehicles - calculation of electrostatic field of AC lines- effect of high field on humans, animals, and plants - measurement of electrostatic fields - electrostatic Induction in unenergised circuit of a D/C line - induced voltages in insulated ground wires - electromagnetic interference

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Rakosh Das Begamudre, “Extra High Voltage AC Transmission Engineering”, Second Edition, New Age International Pvt. Ltd., 1990.
2. Power Engineer’s Handbook, Revised and Enlarged 6th Edition, TNEB Engineers’ Association, October 2002.
3. Microtran Power System Analysis Corporation, Microtran Reference Manual, Vancouver Canada. (Website: www.microtran.com).

SEMESTER – II

19272C22P - POWER SYSTEM PROTECTION

3 1 0 4

1. INTRODUCTION 9

General philosophy – Review of conventional equipment protection schemes – state of the art: Numerical relays

2. DISTANCE PROTECTION 9

Transmission line protection – fault clearing times – relaying quantities during swings – evaluation of distance relay performance during swings – prevention of tripping during transient conditions – automatic line reclosing – generator out of step protection – simulation of distance relays during transients.

3. GENERATOR PROTECTION 9

Out – of – step, loss of excitation. System response to severe upsets – nature of system response to severe upsets – frequency actuated schemes for load shedding and islanding.

4. INTRODUCTION TO COMPUTER RELAYING 9

Development of computer relaying – historical background – Expected benefits of computer relaying – computer relay architecture – A/D converter – Anti aliasing filters – substation computer hierarchy.

5. DIGITAL TRANSMISSION LINE RELAYING 9

Introduction – source of error – relaying as parameter estimation – beyond parameter estimation – symmetrical component distance relay – protection of series compensated lines. Digital protection of transformers, machines and buses.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Arun k. Phadke, James.S.Thorp, " Computer relaying for power system", John Wiley and sons, New York, 1988.
2. Jones D., "Analysis and protection of electrical power systems", Pitman Publishing, 1971.
3. "Power system references manual, Ray rolls protection", Orient press, 1982.
4. Stanly H., Horowitz (ED), "Protective relaying for power system", IEEE press, 1980.
5. Kundur P., "power system stability and control", McGraw Hill, 1994.

SEMESTER - III

19272C31P - ECONOMIC OPERATIONS OF POWER SYSTEMS-I

3 1 0 4

1. INTRODUCTION 9

Planning and operational problems of power systems – review of economic dispatch and calculation using B matrix loss formula – use of participation factors in on line economic dispatch.

2. OPTIMAL POWER FLOW PROBLEM 9

Real and reactive power control variables – operation and security constraints and their limits – general OPF problem with different objective functions – formulation – cost loss minimization using Dommel and Tinney's method and SLP – development of model and algorithm – MVAR planning – optimal sitting and sizing of capacitors using SLR method – interchange evaluation using SLP.

3. HYDRO THERMAL SCHEDULING 9

Problems definition and mathematical model of long and short term problems – discretization – dynamic and incremental dynamic programming – methods of local variation – hydro thermal system with pumped hydro units – solution by local variation treating pumped hydro unit for load management and spinning reserve.

4. UNIT COMMITMENT 9

Constraints in unit commitment – solution by priority list method – dynamic programming method – backward and forward – restricted search range.

5. MAINTENANCE SCHEDULING 9

Factors considered in maintenance scheduling for generating units – turbines – boilers – introduction to maintenance scheduling using mathematical programming.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Allen J.Wood and Bruce F.Wollenberg, "Power generation and control", John Wiley & Sons, New York, 1984.
2. Krichmayer L., "Economic operation of power systems", John Wiley and sons Inc, New York, 1958.
3. Krichmayer L.K, "Economic control of Interconnected systems", Jhon Wiley and sons Inc, New York, 1959.
4. Elgerd O.I., "Electric energy systems theory – an introduction", McGraw Hill, New Delhi, 1971.

SEMESTER – III

19272C32P- HIGH VOLTAGE DIRECT CURRENT TRANSMISSION SYSTEM

3 1 0 4

1. DC POWER TRANSMISSION TECHNOLOGY 9

Introduction – comparison of Ac and DC transmission _ application of DC transmission – description of DC transmission system system – planning for HVDC transmission – modern trends in DC transmission.

2. ANALYSIS OF HVDC CONVERTERS 9

Pulse number – choice of converter configuration simplified analysis of Graetz circuit converter converter bridge characteristics – characteristics of a twelve pulse converter – detailed analysis of converters.

3. CONVERTER AND HVDC SYSTEM CONTROL 9

General principles of DC link control – converter control characteristics – systems control hierarchy – firing angle control – current and extinction angle control – starting and stopping of DC link – power control – higher level controllers – telecommunication requirements.

4. HARMONICS AND FILTERS 9

Introduction – generation of harmonics – design of AC filters – DC filters – carrier frequency and RI noise.

5. SIMULATION OF HVDC SYSTEMS 9

Introduction – system simulation: Philosophy and tools- HVDC system simulation – modeling of HVDC systems for digital dynamic simulation.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Padiyar. K.R., HVDC power transmission system, Wiley Eastern Limited, New Delhi, 1990.
2. Edward Wilson Kimbark, Direct Current Transmission, Vol.1, Wiley Interscience, New York, London, Sydney, 1971.
3. Rakosh Das Begamudre, Extra high voltage AC transmission engineering Wiley Eastern Ltd., New Delhi, 1990.
4. Arrillaga, J, High voltage direct current transmission, peter Pregrinus, London, 1983.
5. Adamson.C and Hingorani.N.G., High Voltage Direct Current Power Transmission, Garraway Limited, London, 1960. WWW.hvdc.ca

19272L34P- POWER SYSTEM SIMULATION LAB – II 0 0 3 3

LIST OF EXPRIMENTS:

1. Small signal stability analysis: SMIB and Multi machine configuration.
2. Transients stability analysis of Multi – machine configuration.
3. Load Frequency control: single area, multi area control.
4. Economic load dispatch with losses
5. Unit commitment by dynamic programming & priority list method

P=3 C=3

SEMESTER – IV

19272C41P - ECONOMIC OPERATIONS OF POWER SYSTEMS-II 3 1 0 4

1. AUTOMATIC GENERATION CONTROL 9

Plant and system level control problem – ALFC of single area system modeling state and transient response – EDC control loop – ALFC of multi area system – modeling – static and transient response of two area system development of state variable model – two area system – AGC system design Kalman's method.

2. AUTOMATIC VOLTAGE CONTROL 9

Modeling of AVR loop – components – dynamic and static analysis – stability compensation – system level voltage control using OLTC, capacitor and generator voltages – expert system application for system voltage control.

3. SECURITY CONTROL CONCEPT 9

System operating states by security control functions – monitoring evaluation of system state by contingency analysis – corrective controls (preventive, emergency and restorative) – islanding scheme.

4. STATE ESTIMATION 9

Least square estimation – basic solution – sequential form of solution – static state estimation of power system by different algorithms – tracking state estimation of power system- computation consideration – external equivalency. Treatment of bad data and on line load flow analysis.

5. COMPUTER CONTROL OF POWER SYSTEM 9

Energy control center – various levels – national – regional and state level SCADA system – computer configuration – functions, monitoring, data acquisition and controls – EMS system – software in EMS system. Expert system applications for power system operation.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Kundur.P., "power system stability and control", McGraw Hill, 1994.
2. Anderson P.M., and Fouad A.A, "power system control and stability", Galgotia publication, New Delhi, 1981.
3. Taylor C.W., "power systems voltage stability", McGraw Hill, New Delhi, 1993.
4. IEEE recommended practice for excitation system models for power system stabilit y studies, IEEE standard 421.5, 1992.
5. Kimbark E.W., "power system stability", Vol.3., Synchronous machines, John Wiley and sons, 1956.
6. T.V Custem, C.Vournas, "voltage stability of power system", Kluwer Acadamic Publishers, 1998.
7. Elgerd O.L., "Elctric energy systems theory – an introduction", McGraw Hill, New Delhi, 1971.

SEMESTER – IV

19272C42P - ELECTRICAL TRANSIENTS IN POWER SYSTEMS

3 1 0 4

1. TRAVELLING WAVES ON TRANSMISSION LINE 9

Lumped and Distributed Parameters – Wave Equation – Reflection, Refraction, Behavior of Travelling waves at the line terminations – Lattice Diagrams – Attenuation and Distortion – Multi-conductor system and Velocity wave.

2. COMPUTATION OF POWER SYSTEM TRANSIENTS 9

Principle of digital computation – Matrix method of solution, Modal analysis, Z transforms, Computation using EMTP – Simulation of switches and non-linear elements.

3. LIGHTNING, SWITCHING AND TEMPORARY OVERVOLTAGES 9

Lightning: Physical phenomena of lightning – Interaction between lightning and power system – Factors contributing to line design – Switching: Short line or kilometric fault – Energizing transients - closing and re-closing of lines - line dropping, load rejection - Voltage induced by fault – Very Fast Transient Overvoltage (VFTO)

4. BEHAVIOUR OF WINDING UNDER TRANSIENT CONDITION 9

Initial and Final voltage distribution - Winding oscillation - traveling wave solution - Behavior of the transformer core under surge condition – Rotating machine – Surge in generator and motor

5. INSULATION CO-ORDINATION 9

Principle of insulation co-ordination in Air Insulated substation (AIS) and Gas Insulated Substation (GIS), insulation level, statistical approach, co-ordination between insulation and protection level –overvoltage protective devices – lightning arresters, substation earthing.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Pritindra Chowdhari, “Electromagnetic transients in Power System”, John Wiley and Sons Inc., 1996.
2. Allan Greenwood, “Electrical Transients in Power System”, Wiley & Sons Inc. New York, 1991.
3. Klaus Ragaller, “Surges in High Voltage Networks”, Plenum Press, New York, 1980.
4. Rakosh Das Begamudre, “Extra High Voltage AC Transmission Engineering”, (Second edition) Newage International (P) Ltd., New Delhi, 1990.
5. Naidu M S and Kamaraju V, “High Voltage Engineering”, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.
6. IEEE Guide for safety in AC substation grounding IEEE Standard 80-2000.
7. Working Group 33/13-09 (1988), ‘Very fast transient phenomena associated with Gas Insulated System’, CIGRE, 33-13, pp. 1-2

ELECTIVES – I (semester-II)

19272E23AP- FLEXIBLE AC TRANSMISSION SYSTEM

3 1 0 4

1. INTRODUCTION 9

FACTS-a toolkit, Basic concepts of Static VAR compensator, Resonance damper, Thyristor controlled series capacitor, Static condenser, Phase angle regulator, and other controllers.

2. SERIES COMPENSATION SCHEMES 9

Sub-Synchronous resonance, Torsional interaction, torsional torque, Compensation of conventional, ASC, NGH damping schemes, Modelling and control of thyristor controlled series compensators.

3. UNIFIED POWER FLOW CONTROL 9

Introduction, Implementation of power flow control using conventional thyristors, Unified power flow concept, Implementation of unified power flow controller.

4. DESIGN OF FACTS CONTROLLERS 9

Approximate multi-model decomposition, Variable structure FACTS controllers for Power system transient stability, Non-linear variable-structure control, variable structure series capacitor control, variable structure resistor control.

5. STATIC VAR COMPENSATION 9

Basic concepts, Thyristor controlled reactor (TCR), Thyristors switched reactor(TSR), Thyristor switched capacitor(TSC), saturated reactor (SR) , and fixed capacitor (FC)

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Narin G.Hingorani, " Flexible AC Transmission ", IEEE Spectrum, April 1993, pp 40-45.
2. Narin G. Hingorani, " High Power Electronics and Flexible AC Transmission Systems ", IEEE Power Engineering Review, 1998.
3. Narin G.Hingorani, " Power Electronics in Electric Utilities : Role of Power Electronics in future power systems ", Proc. of IEEE, Vol.76, no.4, April 1988.
4. Einar V.Larsen, Juan J. Sanchez-Gasca, Joe H.Chow, " Concepts for design of FACTS Controllers to damp power swings ", IEEE Trans On Power Systems, Vol.10, No.2, May 1995.
5. Gyugyi L., " Unified power flow control concept for flexible AC transmission ", IEEE Proc-C Vol.139, No.4, July 1992.

ELECTIVES – I (semester-II)

19272E23BP - POWER SYSTEM PLANNING AND RELIABILITY

3 1 0 4

1. LOAD FORECASTING 9

Objectives of forecasting - Load growth patterns and their importance in planning – Load forecasting Based on discounted multiple regression technique-Weather sensitive load forecasting-Determination of annual forecasting-Use of AI in load forecasting.

2. GENERATION SYSTEM RELIABILITY ANALYSIS 9

Probabilistic generation and load models- Determination of LOLP and expected value of demand not served –Determination of reliability of iso and interconnected generation systems.

3. TRANSMISSION SYSTEM RELIABILITY ANALYSIS 9

Deterministic contingency analysis-probabilistic load flow-Fuzzy load flow probabilistic transmission system reliability analysis-Determination of reliability indices like LOLP and expected value of demand not served.

4. EXPANSION PLANNING 9

Basic concepts on expansion planning-procedure followed for integrate transmission system planning, current practice in India-Capacitor placer problem in transmission system and radial distributions system.

5. DISTRIBUTION SYSTEM PLANNING OVERVIEW 9

Introduction, sub transmission lines and distribution substations-Design primary and secondary systems-distribution system protection and coordination of protective devices.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Proceeding of work shop on energy systems planning & manufacturing CI.
2. R.L .Sullivan, " Power System Planning",.
3. Roy Billinton and Allan Ronald, "Power System Reliability."
4. Turan Gonen, Electric power distribution system Engineering 'McGraw Hill,1986

ELECTIVE- II (semester-III)

19272E33AP- ANALYSIS OF INVERTERS

3 1 0 4

UNIT- I- SINGLE PHASE INVERTERS 9

Introduction to self commutated switches: MOSFET and IGBT - Principle of operation of half and full bridge inverters – Performance parameters – Voltage control of single phase inverters using various PWM techniques – various harmonic elimination techniques – forced commutated Thyristor inverters.

UNIT-II- THREE PHASE VOLTAGE SOURCE INVERTERS 9

180 degree and 120 degree conduction mode inverters with star and delta connected loads – voltage control of three phase inverters: single, multi pulse, sinusoidal, space vector modulation techniques.

UNIT-III- CURRENT SOURCE INVERTERS 9

Operation of six-step thyristor inverter – inverter operation modes – load – commutated inverters – Auto sequential current source inverter (ASCI) – current pulsations – comparison of current source inverter and voltage source inverters

UNIT-IV- MULTILEVEL INVERTERS 9

Multilevel concept – diode clamped – flying capacitor – cascade type multilevel inverters - Comparison of multilevel inverters - application of multilevel inverters

UNIT-V- RESONANT INVERTERS 9

Series and parallel resonant inverters - voltage control of resonant inverters – Class E resonant inverter – resonant DC – link inverters.

L=45 T=15 P=0 C=4

TEXT BOOKS

1. Rashid M.H., “Power Electronics Circuits, Devices and Applications ", Prentice Hall India, Third Edition, New Delhi, 2004.
2. Jai P.Agrawal, “Power Electronics Systems”, Pearson Education, Second Edition, 2002.
3. Bimal K.Bose “Modern Power Electronics and AC Drives”, Pearson Education, Second Edition, 2003.
4. Ned Mohan,Undeland and Robbin, “Power Electronics: converters, Application and design” John Wiley and sons.Inc,Newyork,1995.
5. Philip T. krein, “Elements of Power Electronics” Oxford University Press -1998.

REFERENCES

1. P.C. Sen, “Modern Power Electronics”, Wheeler Publishing Co, First Edition, New Delhi, 1998.
2. P.S.Bimbra, “Power Electronics”, Khanna Publishers, Eleventh Edition, 2003.

ELECTIVE– II (semester-III)

19272E33BP - MODELLING AND ANALYSIS OF ELECTRICAL MACHINES
3 1 0 4

UNIT I PRINCIPLES OF ELECTROMAGNETIC ENERGY CONVERSION
General expression of stored magnetic energy - co-energy and force/torque - example using single and doubly excited system.
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UNIT II BASIC CONCEPTS OF ROTATING MACHINES
Calculation of air gap M.M.F. - per phase machine inductance using physical machine data - voltage and torque equation of D.C. machine - three phase symmetrical induction machine and salient pole synchronous machines in phase variable form.

UNIT III INTRODUCTION TO REFERENCE FRAME THEORY
Static and rotating reference frames - transformation relationships - examples using static symmetrical three phase R, R-L, R-L-M and R-L-C circuits - application of reference frame theory to three phase symmetrical induction and synchronous machines - dynamic direct and quadrature axis model in arbitrarily rotating reference frames - voltage and torque equations - derivation of steady state phasor relationship from dynamic model - generalized theory of rotating electrical machine and Kron's primitive machine.

UNIT IVD ETERMINATIONOF SYNCHRONOUS MACHINE DYNAMIC EQUIVALENT CIRCUIT PARAMETERS
Standard and derived machine time constants - frequency response test - analysis and dynamic modeling of two phase asymmetrical induction machine and single phase induction machine.

UNIT V SPECIAL MACHINES
Permanent magnet synchronous machine - surface permanent magnet (square and sinusoidal back E.M.F. type) and interior permanent magnet machines - construction and operating principle - dynamic modeling and self controlled operation - analysis of switch reluctance motors.

L = 45 T = 15 P = 0 C =4

TEXT BOOKS
1. Charles Kingsley, A.E. Fitzgerald Jr. and Stephen D. Umans, 'Electric Machinery', Tata McGraw-Hill, Fifth Edition, 1992.
2. R. Krishnan, 'Electric Motor & Drives: Modelling, Analysis and Control', Prentice Hall of India, 2001.
REFERENCES
1. C.V. Jones, 'The Unified Theory of Electrical Machines', Butterworth, 1967.
2. T.J.E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives' Clarendon Press, 1989.

ELECTIVES – III (semester-IV)

19272E43AP - WIND ENERGY CONVERSION SYSTEMS

3 1 0 4

UNIT-I INTRODUCTION: **9**

History of wind Electric generation - Darrieus wind - Horizontal and vertical axis-Wind turbine - other modern developments - Future possibilities.

UNIT-II WIND RESOURCE AND ITS POTENTIAL FOR ELECVTRIC POWER GENERATION: 9

Power Extracted By A Wind Driven Machine - Nature and occurrence of wind characteristics and power production - variation of mean wind speed with time.

UNIT-III WIND POWER SITES AND WIND MEASUREMENTS: **9**

Average wind speed and other factors affecting choice of the site - Effect of wind direction - Measurement of wind velocity - Personal estimation without instruments-anemometers - Measurement of wind direction.

UNIT-IV WIND TURBINES WITH ASYNCHRONOUS GENERATORS AND CONTROL ASPECTS: 9

Asynchronous systems - Ac Generators - Self excitation of Induction Generator - Single Phase operation of Induction Generator - Permanenet magnet Generators - Basic control aspects - fixed speed ratio control scheme - fixed vs variable speed operation of WECS.

UNIT-V GENERATION OF ELECTRICITY 9

Active and reactive power - P and Q transfer in power systems - Power converters - Characteristics of Generators - Variable Speed options - Economics.

L = 45 T = 15 P = 0 C =4

REFERENCES:

1. N.G.Calvert, 'Wind Power Principles: Their Application on small scale', Charles Friffin& co. Ltd, London, 1979.
2. Gerald W.Koeppel, "Pirnam's and Power from the wind", Van Nastran Reinhold Co., London, 1979.
3. Gary L. Johnson, "Wind Energy System", Prentice hall Inc., Englewood Cliffs, New Jersey, 1985.
4. Wind energy conversion system by L. Lfreris, Prentice hall (U.K) Ltd., 1990.

ELECTIVE III ***(semester-IV)***

19272E43BP - AI TECHNIQUES TO POWER SYSTEMS

3 1 0 4

1. INTRODUCTION TO NEURAL NETWORKS 9

Basics of ANN - perceptron - delta learning rule - back propagation algorithm - multilayer feed forward network - memory models - bi-directional associative memory - Hopfield network.

2. APPLICATIONS TO POWER SYSTEM PROBLEMS 9

Application of neural networks to load forecasting - contingency analysis - VAR control - economic load dispatch.

3. INTRODUCTION TO FUZZY LOGIC 9

Crispness - vagueness - fuzziness - uncertainty - fuzzy set theory fuzzy sets - fuzzy set operations - fuzzy measures - fuzzy relations - fuzzy function - structure of fuzzy logic controller – fuzzification models - data base - rule base - inference engine defuzzification module.

4. APPLICATIONS TO POWER SYSTEMS 9

Decision making in power system control through fuzzy set theory - use of fuzzy set models of LP in power systems scheduling problems - fuzzy logic based power system stabilizer.

5. GENETIC ALGORITHM AND ITS APPLICATIONS TO POWER SYSTEMS 9

Introduction - simple genetic algorithm - reproduction - crossover - mutation – advanced operators in genetic search - applications to voltage control and stability studies.

L = 45 T = 15 P = 0 C =4

REFERENCES:

1. James A. Freeman and Skapura.B.M „Neural Networks - Algorithms Applications and Programming Techniques‟, Addison Wesley, 1990.
2. George Klir and Tina Folger.A, „Fuzzy sets, Uncertainty and Information‟, Prentice Hall of India, 1993.
3. Zimmerman.H.J,„Fuzzy Set Theory and its Applications‟, Kluwer Academic Publishers 1994.
4. IEEE tutorial on „Application of Neural Network to Power Systems‟, 1996.
5. Loi Lei Lai, „Intelligent System Applications in Power Engineering‟, John Wiley & SonsLtd.,1998.

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ELECTIVES – IV (semester-V)

19272E51AP - POWER ELECTRONICS APPLICATIONS IN POWER SYSTEMS

3 1 0 4

UNIT: I STATIC COMPENSATOR CONTROL 9

Theory of load compensation - voltage regulation and power factor correction - phase balance and PF correction of unsymmetrical loads - Property of static compensator - Thyristor controlled rectifier (TCR) - Thyristor Controlled Capacitor (TSC) -Saturable core reactor - Control Strategies.

UNIT: II HARMONIC CONTROL AND POWER FACTOR IMPROVEMENT 9

Input power factor for different types of converters - power factor improvement using Load and forced commutated converters.

UNIT: III VOLTAGE CONTROL USING STATIC TAP-CHANGERS 9

Conventional tap changing methods, static tap changers using Thyristor, different schemes - comparison.

UNIT: IV STATIC EXCITATION CONTROL 9

Solid state excitation of synchronous generators - Different schemes - Generex excitation systems.

UNIT: V UNINTERRUPTABLE POWER SUPPLY SYSTEM 9

Parallel, Redundant and non- redundant UPS - Ups using resonant power converters - Switch mode power supplies.

L = 45 T = 15 P = 0 C =4

TEXT BOOK

Miller. T.J.E, “Reactive power control in Electric systems”. Wiley inter science, New York, 1982.

REFRENCES

1. “Static Compensator for AC power systems”, Proc. IEE vol.128 Nov. 1981. pp 362-406.
2 “A Static alternative to the transformer on load tap changing”, IEEE Trans. On Pas, Vol.PAS-99, Jan. /Feb. 1980, pp86-89.
3. “Improvements in Thyristor controlled static on- load tap controllers for transformers”, IEEE Trans. on PAS, Vol.PAS-101, Sept.1982, pp3091-3095.
4. “Shunt Thyristor rectifiers for the Generex Excitation systems”, IEEE Trans. On PAS. PAS -96, July/August, 1977, pp1219-1325.

ELECTIVES – IV (semester-V)

19272E51BP - POWER SYSTEM DYNAMICS 3 1 0 4

1. SYNCHRONOUS MACHINE MODELLING 9

Schematic Diagram, Physical Description: armature and field structure, machines with multiple pole pairs, mmf waveforms, direct and quadrature axes, Mathematical Description of a Synchronous Machine: Basic equations of a synchronous machine: stator circuit equations, stator self, stator mutual and stator to rotor mutual inductances, dq0 Transformation: flux linkage and voltage equations for stator and rotor in dq0 coordinates, electrical power and torque, physical interpretation of dq0 transformation, Per Unit Representations: L_{ad}-reciprocal per unit system and that from power-invariant form of Park's transformation; Equivalent Circuits for direct and quadrature axes, Steady-state Analysis: Voltage, current and flux-linkage relationships, Phasor representation, Rotor angle, Steady-state equivalent circuit, Computation of steady-state values, Equations of Motion: Swing Equation, calculation of inertia constant, Representation in system studies, Synchronous Machine Representation in Stability Studies: Simplifications for large-scale studies : Neglect of stator $p\Psi$ terms and speed variations, Simplified model with amortisseurs neglected: two-axis model with amortisseur windings neglected, classical model.

2. MODELLING OF EXCITATION AND SPEED GOVERNING SYSTEMS 9

Excitation System Requirements; Elements of an Excitation System; Types of Excitation System;Control and protective functions;IEEE (1992) block diagram for simulation of excitation systems. Turbine and Governing System Modelling: Functional Block Diagram of Power Generation and Control, Schematic of a hydroelectric plant, classical transfer function of a hydraulic turbine (no derivation), special characteristic of hydraulic turbine, electrical analogue of hydraulic turbine, Governor for Hydraulic Turbine: Requirement for a transient droop, Block diagram of governor with transient droop compensation, Steam turbine modelling: Single reheat tandem compounded type only and IEEE block diagram for dynamic simulation; generic speed-governing system model for normal speed/load control function.

3. SMALL-SIGNAL STABILITY ANALYSIS WITHOUT CONTROLLERS 9

Classification of Stability, Basic Concepts and Definitions: Rotor angle stability, The Stability Phenomena. Fundamental Concepts of Stability of Dynamic Systems: State-space representation, stability of dynamic system, Linearisation, Eigen properties of the state matrix: Eigen values and eigenvectors, modal matrices, eigen value and stability, mode shape and participation factor. Single-Machine Infinite Bus (SMIB) Configuration: Classical Machine Model stability analysis with numerical example, Effects of Field Circuit Dynamics: synchronous machine, network and linearised system equations, block diagram representation with K-constants; expression for K-constants (no derivation), effect of field flux variation on system stability: analysis with numerical example,

4. SMALL-SIGNAL STABILITY ANALYSIS WITH CONTROLLERS 9

Effects Of Excitation System: Equations with definitions of appropriate K-constants and simple thyristor excitation system and AVR, block diagram with the excitation system, analysis of effect of AVR on synchronizing and damping components using a numerical example, Power System Stabiliser: Block diagram with AVR and PSS, Illustration of principle of PSS application with numerical example, Block diagram of PSS with description, system state matrix including PSS, analysis of stability with numerical a example. Multi-Machine Configuration: Equations in a common reference frame, equations in individual machine rotor coordinates, illustration of formation of system state matrix for a two-machine system with classical models for synchronous machines, illustration of stability analysis using a numerical example. Principle behind small-signal stability improvement methods: delta-omega and delta P-omega stabilizers.

5. ENHANCEMENT OF SMALL SIGNAL STABILITY 9

Power System Stabilizer – Stabilizer based on shaft speed signal (delta omega) – Delta –P-Omega stabilizer-Frequency-based stabilizers – Digital Stabilizer – Excitation control design – Exciter gain – Phase lead compensation – Stabilizing signal washout stabilizer gain – Stabilizer limits

L = 45 T = 15 P = 0 C =4

REFERENCES

1. P. Kundur, "Power System Stability and Control", McGraw-Hill, 1993.
2. IEEE Committee Report, "Dynamic Models for Steam and Hydro Turbines in Power System Studies", IEEE Trans., Vol.PAS-92, pp 1904-1915, November/December, 1973. on Turbine-Governor Model.
3. P.M Anderson and A.A Fouad, "Power System Control and Stability", Iowa State University Press, Ames, Iowa, 1978.

ELECTIVES – V (semester-V)

19272E52AP - POWER CONDITIONING

3 1 0 4

1. INTRODUCTION 9

Introduction – Characterization of Electric Power Quality: Transients, short duration and long duration voltage variations, Voltage imbalance, waveform distortion, Voltage fluctuations, Power frequency variation, Power acceptability curves – power quality problems: poor load power factor, Non linear and unbalanced loads, DC offset in loads, Notching in load voltage, Disturbance in supply voltage – Power quality standards.

2. NON-LINEAR LOADS 9

Single phase static and rotating AC/DC converters, Three phase static AC/DC converters, Battery chargers, Arc furnaces, Fluorescent lighting, pulse modulated devices, Adjustable speed drives.

3. MEASUREMENT AND ANALYSIS METHODS 9

Voltage, Current, Power and Energy measurements, power factor measurements and definitions, event recorders, Measurement Error – Analysis: Analysis in the periodic steady state, Time domain methods, Frequency domain methods: Laplace′s, Fourier and Hartley transform – The Walsh Transform – Wavelet Transform.

4. ANALYSIS AND CONVENTIONAL MITIGATION METHODS 9

Analysis of power outages, Analysis of unbalance: Symmetrical components of phasor quantities, Instantaneous symmetrical components, Instantaneous real and reactive powers, Analysis of distortion: On–line extraction of fundamental sequence components from measured samples – Harmonic indices – Analysis of voltage sag: Detorit Edison sag score, Voltage sag energy, Voltage Sag Lost Energy Index (VSLEI)- Analysis of voltage flicker, Reduced duration and customer impact of outages, Classical load balancing problem: Open loop balancing, Closed loop balancing, current balancing, Harmonic reduction, Voltage sag reduction.

5. POWER QUALITY IMPROVEMENT 9

Utility-Customer interface –Harmonic filters: passive, Active and hybrid filters – Custom power devices: Network reconfiguring Devices, Load compensation using DSTATCOM, Voltage regulation using DSTATCOM, protecting sensitive loads using DVR, UPQC –control strategies: P- Q theory, Synchronous detection method – Custom power park –Status of application of custom power devices

L = 45 T = 15 P = 0 C =4

REFERENCES:

1. Arindam Ghosh "Power Quality Enhancement Using Custom Power Devices", Kluwer Academic Publishers, 2002.
2. Heydt.G.T, "Electric Power Quality", Stars in a Circle Publications, 1994(2nd edition)

3. Dugan.R.C, " Electrical Power System Quality",TMH,2008.
4.Arrillga.A.J and Neville R.Watson, Power System Harmonics, John Wiley second Edition,2003.
5. Derek A. Paice, "Power electronic converter harmonics",John Wiley & sons, 1999.

ELECTIVES – V (semester-V)

19272E52BP – POWER SYSTEM RESTRUCTURING AND DEREGULATION

3 1 0 4

1. FUNDAMENTALS AND ARCHITECTURE OF POWERMARKETS 9

Deregulation of Electric utilities: Introduction-Unbundling-Wheeling- Reform motivations- Fundamentals of Deregulated Markets – Types (Future, Day-ahead and Spot) – Participating in Markets (Consumer and Producer Perspective) – bilateral markets – pool markets. Independent System Operator (ISO)-components-types of ISO - role of ISO - Lessons and Operating Experiences of Deregulated Electricity Markets in various Countries (UK, Australia, Europe, US, Asia).

2. TECHNICAL CHALLENGES 9

Total Transfer Capability – Limitations - Margins – Available transfer capability (ATC) – Procedure - Methods to compute ATC – Static and Dynamic ATC – Effect of contingency analysis – Case Study. Concept of Congestion Management – Bid, Zonal and Node Congestion Principles – Inter and Intra zonal congestion – Generation Rescheduling - Transmission congestion contracts – Case Study.

3. TRANSMISSION NETWORKS AND SYSTEM SECURITY SERVICES 9

Transmission expansion in the New Environment – Introduction – Role of transmission planning – Physical Transmission Rights – Limitations – Flow gate - Financial Transmission Rights – Losses – Managing Transmission Risks – Hedging – Investment. Ancillary Services – Introduction – Describing Needs – Compulsory and Demand-side provision – Buying and Selling Ancillary Services – Standards.

4. MARKET PRICING 9

Transmission pricing in open access system – Introduction – Spot Pricing – Uniform Pricing – Zonal Pricing – Locational Marginal Pricing – Congestion Pricing – Ramping and Opportunity Costs. Embedded cost based transmission pricing methods (Postage stamp, Contract path and MW-mile) – Incremental cost based transmission pricing methods (Short run marginal cost, Long run marginal cost) - Pricing of Losses on Lines and Nodes.

5. INDIAN POWER MARKET 9

Current Scenario – Regions – Restructuring Choices – Statewise Operating Strategies – Salient features of Indian Electricity Act 2003 – Transmission System Operator – Regulatory and Policy development in Indian power Sector – Opportunities for IPP and Capacity Power Producer. Availability based tariff – Necessity – Working Mechanism – Beneficiaries – Day Scheduling Process – Deviation from Schedule – Unscheduled

Interchange Rate – System Marginal Rate – Trading Surplus Generation – Applications.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Kankar Bhattacharya, Math H.J. Bollen and Jaap E. Daalder, "Operation of Restructured Power Systems", Kluwer Academic Publishers, 2001
2. Loi Lei Lai, "Power system Restructuring and Regulation", John Wiley sons, 2001.
3. Shahidehpour.M and Alomoush.M, "Restructuring Electrical Power Systems", Marcel Decker Inc., 2001.
4. Steven Stoft, " Power System Economics", Wiley – IEEE Press, 2002
5. Daniel S. Kirschen and Goran Strbac, " Fundamentals of Power System Economics", John Wiley & Sons Ltd., 2004.
6. Scholarly Transaction Papers and Utility web sites

ELECTIVES – VI (semester-V)

19272E53AP - SOFTWARE FOR CONTROL SYSTEM DESIGN

3 1 0 4

1. INTRODUCTION TO DESIGN AND CLASSICAL PID CONTROL

Systems performance and specifications –Proportional, Integral and Derivative Controllers – Structure – Empirical tuning- Zeigler Nichols-Cohen Coon – Root Locus method – Open loop inversion-– Tuning using ISE, IAE and other performance indices.

2. COMPENSATOR DESIGN

Design of lag, lead, lead-lag compensators – Design using bode plots – Polar plots – Nichols charts – root locus and Routh Hurwitz criterion.

3. MATLAB

Introduction – function description – Data types – Tool boxes – Graphical Displays – Programs for solution of state equations – Controller design – Limitations.-simulink-Introduction – Graphical user interface – Starting – Selection of objects – Blocks – Lines - simulation – Application programs – Limitations.

4. MAPLE

Introduction – symbolic programming – Programming constructs – Data structure computation with formulae – Procedures – Numerical Programming.

5. MATLAB

Programs using MATLAB software

L = 45 T = 15 P = 0 C =4

REFERENCES

1. MAPLE V Programming guide.
2. MATLAB user manual.
3. SIMULINK user manual.
4. K.Ogatta ,"Modern Control Engineering",PHI,1997.
5. Dorf and Bishop,"Modern control Engineering', Addison Wesley, 1998.

ELECTIVES – VI (semester-V)

19272E53BP - INDUSTRIAL POWER SYSTEM ANALYSIS AND DESIGN

3 1 0 4

1. MOTOR STARTING STUDIES 9

Introduction-Evaluation Criteria-Starting Methods-System Data-Voltage Drop Calculations-Calculation of Acceleration time-Motor Starting with Limited-Capacity Generators-Computer-Aided Analysis-Conclusions.

2. POWER FACTOR CORRECTION STUDIES 9

Introduction-System Description and Modeling-Acceptance Criteria-Frequency Scan Analysis-Voltage Magnification Analysis-Sustained Overvoltages-Switching Surge Analysis-Back-to-Back Switching-Summary and Conclusions.

3. HARMONIC ANALYSIS 9

Harmonic Sources-System Response to Harmonics-System Model for Computer-Aided Analysis-Acceptance Criteria-Harmonic Filters-Harmonic Evaluation-Case Study-Summary and Conclusions.

4. FLICKER ANALYSIS 9

Sources of Flicker-Flicker Analysis-Flicker Criteria-Data for Flicker analysis- Case Study-Arc Furnace Load-Minimizing the Flicker Effects-Summary.

5. GROUND GRID ANALYSIS 9

Introduction-Acceptance Criteria-Ground Grid Calculations-Computer-Aided Analysis - Improving the Performance of the Grounding Grids-Conclusions.

L = 45 T = 15 P = 0 C =4

REFERENCES

1. Ramasamy Natarajan, "Computer-Aided Power System Analysis", Marcel Dekker Inc., 2002.

Research Integrated Curriculum

The relationship between teacher and learner is completely different in higher education from what it is in school. At the higher level, the teacher is not there for the sake of the student, both have their justification in the service of scholarship. For the students who are the professionals of the future, developing the ability to investigate problems, make judgments on the basis of sound evidences, take decisions on a rational basis and understand what they are doing and why is vital. Research and inquiry is not just for those who choose to pursue an academic career. It is central to professional life in the twenty-first century.

It is observed that the modern world is characterized by heightened levels of complexity and uncertainty. Fluidity, fuzziness, instability, fragility, unpredictability, indeterminacy, turbulence, changeability, contestability: these are some of the terms that mark out the world of the twenty-first century. Teaching and research is correlated when they are co-related. Growing out of the research on teaching- research relations, the following framework has been developed and widely adopted to help individual staff, course teams and whole institutions analyse their curricula and consider ways of strengthening students understanding of and through research. Curricula can be:

Research – Led: Learning about current research in the discipline

Here the curriculum focus is to ensure that what students learn clearly reflects current and ongoing research in their discipline. This may include research done by staff teaching them.

Research – Oriented: Developing research skills and techniques

Here the focus is on developing student's knowledge of and ability to carry out the research methodologies and methods appropriate to their discipline(s)

Research – Based: Undertaking research and inquiry

Here the curriculum focus is on ensuring that as much as possible the student learns in research and or inquiry mode (i.e. the students become producers of knowledge not just consumers). The strongest curricula form of this is in those special undergraduate programmes for selected students, but such research and inquiry may also be mainstreamed for all or many students.

Research- Tutored: engaging in research discussions

Here the focus is on students and staff critically discussing ongoing research in the discipline.

All four ways of engaging students with research and inquiry are valid and valuable and curricula can and should contain elements of them.

Moreover, the student participation in research may be classified as,

Level 1: Prescribed Research
Level 2: Bounded Research
Level 3: Scaffolded Research
Level 4: Self actuated Research
Level 5: Open Research

Taking into consideration the above mentioned facts in respect of integrating research into the M.Tech Power system curriculum, the following Research Skill Based Courses are introduced in the curriculum.

Semester	RSB Courses	Credits
I	Research Led Seminar	1
II	Research Methodology	3
II	Participation in Bounded Research	2
III	Design Project/ Socio Technical Project (Scaffolded Research)	4
IV	Project Work	12

Blueprint for assessment of student's performance in Research Led Seminar Course

- **Internal Assessment:** **40 Marks**
  - Seminar Report (UG)/Concept Note(PG) : 5 X 4= 20 Marks
  - Seminar Review Presentation : 10 Marks

- Literature Survey : 10 Marks

- **Semester Examination : 60 Marks**

(Essay type Questions set by the concerned resource persons)

Blueprint for assessment of student's performance in Design/Socio Technical Project

- **Continuous Internal Assessment through Reviews: 40 Marks**
  - Review I : 10 Marks
  - Review II : 10 Marks
  - Review III : 20 Marks
- **Evaluation of Socio Technical Practicum Final Report: 40 Marks**
- **Viva- Voce Examination: 20 Marks**
- **Total: 100 Marks**

Blueprint for assessment of student's performance in Research Methodology Courses

Continuous Internal Assessment: 20 Marks

- Research Tools(Lab) : 10 Marks
- Tutorial: 10 Marks

Model Paper Writing: 40 Marks

- Abstract: 5 Marks
- Introduction: 10 Marks
- Discussion: 10 Marks
- Review of Literature: 5 Marks
- Presentation: 10 Marks

Semester Examination: 40 Marks

Total: 100 Marks

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PRISTUNIVERSITY
VALLAM,THANJAVUR.

DEPARTMENT OF
COMPUTERSCIENCE&ENGINEERING

PROGRAMHANDBOOK

B.TECH-CSE(PART-TIME)

[REGULATION2022]
[forcandidatesadmittedtoB.TechCSEprogramfromJune2022 onwards]

PROGRAMEDUCATIONALOBJECTIVES

Theprogramobjectives, addressourmissionofgraduatingstudentswithsolid foundation incomputerscienceandengineeringandto engageinactivitiesthat improvethewelfareof societywithin a few years after their graduation. Based onthe missionand vision, Program Educational Objectives are listed below:

- **I.** Graduating students to practice fundamentals of computer science engineering and apply their problem solving skills to analyze and solve engineering problems to meet the emerging needs of software industry**.**
- II. Toencouragegraduatestopursueadvancededucation, researchanddevelopment, and other creative efforts in science and technology.
- III. Graduatingstudentsto achieveprofessionalstatusduetotheir masteryofComputer Science theoryand practice, exposure to emerging hardware technologies.
- IV. Toendorsegraduates withcommunication,andinterpersonalskillstoenablethemto workinteameffectivelyinmultidisciplinaryfield andintheir professionalcareers.
- V. To impart the students to engage in lifelong learning and continuing professional development to usetheir understanding ofthe impact oftechnologyonsocietyfor the benefit of humankind.

PROGRAMOUTCOMES

Programoutcomesaretheknowledge, skills,andbehaviorsthat studentsacquireduring the time ofgraduation throughthe programobjectives. Students should be in possession of:

a) Anabilitytoapplymathematical, algorithmicprinciples,andcomputingtechniquesin the modeling and design of computer-based systems.
b) An ability to apply software engineering techniques todesign,implementand test a softwaresystem, and to evaluateandcomparetheefficienciesofalternative solutions.
c) Knowledgeto identifyandsolvetheopenendproblemstomeettherequirements in computing industry.
d) Understandingofnetworktechnologiestoevolve and deploynetwork.
e) Anabilitytochoosebest webtechnologiesfor solvingwebclient/server problemand to create web pages with dynamic effects.
f) Anabilitytoworkinmultidisciplinaryprojects.
g) Verbalskills to interact withcustomers, colleagues, and managers, and possess writtencommunicationskillstodescribeideas,documentprocesses,andresults.
h) Anabilitytoengageinlife-long learningto remain current intheirprofessionand be leaders in technological society.
i) Thebroadeducationnecessaryto understandthe impact ofcomputing ina global, economic, societal context and in all endeavors.
j) Fundamentalknowledgeindigitalcircuits,communicationsystemsandcomputer hardware.
k) Anabilitytomapcomputing ideas into workingphysicalsystemswiththehelpof computing technologies for the benefit of society.

MAPPINGOFPEOWITHPO

PEO	PROGRAMOUTCOMES										
	a	b	C	d	e	f	g	h	i	j	k
I	X	X		X	X						
II			X					X			
III							X				X
IV									X	X	
V						X					

COURSE STRUCTURE

SEMESTERI

SubjectCode	SubjectName	PeriodsPerWeek			C
		L	T	P	
22148S11P	TransformsandPartialDifferential Equations	3	1	0	4
22152S12P	DigitalSystems	3	1	0	4
22150H13P	DataStructuresandalgorithms	3	1	0	4
22150H14P	ComputerArchitectureand Organization	3	1	0	4
22150H15P	ProblemSolvingAndPython Programming	3	0	0	3
TotalNo.ofcredits					**19**

SEMESTERII

SubjectCode	SubjectName	PeriodsPerWeek			C
		L	T	P	
22148S21P	NumericalMethods	3	1	0	4
22150H22P	Microprocessorsand Interfacing	3	1	0	4
22150H23P	DatabaseManagement Systems	3	1	0	4
22150H24P	DesignandAnalysis Of Algorithm	3	1	0	4
22150H25P	Programmingin C	3	0	0	3
TotalNo.ofcredits					**19**

SEMESTERIII

SubjectCode	SubjectName	PeriodsPerWeek			C
		L	T	P	
22148S31P	DiscreteMathematics	3	1	0	4
22150H32P	OperatingSystem	4	0	0	4
22150H33P	ArtificialIntelligence	4	0	0	4
22150H34P	ComputerNetworks	4	0	0	4
22150L35P	OperatingSystemsandNetworking Lab	0	0	3	2
TotalNo.ofcredits					**18**

SEMESTERIV

SubjectCode	SubjectName	PeriodsPerWeek			C
		L	T	P	
22150H41P	SoftwareEngineering Fundamentals	3	1	0	4
22150H42P	InternetProgramming	3	1	0	4
22150H43P	C#And.NetFramework	3	1	0	4
221__E44_P	**Elective-I**	3	1	0	4
22150L45P	InternetProgrammingLab	0	0	3	2
TotalNo.ofcredits					**18**

SEMESTER -V

SubjectCode	SubjectName	PeriodsPerWeek			C
		L	T	P	
22150H51P	Object OrientedAnalysis and Design	4	0	0	4
22150H52P	SoftwareQualityManagement				
22150H53P	GraphicsandMultimedia	3	1	0	4
221__E54_P	**Elective–II**	3	1	0	4
22150L55P	SoftwareDevelopmentLab	0	0	3	2
TotalNo.ofcredits					**18**

SEMESTER -VI

SubjectCode	SubjectName	PeriodsPerWeek			C
		L	T	P	
22150H61P	CryptographyandNetworkSecurity	4	0	0	4
22150H62P	AdvancedJavaprogramming	3	1	0	4
22150H63P	SoftwareTesting	4	0	0	4
221__E64_P	**ElectiveIII**	4	0	0	4
22150L65P	JavaProgrammingLab	0	0	3	2
TotalNo.ofcredits					**18**

SEMESTER-VII

SubjectCode	SubjectName	PeriodsPerWeek			C
		L	T	P	
22160S71P	TotalQualityManagement	3	0	0	3
22150H72P	GridandCloudComputing	4	0	0	4
22150H73P	MiddlewareTechnologies	3	1	0	4
221__E74_P	**ElectiveIV**	3	0	0	3
22150P75P	Project	0	0	12	6
TotalNo.ofcredits					**20**

LIST OF ELECTIVES SEMESTER-IV(ELECTIVEI)

SubjectCode	SubjectName	PeriodsPerWeek			C
		L	T	P	
22150E44AP	TheoryofComputation	3	1	0	4
22150E44BP	DataWarehousingandData Mining	3	1	0	4
22150E44CP	ProfessionalEthicsin Engineering	3	1	0	4
22150E44DP	AdvancedDatabases	3	1	0	4

SEMESTER-V(ELECTIVEII)

SubjectCode	SubjectName	PeriodsPerWeek			C
		L	T	P	
22150E54AP	AdhocandSensorNetworks	3	1	0	4
22150E54BP	PrinciplesofCompilerDesign	3	1	0	4
22150E54CP	DistributedSystems	3	1	0	4
22150E54DP	MobileComputing	3	1	0	4

SEMESTER-VI(ELECTIVEIII)

SubjectCode	SubjectName	PeriodsPerWeek			C
		L	T	P	
22160E64AP	PrinciplesofManagement	4	0	0	4
22150E64BP	UnixInternals	4	0	0	4
22150E64CP	GraphTheoryAnd Applications	4	0	0	4
22150E64DP	Programmingparadigms	4	0	0	4

SEMESTER-VII(ELECTIVE VI)

SubjectCode	SubjectName	PeriodsPerWeek			C
		L	T	P	
22150E74AP	HighSpeedNetworks	3	0	0	3
22150E74BP	InformationRetrieval Techniques	3	0	0	3
22150E74CP	SoftwareProject Management	3	0	0	3
22150E74DP	CyberForensics	3	0	0	3

CREDITSDISTRIBUTION

Semester	Theory Courses		Elective Courses		Practical Courses		Project	Total Credit
	Nos	Credit	Nos	Credit	Nos	Credit	Credit	
I	5	**19**	-	**-**	-	**-**	-	**19**
II	5	**19**	-	**-**	-	**-**	-	**19**
III	4	**16**	-	**-**	1	**02**	-	**18**
IV	3	**12**	1	**04**	1	**02**	-	**18**
V	3	**12**	1	**04**	1	**02**	-	**18**
VI	3	**12**	1	**04**	1	**02**	**-**	**18**
VII	3	**11**	1	**03**	-	**-**	**06**	**20**
TotalCredits								**130**

TOTALCREDITS	
Semester–I	**19**
Semester–II	**19**
Semester–III	**18**
Semester–IV	**18**
Semester–V	**18**
Semester–VI	**18**
Semester–VI	**20**
TOTALCREDITS	**130**

22148S11P-TRANSFORMSANDPARTIALDIFFERENTIAL EQUATIONS

AIM:

To develop the skills for the students in the areas of Transforms and Partial Differential Equations. This will be necessary for their effective studies in a large number of engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory. Thecoursewillalsoserveasa prerequisitefor specializedstudies and research.

OBJECTIVES:

- Solvesimplesecondorderdifferentialequations;
- BeabletocalculateFourierseries;
- ProvetheOrthogonalityof Eigenfunctions ofboundaryvalueproblems;
- Beabletoclassifysecondorder partialdifferentialequationsandchoosethe appropriate boundary conditions;
- Applythemethodofseparationofvariables tostandard PDEs;
- Understandthewideapplicationsofdifferentialequation;
- UseLaplacetransformstosolvesimplelineardifferentialequations.

UNITIFOURIERSERIES 9+3hrs

Periodic function-Graph of functions- Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex formofFourier Series– Parseval'sidentity– Harmonic Analysis.

UNITII FOURIERTRANSFORM 9+3hrs

Fourier integral theorem (without proof) – Sine and Cosine transforms – Properties (without Proof) – Transforms of simple functions – Convolution theorem – Parseval's identity – Finite Fourier transform, Sine and Cosine transform.

UNITIII Z-TRANSFORMANDDIFFERENCEEQUATIONS 9+3hrs

Z-transform - Elementary properties (without proof) – Inverse Z – transform – Convolution theorem -Formation of difference equations – Solution of difference equations using Z – transform-Sampling of signals –an introduction.

UNITIV PARTIALDIFFERENTIALEQUATIONS 9+ 3hrs

Formation of PDE –solution of standard type first order equation- Lagrange'slinearequation –Linear partial differential equations of secondorder and higher order withConstant coefficients.

UNITV BOUNDARYVALUEPROBLEMS 9+ 3hrs

Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two-dimensional heat equation (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

TOTAL:60hrs

TEXT BOOKS:

1. Andrews, L.A., and ShivamoggiB.K., "IntegralTransforms for Engineers and AppliedMathematicians", Macmillen , New York ,1988.
2. Grewal,B.S.,"HigherEngineeringMathematics",ThirtySixthEdition,Khanna Publishers, Delhi,2001.
3. Kandasamy,P.,Thilagavathy,K.,andGunavathy,K.,"EngineeringMathematics Volume III",S.Chand&Companyltd.,NewDelhi,1996.

REFERENCES:

1. Narayanan, S., ManicavachagomPillay, T.K. and Ramanaiah, G., "Advanced Mathematics for Engineering Students", Volumes II and III, S. Viswanathan(Printers and Publishers) Pvt. Ltd. Chennai, 2002.

2. Churchill, R.V. and Brown, J.W., "Fourier Series and BoundaryValue Problems", FourthEdition, McGraw-Hill Book Co., Singapore, 1987.

3. AdvancedModernEngineeringmathematics–GlynJames

CSE/SemI

22152S12P-DIGITALSYSTEMS

AIM:

Tolearnthefundamentalconcepts thoseareusefulfordesigningdigitalsystemsorcircuits.

OBJECTIVES:

- Tointroducenumber systemsandcodes
- To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions
- Tointroducethemethods forsimplifyingBooleanexpressions
- To outline the formal proceduresforthe analysisanddesignofcombinationalcircuitsand sequential circuits
- Tointroducetheconceptofmemories devices.

UNITI BOOLEANALGEBRAANDLOGICGATES 9+3

Binary, Octal, Decimal, Hexadecimal-Number base conversions – complements – signed Binary numbers. Binary Arithmetic- Binary codes -Boolean postulates and laws –De-Morgan's Theorem-Principle of Duality- Boolean expression – Boolean function- Minimization of Boolean expressions–Karnaugh map Minimization .

LOGIC GATES: AND, OR, NOT, NAND, NOR, Exclusive – OR and Exclusive – NOR-Implementations of Logic Functions using gates, NAND –NOR implementations

UNITII. COMBINATIONALCIRCUITS 9+3

Adders-Subtractors – Serial adder/ Subtractor - Parallel adder/ Subtractor-Carry look ahead adder-Multiplexer/ De multiplexer- Implementation using MUX- encoder / decoder – parity checker –code converters

UNITIII SEQUENTIALCIRCUIT 9+3

Flip flops SR, JK,T, Dand Master slave– Characteristic tableand equation –Applicationtable–Edge triggering-Level triggering-Realization of one flip flop using other flip flops-Asynchronous / Ripple counters – Synchronous counters –Modulo – n counter –Classification of sequential circuits –Introduction to shift registers

UNITIV ASYNCHRONOUSSEQUENTIALCIRCUITS 9+3

Introduction to asynchronous sequential circuits - primitive state / flow table – Minimization of primitivestatetable–stateassignment –Excitationtable–Excitationmap-cycles – Races –Hazards: Static –Dynamic –Essential –Hazards elimination.

UNITV MEMORYDEVICES 9+3

Classification of memories –RAM organization – Write/Read operation – Memory cycle - Timing wave forms –memory decoding- memory expansion- Static RAM Cell-Bipolar RAM cell – MOSFET RAM cell –Dynamic RAM cell –ROM organization - PROM –EPROM –EEPROM –EAPROM –Programmable Logic Devices –Implementation using ROM- Field Programmable GateArrays (FPGA)

TOTAL:60hrs

TEXTBOOKS:

1. M. Morris Mano, Digital Design, 3.ed., Prentice Hall of India Pvt. Ltd., New Delhi, 2003/Pearson Education (Singapore) Pvt. Ltd., NewDelhi, 2003 – (Unit I, II, V)
2. John.MYarbrough,DigitalLogicApplicationsandDesign,Thomson-Vikaspublishing house, New Delhi, 2002. (Unit III, IV)

REFERENCES:

1. S.SalivahananandS.Arivazhagan,DigitalCircuitsand Design,2nd ed.,VikasPublishing House Pvt. Ltd, New Delhi, 2004
2. CharlesH.Roth.“FundamentalsofLogicDesign”,ThomsonPublicationCompany,2003.
3. DonaldP.LeachandAlbertPaulMalvino, DigitalPrinciples andApplications, 5ed.,Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.
4. R.P.Jain, Modern Digital Electronics, 3 ed., Tata McGraw–Hill publishing company limited, New Delhi, 2003.
5. ThomasL.Floyd,DigitalFundamentals,PearsonEducation,Inc,NewDelhi, 2003

22150H13P-DATASTRUCTURESANDALGORITHMS

AIM:

Toemphasize, thepracticalapplicationoftechniquesforanalyzingtheperformanceof algorithms and to know fundamentals of data structures.

OBJECTIVES:

- Tolearnthesystematicwayofsolvingproblems
- Tounderstandthedifferentmethods of organizinglargeamountsof data
- Toefficientlyimplementsolutionsforspecificproblems
- Togainknowledgeofvarioussortingtechniques.
- Toefficientlyimplementthedifferentdata structures

UNIT-I PROBLEMSOLVING 9+3

Problem solving- Top-Down Design- Implementation - Verification- Efficiency -Analysis - Sample Algorithms

UNITIILISTS,STACKSANDQUEUES 9+3

Abstract DataType(ADT)–TheListADT–TheStackADT-Queueas ADT

UNITIIITREES 9+3

Binary trees: Operations on binary trees - Applications of binary trees - Binary tree representation - Node representation of binary trees - Implicit array representation of binary tree

UNIT-IV SORTING&SEARCHING 9+3

Preliminaries–InsertionSort–Heapsort–Mergesort–Quicksort– Bubblesort
Basic Search Techniques – Linear Search – Indexed Sequential Search , Binary Search – Tree Searching – Inserting into a Binary searching tree – Deleting froma Binary Search tree

UNIT-V GRAPHS 9+3

Definitions – Shortest-Path Algorithms – Dijkstra's Algorithm – Minimum Spanning Tree – Prim's Algorithm - Depth first traversal - Application of depth first traversal -Breadth first traversal-Application of BFS.

TOTAL:60hrs

TEXTBOOKS:

1. R.G.Dromey,"Howtosolveitbycomputer",Prentice- HallofIndia,2002.
2. AaronM.Tenenbaum,YeedidyahLangsam,MosheJ.Augenstein,'Datastructures using C', Pearson Education, 2004 / PHI.
3. M. A. Weiss, "DataStructures and AlgorithmAnalysis inC", 2nd ed, PearsonEducationAsia, 2002

REFERENCES:

1. E.Balagurusamy,'ProgramminginAnsiC',SecondEdition,TataMcGrawHill Publication, 2003.

2. RobertL.Kruse,BruceP.LeungClovisL.Tondo,'DataStructuresandProgram Design in C', Pearson Education, 2000 / PHI.
3. Y.Langsam,M.J.Augenstein andA.M. Tenenbaum,"DataStructuresusing C",Pearson Education Asia, 2004.
4. Richard F. Gilberg, Behrouz A. Forouzan, "Data Structures – A Pseudocode Approach with C", Thomson Brooks / COLE, 1998.
5. Aho,J.E.HopcroftandJ.D.Ullman,"DataStructuresandAlgorithms",Pearson education Asia, 1983.

CSE/SemI

22150H14P-COMPUTER ARCHITECTUREANDORGANIZATION

AIM:

Tounderstandthebasicstructureandorganization ofdigitalcomputer.

OBJECTIVES:

- Tohaveathoroughunderstandingofoperationofadigitalcomputer.
- Tolisttheoperationofthearithmeticunit.
- Tostudyindetailthedifferenttypesofcontrolandtheconcept of pipelining.
- Tounderstandthehierarchyofmemories.
- Tostudythedifferent waysofcommunicatingwithI/OdevicesandstandardI/O interfaces.

UNITI BASICSTRUCTUREOFCOMPUTERS 10+3

Functional units - Basic operational concepts - Bus structures - Software performance – Memory locations and addresses – Memory operations – Instruction and instruction sequencing – Addressing modes – Assembly language

UNITII ARITHMETICUNIT 8+3

Addition and subtraction of signed numbers – Design of fast adders – Multiplication of positive numbers - Signed operand multiplication and fast multiplication – Integer division

UNITIII BASICPROCESSINGUNIT 9+3

Fundamentalconcepts – Execution of a completeinstruction – Multiplebus organization – Hardwired control – Microprogrammed control - Pipelining – Basic concepts – Data hazards –Instruction hazards –Superscalar operation.

UNITIV MEMORYSYSTEM 9+3

Basic concepts – Semiconductor RAMs - ROMs – Speed - size and cost – Cache memories - Performance consideration – Virtual memory- Memory Management requirements – Secondary storage.

UNITV I/O ORGANIZATION 9+3

Accessing I/O devices – Interrupts – Direct Memory Access – Buses – Interface circuits – Standard I/O Interfaces (PCI, SCSI, USB).

TOTAL:60hrs

TEXTBOOK:

1. CarlHamacher, ZvonkoVranesic andSafwatZaky, 5th Edition"Computer Organization", McGraw-Hill, 2002.

REFERENCES:

1. WilliamStallings, "Computer Organization and Architecture – Designing for Performance", 6th Edition, Pearson Education, 2003.
2. DavidA.PattersonandJohnL.Hennessy,"ComputerOrganizationandDesign:Thehardware /softwareinterface",2ndEdition,MorganKaufmann,2002.
3. JohnP.Hayes,"Computer ArchitectureandOrganization",3rdEdition,McGrawHill, 1998.

22150H15P-PROBLEMSOLVINGANDPYTHONPROGRAMMING

AIM:

Tointroducethestudentsaboutobject orientedprogramminganddesign.

OBJECTIVES:

Oncompletionoftheclass,astudentshouldbeable:

- Toknowthebasicsofalgorithmicproblemsolving
- ToreadandwritesimplePythonprograms.
- TodevelopPythonprogramswithconditionalsandloops.
- TodefinePythonfunctionsandcallthem.
- TousePythondatastructures–-lists,tuples,dictionaries.
- Todoinput/output withfilesinPython

UNITIALGORITHMICPROBLEMSOLVING 9

Algorithmsbuildingblocksofalgorithms(statements,state,controlflow,functions),notation(pseud o code, flowchart, programming language),algorithmic problem solving, simplestrategies for developing algorithms(iteration,recursion).Illustrativeproblems:findminimuminalist,insertacar dinal, guessan integer number in arrange, Towers of Hanoi.

UNITIIDATA,EXPRESSIONS,STATEMENTS 9

PythonInterpreterandinteractivemode;valuesandtypes:int,float,boolean,string,andlist;variables,expressions, statements, tuple assignment,precedence of operators, comments; modules and functions, function definition anduse,flowofexecution, parametersandarguments;Illustrativeprograms:exchangethevaluesoftwovariables,circulatethevaluesofn variables, distancebetween two points.

UNIT-IIICONTROLFLOW,FUNCTIONS 9

Conditionals:Booleanvaluesandoperators,conditional(if),alternative(if- else),chainedconditional(if-elif-else);Iteration:state,while,for,break,continue,pass;functions:returnvalues,parameters, local and global scope, function composition,recursion;Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, suman arrayofnumbers, linearsearch,binary search.

UNITIVLISTS,TUPLES,DICTIONARIES 9

Lists:listoperations,listslices,listmethods,listloop,mutability,aliasing,cloninglists,listparameters; Tuples:tupleassignment,tupleasreturnvalue;Dictionaries:operationsandmethods;advancedli st processing-listcomprehension;Illustrativeprograms:selection sort, insertion sort, mergesort, histogram.

UNITVFILES,MODULES,PACKAGES 9

Filesandexception:textfiles,readingandwritingfiles,formatoperator;commandlinearg uments,errors and exceptions, handling exceptions, modules, packages;Illustrativeprograms:word count, copyfile.

TOTAL:45PERIODS

TextBook:
BalagurusamyE,“ObjectOrientedProgrammingwithC++”,3/E,TMG, 2006.

Reference:

1. Hubbard,“ProgrammingwithC++”, 2/e, SchaumOutlineSeries,TMH,2006.
2. BjarneStroustrup, "TheC++ ProgrammingLanguage", AddisonWesleyPublications, Second Edition, 1991.
3. SarangProonachandra,”ObjectOrientedProgrammingwithC++”,PHI,2006.
4. JagadevAK, RathAM,andDehuriS,”ObjectOrientedProgrammingUsingC++”,PHI,2007.

22148S21P-NUMERICALMETHODS

AIM:

Studentswilldevelopproblemsolvingskills,withNumericalandStatistical Methods, whichcanbeimplementedinI.T.field.

OBJECTIVES:

- Demonstrateknowledgeandunderstanding of numerical methods tosolve ordinary differential equations
- Demonstrateknowledgeand understanding of numerical methods to solvesimplepartial differential equations
- Introduceto students numerical methods and scientific computation techniques for dealing with important computational problems

UNITI SOLUTIONOFEQUATIONSANDEIGENVALUEPROBLEMS 9+3hrs

Solution of equations–Newton Raphson's method, Regula-falsi methods Solution of linearSystem of equations by Gaussian elimination and Gauss-Jordon methods- Iterative methods:Gauss Jacobi and Gauss-Seidel methods– Eigenvalue of a matrix by power method.

UNITII INTERPOLATION 9+3hrs

Newton's forward and backward difference formulas – Central difference formula: Bessels andStirling's formula - Lagrangian Polynomials – Divided difference method.

UNITIII NUMERICALDIFFERENTIATIONANDINTEGRATION9+3hrs

Derivatives from difference tables – Divided differences and finite differences –Numericalintegration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Double integrals using trapezoidal and Simpson's rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS

9+3hrs

Single step methods: Taylor series method – Euler and modified Euler methods – Fourth order Runge–Kutta method for solving first and second order equations – Multistep methods: Milne's and Adam's predictor and corrector methods

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9+3hrs

Finite difference solution of second order ordinary differential equation – Finite differencesolution of one dimensional heat equation by explicit and implicit methods – One dimensionalwave equation and two dimensional Laplace and Poisson equations.

TOTAL:60hrs

<u>TEXTBOOKS</u>

1. Gerald,C.F, and Wheatley,P.O, "Applied Numerical Analysis",Sixth Edition,Pearson Education Asia, New Delhi, 2002.
2. Kandasamy, P., Thilagavathy, K. andGunavathy, K., "Numerical Methods", S.ChandCo. Ltd., New Delhi, 2003.

REFERENCES:

1. Burden, R.LandFaires, T.D., “Numerical Analysis”, SeventhEdition, Thomson Asia Pvt. Ltd., Singapore, 2002.
2. Balagurusamy,E.,“NumericalMethods”,TataMcGraw-HillPub.Co.Ltd,NewDelhi, 1999.

CSE/SemII

22150H22P-MICROPROCESSORSANDINTERFACING

AIM:

To have an in depth knowledge of the architecture and programming of 8-bit and 16-bit Microprocessors, Microcontrollersandtostudyhowtointerfacevariousperipheraldeviceswiththem.

OBJECTIVES:

- TostudythearchitectureandInstructionsetof8085and8086
- Todevelop assemblylanguageprogramsin8085 and8086.
- Todesignandunderstandmultiprocessorconfigurations
- Tostudydifferentperipheraldevicesandtheirinterfacingto 8085/8086.
- Tostudythearchitectureandprogrammingof8051microcontroller.

UNITI8085CPU 9+3

8085Architecture–Instructionset–Addressingmodes–Timingdiagrams–Interrupts– Memory interfacing – Interfacing, I/O devices.

UNITII PERIPHERALSINTERFACING 9+3

InterfacingSerialI/O(8251)-parallelI/O(8255)–KeyboardandDisplaycontroller 8279Interrupt Controller –DMA controller - Bus: RS232C-RS485

UNITIII 8086CPU 9+3

Intel8086InternalArchitecture–8086Addressingmodes-Instructionset-8086–Interrupts.

UNITIV 8086SYSTEMDESIGN 9+3

8086 signalsand timing – MIN/MAXmode ofoperation – Addressing memory and I/O — System design using 8086

UNITV 8085APPLICATIONS 9+3

Stepper motor control – DC motor control–Traffic light control– LCD Controller — Squarewave generation –Introduction to microcontroller.- 8051 Architecture.

TOTAL :60Hrs.

TEXTBOOKS:

1. Ramesh SGaonkar, MicroprocessorArchitecture,Programming and application with8085, 4th Edition, PenramInternational Publishing, New Delhi, 2000. (Unit I, II)
2. JohnUffenbeck,The 80x86Family,Design,ProgrammingandInterfacing,ThirdEdition. Pearson Education, 2002.
3. S.P.Chowdhury , SunetraChowdhury,Microprocessor& Peripherals ,First Edition ,Scitech Publications(INDIA)Pvt. Ltd.(Unit V)

REFERENCES:

1. A.K. RayandK.M.Burchandi, IntelMicroprocessorsArchitectureProgrammingand Interfacing, McGraw Hill International Edition, 2000(Unit III,IV).
2. Kenneth J Ayala, The 8051 MicrocontrollerArchitecture Programming and Application,2nd Edition, Penram International Publishers (India), New Delhi, 1996.
3. M. Rafi Quazzaman, Microprocessors Theory and Applications: Intel and Motorola prentice Hall of India, Pvt. Ltd., New Delhi, 2003.

22150H23P-DATABASE MANAGEMENTSYSTEMS

AIM:

To know the methodologies in database technology and an introduction to the current trends in this field.

OBJECTIVES:

- Tolearnthefundamentalsofdatamodels.
- Tounderstandtheinternalstoragestructuresusingdifferent fileandindexingtechniques.
- Toknowthefundamentalconceptsoftransactionprocessing-concurrencycontrol techniques and recovery procedure.
- To understand thebasic concepts of the emerging trends in thearea of distributed DB- and OODB.

UNITI INTRODUCTIONANDCONCEPTUALMODELING 9+ 3

IntroductiontoFileandDatabasesystems- Databasesystemstructure– Data Models – Introductionto NetworkandHierarchicalModels – ERmodel– RelationalModel– Relational Algebra andCalculus.

UNITII RELATIONALMODEL 9+ 3

SQL – Data definition- Queries in SQL- Updates- Views – Integrity and Security – Relational Database design – Functional dependences and Normalization for Relational Databases (up toBCNF).

UNIT III DATASTORAGEAND QUERYPROCESSING 9+ 3

Primary file organization- Secondary storage Devices- Operations on Files- Heap File- Sorted Files- Hashing Techniques – Index Structure for files –Different types of Indexes- B-Tree - Query Processing.

UNITIV TRANSACTIONMANAGEMENT 9+ 3

Transaction Processing – Introduction- Need for Concurrency control- Schedule and Recoverability- Serializability and Schedules – Concurrency Control – Types of Locks- Two Phases locking- Deadlock- Time stamp based concurrency control – Recovery Techniques – Concepts- Immediate Update- Deferred Update - Shadow Paging.

UNITV CURRENTTRENDS 9+ 3

Object Oriented Databases – Need for Complex Data types- OO data Model- Nested relations- Complex Types- Inheritance Reference Types - Distributed databases- Homogenous and Heterogeneous- Distributed data Storage.

TOTAL:60Hrs.

TEXTBOOKS:

1. AbrahamSilberschatz, HenryF. KorthandS. Sudarshan-“DatabaseSystemConcepts”, Fourth Edition, McGraw-Hill, 2002.

REFERENCES:

1. RamezElmasri and Shamkant B. Navathe,“Fundamental Database Systems”, Third Edition, Pearson Education, 2003.
2. RaghuRamakrishnan,“Database ManagementSystem”,TataMcGraw-HillPublishing Company, 2003.
3. Hector Garcia–Molina, JeffreyD.UllmanandJennifer Widom-“DatabaseSystem Implementation”- Pearson Education- 2000.
4. Peter Rob and Corlos Coronel- “DatabaseSystem, Design, Implementation and Management”, Thompson Learning Course Technology- Fifth edition, 2

CSE/SemII

22150H24P-DESIGNANDANALYSISOFALGORITHMS

AIM:

This course aims to introducethe classic and complexalgorithms in various domains, and techniques for designing and analyzing the efficient algorithms.

OBJECTIVES:

- Toprovethecorrectnessandanalyze therunningtimeofthebasicalgorithms
- Toapplythealgorithmsanddesigntechniquestosolveproblems.
- Toanalyzethecomplexitiesofvariousproblemsindifferentdomains.

UNITI BASICCONCEPTS OF ALGORITHMS 8+ 3

Introduction – Notion of Algorithm – Fundamentals of Algorithmic Solving – Important Problemtypes – Fundamentalsofthe Analysis Framework –Asymptotic Notationsand Basic Efficiency Classes.

UNITIIMATHEMATICALASPECTSANDANALYSISOFALGORITHMS 8+3

Mathematical Analysis of Non-recursive Algorithm – Mathematical Analysis of Recursive Algorithm – Example: Fibonacci Numbers – Empirical Analysis of Algorithms – Algorithm Visualization.

UNIT III ANALYSISOFSORTINGANDSEARCHINGALGORITHMS 10+ 3

Brute Force – Bubble Sort – SequentialSearch and Brute-force string matching – Divide and conquer – Merge sort – Quick Sort – Binary Search – Binary tree- Decrease and Conquer – Insertion Sort – Depth first Search and Breadth First Search.

UNITIV ALGORITHMICTECHNIQUES 10+ 3

Transform and conquer – Presorting – Balanced Search trees – AVL Trees – Heaps and Heap sort –Dynamic Programming – Warshall's and Floyd's Algorithm– OptimalBinary Search trees – GreedyTechniques – Prim's Algorithm– Kruskal's Algorithm – Dijkstra's Algorithm– Huffman trees.

UNITV ALGORITHMDESIGNMETHODS 9+ 3

Backtracking – n-Queen's Problem – Hamiltonian Circuit problem – Subset-Sumproblem – Branch and bound – Assignment problem – Knapsack problem – Travelingsalesman problem.

TOTAL:60Hrs.

TEXTBOOKS:

1. AnanyLevitin, "Introductionto theDesignand Analysis ofAlgorithm", PearsonEducation Asia, 2003.

REFERENCES:

1. T.H.Cormen, C.E. Leiserson, R.L. Rivest andC.Stein, "Introductionto Algorithms",PHI Pvt. Ltd., 2001
2. Sara Baase andAllen Van Gelder,"ComputerAlgorithms -Introduction to Designand Analysis", Pearson Education Asia, 2003.
3. A.V.Aho,J.E.HopcroftandJ.D.Ullman,"TheDesignandAnalysisOf ComputerAlgorithms", Pearson Education Asia, 2003.

22150H22P-PROGRAMMINGINC

OBJECTIVES:

TodevelopCProgramsusingbasicprogramming constructs

- TodevelopCprogramsusingarraysand strings
- TodevelopapplicationsinCusingfunctions,pointersand structures
- Todo input/output andfilehandlinginC

UNITI BASICSOFCPROGRAMMING 12

Introductiontoprogrammingparadigms-StructureofCprogram-Cprogramming:Data Types–Storage classes- Constants–Enumeration Constants-Keywords– Operators: Precedence and Associativity- Expressions- Input/output statements, Assignment statements–Decision making statements-Switch statement-Looping statements – Pre- processor directives- Compilation process

UNITII ARRAYS ANDSTRINGS 9+3

IntroductiontoArrays:Declaration,Initialization–Onedimensionalarray–ExampleProgram:ComputingMean,MedianandMode-Twodimensionalarrays –ExampleProgram:MatrixOperations(Addition,Scaling,Determinantand

Transpose)-Stringoperations:length,compare,concatenate,copy–Selection sort,linear and binary search

UNITIIIFUNCTIONSANDPOINTERS9+3

Introductiontofunctions: Function prototype,function definition, function call, Built-infunctions (stringfunctions,mathfunctions)–Recursion–ExampleProgram:Computation of Sineseries, Scientificcalculatorusingbuilt-infunctions,Binary Searchusingrecursivefunctions–Pointers– Pointer operators–Pointer arithmetic –Arrays and pointers – Array ofpointers –Example Program: Sorting of names–Parameter passing:Pass by value, Pass by reference ample Program: Swappingof two numbersand changing the value of a variable using pass by reference

UNITIV STRUCTURES 9+3

Structure-Nestedstructures–PointerandStructures–Arrayofstructures–ampleProgramusing structures and pointers–Self-referential structures–Dynamic memory allocation-Singly inked list- type def

UNITV FILEPROCESSING9+3

Files–Typesoffileprocessing:Sequentialaccess,Randomaccess–Sequentialaccessfile- Example Program: Findingaverageofnumbersstoredinsequentialaccessfile-Randomaccessfile-Example Program: Transaction processing using random access files – Command line arguments

TOTAL:60PERIODS

OUTCOMES:

Learnersshouldbeableto:

- Developsimpleapplications inCusingbasicconstructs
- Designandimplementapplicationsusingarraysandstrings
- Developand implementapplicationsinCusing functionsandpointers.
- DevelopapplicationsinCusingstructures.
- Designapplicationsusingsequentiallandrandomaccessfileprocessing.

TEXTBOOKS:

1. ReemaThareja,―ProgramminginC‖,OxfordUniversityPress,SecondEdition,2016.
2. Kernighan,B.WandRitchie,D.M,―TheCProgramming language‖,Second Edition, Pearson Education, 2006

REFERENCES:

1. PaulDeitelandHarveyDeitel, ―CHowtoProgram‖, Seventhedition, Pearson Publication
2. Juneja,B.LandAnitaSeth,―Programming inC‖,CENGAGELearningIndia pvt. Ltd., 2011
3. PradipDey,ManasGhosh,―FundamentalsofComputingandProgramminginC‖, First Edition,OxfordUniversityPress,2009
4. AnitaGoeland AjayMittal,―ComputerFundamentalsandProgramming inC‖, Dorling Kindersley(India) Pvt.Ltd., PearsonEducationinSouthAsia,2011.
5. ByronS.Gottfried, "Schaum'sOutlineofTheoryand Problemsof Programming with C",McGraw-HillEducation,1996.

CSE/SemIII

22148S31P-DISCRETEMATHEMATICS

AIM:

Thiscoursewilldeveloptheintuitionfordiscretemathematicsreasoninginvolvingnumbers and sets.

OBJECTIVES:

Oncompletingthecourse,studentsshouldbeableto

- Writeaclearstatement ofaproblemasatheoremin mathematicalnotation;
- Proveanddisproveassertionsusingavarietyoftechniques.
- UnderstandthelogicofPropositionalandpredicateformulasandtheir relationship toinformal reasoning, truth tables, validity.
- UnderstandtheProvingofpropositionalandpredicateformulasinastructuredway.
- Knowthebasicsettheory.Relations,graphs,and orders

UNITI PROPOSITIONALCALCULUS 10+ 3hrs

Propositions – Logical connectives – Compound propositions – Conditional and bi-conditional propositions – Truth tables – Tautologies and contradictions – Contrapositive – Logical equivalences and implications – DeMorgan’s Laws - Normal forms – Principal conjunctive and disjunctive normal forms – Rules of inference – Arguments - Validity of arguments.

UNITII PREDICATECALCULUS 9+ 3hrs

Predicates – Statement function – Variables – Free and bound variables – Quantifiers – Universe of discourse – Logical equivalences and implications for quantified statements – Theory of inference – The rules of universal specification and generalization – Validity of arguments.

UNITIII SETTHEORY 10+ 3hrs

Basic concepts – Notations – Subset – Algebra of sets – The power set – Ordered pairs andCartesian product – Relations on sets –Types of relations and their properties – Relational matrix and the graph of a relation – Partitions – Equivalencerelations – Partialordering – Poset – Hassediagram– Lattices and their properties – Sublattices – Boolean algebra – Homomorphism.

UNITIV FUNCTIONS 7+ 3hrs

Definitions of functions –Classificationoffunctions –Typeoffunctions -Examples –Compositionof functions – Inverse functions – Binary and n-ary operations – Characteristic function of a set – Hashing functions – Recursive functions – Permutation functions.

UNITV GROUPS 9+ 3hrs

Algebraicsystems – Definitions – Examples – Properties – Semigroups – Monoids – Homomorphism – Sub semigroups and Submonoids- Cosets and Lagrange's theorem – Codes and group codes– Basic notions of error correction - Error recovery in group codes.

TOTAL :60hrs

TEXT BOOKS:

1. TremblyJ.PandManohar R,"DiscreteMathematicalStructureswithApplicationstoComputer Science", Tata McGraw–Hill Pub. Co. Ltd, New Delhi, 2003.
2. Ralph.P.Grimaldi,"DiscreteandCombinatorialMathematics:AnAppliedIntroduction", Fourth Edition, Pearson Education Asia, Delhi, 2002.

REFERENCES:

1. BernardKolman,RobertC.Busby,SharanCutlerRoss,"DiscreteMathematicalStructures", Fourth Indian reprint, Pearson Education Pvt Ltd., New Delhi, 2003.

KennethH.Rosen, "DiscreteMathematicsanditsApplications", Fifth Edition,TataMcGraw–Hill Pub. Co. Ltd., New Delhi, 2003.

22150H32P-OPERATINGSYSTEM

AIM:

Tounderstandthefunctionsofanoperatingsystem.

OBJECTIVES:

- Tohaveanoverviewof differenttypesofoperatingsystems.
- Toknowthecomponentsofanoperatingsystem.
- Tohaveaknowledgeofprocess managementandstoragemanagement.
- ToknowtheconceptsofI/O andfilesystems.
- ToknowtheconceptsofDistributedOperatingSystem

UNITI 9

Introduction - Mainframe systems – Desktop Systems – Multiprocessor Systems –Distributed Systems – Clustered Systems – Real Time Systems – Handheld Systems - Hardware Protection - System Components – Operating System Services – System Calls – System Programs - Process Concept – Process Scheduling – Operations on Processes – Cooperating Processes – Inter-process Communication.

UNITII 9

Threads – Overview – Threading issues - CPU Scheduling – Basic Concepts – Scheduling Criteria – Scheduling Algorithms – Multiple-Processor Scheduling – Real Time Scheduling - The Critical-Section Problem– Synchronization Hardware – Semaphores – Classic problems of Synchronization – Critical regions – Monitors.

UNITIII 9

SystemModel – Deadlock Characterization – Methodsfor handling Deadlocks -Deadlock Prevention – Deadlock avoidance – Deadlock detection – Recovery from Deadlocks - Storage Management – Swapping – Contiguous Memory allocation – Paging – Segmentation – Segmentation with Paging.

UNITIV 9

Virtual Memory – Demand Paging – Process creation – Page Replacement – Allocation of frames – Thrashing - File Concept – Access Methods – Directory Structure – File System Mounting – File Sharing-Protection

UNITV 9

File System Structure – File System Implementation – Directory Implementation – Allocation Methods – Free-space Management. Kernel I/O Subsystems- Disk Structure – Disk Scheduling – Disk Management – Swap-Space Management. Case Study: The Linux System, Windows

TOTAL:45hrs

TEXTBOOK:

1. Abraham Silberschatz,PeterBaerGalvin and GregGagne,“Operating System Concepts”, Sixth Edition, John Wiley & Sons (ASIA) Pvt. Ltd, 2003.

REFERENCES:

1. HarveyM.Deitel,“OperatingSystems”,SecondEdition,PearsonEducationPvt.Ltd, 2002.
2. AndrewS.Tanenbaum,“ModernOperatingSystems”,PrenticeHallofIndia Pvt. Ltd,2003.
3. WilliamStallings,“OperatingSystem”,PrenticeHallofIndia,4th Edition, 2003.
4. Pramod Chandra P. Bhatt –“An Introduction to Operating Systems, Concepts and Practice”, PHI, 2003.

22150H33P-ARTIFICIALINTELLIGENCE

AIM:

Tocreategeneralunderstandingofmajorconceptsandapproachesinknowledge representation, planning, learning, robotics and other AI areas.

OBJECTIVES:

- TostudyvariouscomplexproblemsolvingAItoolslikeSearchandoptimization
- To facilitate of logic, Probabilisticmethods foruncertain reasoning,Classifiers and statistical learning methods, Neural networks, Control theory & Languages.
- TodevelopprogrammingskillsforAIapplications.
- Toprovideexposuretologicprogrammingwithpracticaltopics.

UNITI INTRODUCTION 8+ 3

IntelligentAgents–Agentsandenvironments-Goodbehavior– Thenature ofenvironments –structure of agents - Problem Solving - problem solving agents – example problems –searching for solutions – uniformed search strategies - avoiding repeated states – searching with partial information.

UNITII SEARCHINGTECHNIQUES 10+ 3

Informed search and exploration – Informed search strategies – heuristic function – local searchalgorithmsand optimistic problems – localsearch incontinuousspaces –online search agents and unknown environments - Structureof problems - Adversarial Search.

UNIT III KNOWLEDGE REPRESENTATION 10+ 3

First order logic – representation revisited – Syntax and semantics for first order logic– Using first order logic – Knowledge engineering in first order logic - Inference in First order logic – prepositional versus first order logic – unification and lifting – forward chaining – backward chaining - Resolution - Knowledge representation -Ontological Engineering - Categories and objects – Actions - Simulationand events - Mentalevents and mentalobjects.

UNIT IV LEARNING 9+ 3

Learningfromobservations-formsof learning-Inductivelearning-Learningdecision Trees - Ensemble learning - Knowledge in learning – Logical formulation of learning – Explanation based learning – Learning using relevant information – Inductive logic programming - Statistical learning methods - Learning with complete data - Learning with hidden variable .

UNITV APPLICATIONS 8+ 3

Communication – Communication as action – Formal grammar for a fragment ofEnglish – Syntactic analysis – Augmented grammars – Semantic interpretation – Ambiguity and disambiguation – Discourse understanding – Grammar induction .

TOTAL:60

TEXT BOOK:

1. StuartRussell,PeterNorvig,“ArtificialIntelligence–A ModernApproach”,2nd Edition, Pearson Education / Prentice Hall of India, 2004.

RE`FERENCES:

1. NilsJ.Nilsson,“ArtificialIntelligence:AnewSynthesis”,HarcourtAsiaPvt.Ltd.,2000.
2. ElaineRichandKevinKnight,“ArtificialIntelligence”,2ndEdition,TataMcGraw-Hill, 2003.

22150H34P-COMPUTERNETWORKS

AIM:

Tointroducetheconcepts, terminologiesandtechnologiesusedinmoderndaysdata communication and computer networking.

OBJECTIVES:

- Tounderstandtheconcepts ofdatacommunications.
- Tostudythefunctionsofdifferent layers.
- TointroduceIEEEstandardsemployedincomputernetworking.
- Tomakethestudentstogetfamiliarizedwithdifferentprotocolsandnetworkcomponents.

UNITIDATA COMMUNICATIONS 9

Components – Direction of Data flow – networks – Components and Categories – types of Connections – Topologies –Protocols and Standards – ISO / OSI model – TransmissionMedia – Coaxial Cable – Fiber Optics – Line Coding – Modems – RS232 Interfacing sequences.

UNITIIDATALINKLAYER 9

Error – detection and correction – Parity – LRC – CRC – Hamming code – low Control and Error control - stop and wait – go back-N ARQ – selective repeat ARQ- sliding window – HDLC.-LAN-EthernetIEEE802.3-IEEE802.4-IEEE802.5-IEEE802.11– FDDI-SONET–Bridges.

UNITIIINETWORKLAYER 9

Internetworks–PacketSwitching and Datagram approach –IP addressingmethods– Subnetting – Routing – Distance Vector Routing – Link State Routing – Routers.

UNITIVTRANSPORTLAYER 9

Dutiesoftransportlayer –Multiplexing–Demultiplexing–Sockets–User DatagramProtocol(UDP) – Transmission Control Protocol (TCP) – Congestion Control – Quality of services (QOS) – IntegratedServices.

UNITVAPPLICATIONLAYER 9

DomainNameSpace(DNS)–SMTP–FTP–HTTP-WWW–Security–Cryptography.

TOTAL:45hrs

TEXT BOOK:

1. BehrouzA.Forouzan,“DatacommunicationandNetworking”,TataMcGraw-Hill,2004.

REFERENCES:

JamesF. KuroseandKeithW. Ross,“Computer Networking: ATop-DownApproachFeaturingthe Internet”, Pearson Education, 2003.
LarryL.PetersonandPeterS.Davie,“ComputerNetworks”, HarcourtAsiaPvt.Ltd.,SecondEdition.
Andrew S. Tanenbaum, “Computer Networks”, PHI, Fourth Edition, 2003.
WilliamStallings,“DataandComputerCommunication”,SixthEdition,PearsonEducation, 2000.

CSE/SemIII

22150L35P-OPERATINGSYSTEMSANDNETWORKINGLAB

LISTOFEXERCISE:

OPERATINGSYSTEMS:

(ImplementthefollowingonLINUXplatform.UseCforhighlevellanguageimplementation)

1. Shellprogramming
   - commandsyntax
   - writesimplefunctions
   - basictests

2. Shellprogramming
   - loops
   - patterns
   - expansions
   - substitutions

3. Writeprogramsusingthefollowingsystemcalls ofUNIXoperatingsystem: fork, exec, getpid, exit, wait, close, stat, opendir, readdir

4. Writeprograms usingtheI/Osystemcallsof UNIX operatingsystem(open, read, write, etc)

5. WriteCprogramstosimulateUNIXcommandslikels,grep,etc.

6. Implementsomememorymanagementschemes

NETWORKING:

1. SimulationofARP/RARP.
2. Writea programthat takes a binary fileas input andperforms bit stuffingand CRC Computation.
3. SimulationofSliding-Windowprotocol.
4. DevelopaClient–Serverapplicationforchat.
5. DevelopaClientthatcontactsagivenDNSServertoresolveagivenhost name.
6. WriteaClienttodownloadafilefromaHTTPServer.

22150H41P-SOFTWAREENGINEERINGFUNDAMENTALS

AIM:-

Tomakethestudents understandthemethodologiesinpreparingasoftware.

OBJECTIVES:

- Toknowthegenericmodelstostructurethesoftwaredevelopmentprocess.
- Tounderstanddifferentnotionofcomplexityatboththemoduleandsystemlevel.
- Tobeawareofsomewidely knowndesign methods.
- Tounderstandtheroleandcontentsoftestingactivitiesindifferentlifecyclephases.

UNITI SOFTWAREPROCESS 9

Introduction –S/W Engineering Paradigm – life cycle models (water fall, incremental,spiral, WINWIN spiral, evolutionary, prototyping, object oriented) - system engineering – computer based system – verification – validation – life cycle process – development process –system engineering hierarchy.

UNITII SOFTWAREREQUIREMENTS 9

Functionalandnon-functional- user –system–requirement engineeringprocess –feasibilitystudies – requirements – elicitation – validation and management – software prototyping – prototyping in the softwareprocess –rapidprototypingtechniques –user interfaceprototyping-S/Wdocument. Analysis and modeling – data, functional and behavioral models – structured analysis and data dictionary.

UNITIII DESIGNCONCEPTSANDPRINCIPLES 9

Design process and concepts – modular design – design heuristic – design model and document. Architectural design – software architecture – data design – architectural design – transform and transaction mapping – user interface design – user interface design principles. Real time systems- Real time software design – system design – real time executives – data acquisition system - monitoring and control system. SCM – Need for SCM – Version control – Introduction to SCM process – Software configuration items.

UNITIV TESTING 9

Taxonomy of softwaretesting – levels – test activities – types of s/wtest – black box testing – testing boundary conditions – structural testing – test coverage criteria based on data flow mechanisms – regression testing – testing in the large. S/W testing strategies – strategic approach and issues - unit testing – integration testing – validation testing – systemtesting and debugging.

UNITV SOFTWAREPROJECTMANAGEMENT 9

Measures and measurements – S/W complexity and science measure – size measure – data and logic structure measure – information flow measure. Software cost estimation – function point models – COCOMO model- Delphimethod.- Defining a Task Network – Scheduling – Earned Value Analysis– Error Tracking - Software changes – program evolution dynamics – software maintenance – Architectural evolution. Taxonomy of CASE tools.

TOTAL:45hrs

TEXTBOOK:

1. RogerS.Pressman,Software engineering- A practitioner'sApproach,McGraw-Hill International Edition, 5th edition, 2001.

REFERENCES:

1. IanSommerville,Softwareengineering,PearsoneducationAsia,6thedition,2000.
2. PankajJalote-AnIntegratedApproachtoSoftwareEngineering,SpringerVerlag,1997.
3. JamesFPetersandWitoldPedryez,"SoftwareEngineering–AnEngineeringApproach", John Wiley and Sons, New Delhi, 2000.
4. Ali Behforooz and Frederick J Hudson, "Software Engineering Fundamentals", Oxford University Press, New Delhi, 1996.

CSE/SemIV

22150H42P-INTERNET PROGRAMMING

OBJECTIVES:

- TounderstanddifferentInternetTechnologies.
- Tolearnjava-specificwebservicesarchitectureTodesignacontextfreegrammar for any given language

UNITI WEBSITEBASICS,HTML5,CSS3,WEB 2.0 9

WebEssentials:Clients,ServersandCommunication–TheInternet–BasicInternet

protocols – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML5 – Tables – Lists – Image – HTML5 control elements – Semantic elements – Drag and Drop – Audio – Video controls - CSS3 – Inline, embedded and externalstyle sheets – Rule cascading – Inheritance – Backgrounds – BorderImages – Colors – Shadows – Text – Transformations – Transitions – Animations.

UNITII CLIENTSIDEPROGRAMMING 9

Java Script: An introduction to JavaScript–JavaScript DOM Model-Date andObjects,-RegularExpressions- Exception Handling-Validation-Built-in objects-Event Handling-DHTML with JavaScript- JSON introduction – Syntax – Function Files – Http Request – SQL.

UNITIIISERVERSIDE PROGRAMMING 9

Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions-SessionHandling- Understanding Cookies- Installing and Configuring Apache Tomcat Web Server-DATABASECONNECTIVITY:JDBCperspectives,JDBCprogramexample -JSP: Understanding Java Server Pages-JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code.

UNITIVPHPand XML 9

An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions-Form Validation- Regular Expressions - File handling – Cookies - Connecting to Database. XML:BasicXML-DocumentTypeDefinition-XMLSchemaDOMandPresentingXML, XMLParsersandValidation,XSLandXSLT Transformation,NewsFeed(RSSand ATOM).

UNITVINTRODUCTION TOAJAXand WEBSERVICES 9

AJAX:AjaxClient ServerArchitecture-XMLHttpRequest Object-CallBackMethods;Web Services: Introduction- Java web services Basics – Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service, DatabaseDrivenweb service from an application –SOAP.

TOTAL:45PERIODS

OUTCOMES:

At theendofthecourse,thestudentshouldbeableto:

- Construct abasicwebsiteusingHTMLandCascadingStyleSheets.
- Builddynamicwebpagewithvalidationusing JavaScript objectsandbyapplying different event handling mechanisms.
- DevelopserversideprogramsusingServletsandJSP.
- Constructsimplewebpages inPHP andtorepresentdatainXMLformat.
- UseAJAXandwebservicestodevelopinteractivewebapplications Derivewhether a problem is decidable or not.

TEXTBOOKS:

1. JDeitelandDeitelandNieto,―InternetandWorldWide Web- Howto Program‖, Prentice Hall, 5th Edition, 2011.

REFERENCES:

1. StephenWynkoopandJohnBurke―RunningaPerfectWebsite‖,QUE,2nd Edition,1999.
2. ChrisBates,WebProgramming–BuildingIntranetApplications,3rdEdition,Wiley Publications, 2009.
3. JeffreyCandJackson,―WebTechnologiesAComputerSciencePerspective‖ Pearson Education, 2011.
4. GopalanN.P.andAkilandeswariJ.,WebTechnology‖,PrenticeHallofIndia,2011.
5. UttamK.Roy,―WebTechnologies‖,OxfordUniversityPress,2011.

22150H43P-C#AND.NETFRAMEWORK

AIM:

Thegoalofthis courseis toprovidestudents withtheknowledgeandskills they needto develop C# applications for the Microsoft .NET Platform.

OBJECTIVES:

- AnabilitytounderstandC#programstructure, languagesyntax, andimplementation details.
- AnabilitytodevelopapplicationusingC#on.NETframe work.

UNITI INTRODUCTIONTOC# 8+3

Introducing C#, Understanding .NET, Overview of C#, Literals, Variables, Data Types, Operators, Expressions, Branching, Looping, Methods, Arrays, Strings, Structures, Enumerations.

UNITII OBJECTORIENTEDASPECTSOFC# 9+3

Classes, Objects, Inheritance, Polymorphism, Interfaces, Operator Overloading, Delegates, Events, Errors and Exceptions.

UNITIIIAPPLICATIONDEVELOPMENTON.NET 8+3

BuildingWindowsApplications,AccessingDatawithADO.NET.

UNITIVWEBBASEDAPPLICATIONDEVELOPMENTON.NET 8+3

ProgrammingWebApplicationswithWebForms,ProgrammingWebServices.

UNITV THECLRANDTHE.NET FRAMEWORK 12+3

Assemblies, Versioning, Attributes, Reflection, Viewing Meta Data,Type Discovery, Reflecting on a Type, Marshaling, Remoting, Understanding Server Object Types, Specifying a Server with an Interface, Building a Server, Building the Client, Using Single Call, Threads.

TOTAL :60hrs

TEXTBOOKS:

1. E.Balagurusamy,“ProgramminginC#”,TataMcGraw-Hill,2004.(UnitI,II)
2. J.Liberty,“ProgrammingC#”,2nd ed.,O’Reilly,2002.(UnitIII,IV,V)

REFERENCES:

1. HerbertSchildt,“TheCompleteReference:C#”,TataMcGraw-Hill,2004.
2. Robinsonetal, “ProfessionalC#”,2nd ed.,WroxPress,2002.
3. AndrewTroelsen,“C#andthe.NETPlatform”,A!Press,2003.
4. S.ThamaraiSelvi, R.Murugesan,“ATextbookonC#”,PearsonEducation, 2003.

22150L45P-INTERNETPROGRAMMINGLAB

1. Write programs in Java to demonstrate the use of following components Text fields,buttons, Scrollbar, Choice, List and Check box
2. WriteJava programs to demonstratetheuseofvarious Layouts like FlowLayout, BorderLayout, Gridlayout, Gridbaglayout andcard layout
3. WriteprogramsinJavatocreateappletsincorporatingthefollowing features:
4. Createacolor palettewithmatrixofbuttons
    - i) Set background and foreground of thecontrol text area by selecting a color fromcolor palette.
    - ii) Inorder toselectForegroundorbackgroundusecheck box control as radiobuttons
    - iii) Tosetbackgroundimages
5. WriteprogramsinJavatodothefollowing.
    - i) SettheURLofanother server.
    - ii) Downloadthehomepageoftheserver.
    - iii) Display the contents of home page with date, content type,and Expiration date.Lastmodifiedandlengthofthe homepage.
6. WriteprogramsinJavausingsocketstoimplementthefollowing:
    - i) HTTPrequest
    - ii) FTP
    - iii) SMTP
    - iv) POP3
7. Writea programinJava for creatingsimplechat applicationwith datagram sockets anddatagram packets.
8. Createaweb pagewiththefollowingusingHTML
    - i) Toembedamapinawebpage
    - ii) Tofixthehot spotsinthatmap
    - iii) Showalltherelatedinformationwhenthehotspots areclicked.
9. Create awebpage withthefollowing.
    - i) Cascadingstylesheets.
    - ii) Embeddedstylesheets.
    - iii) Inlinestylesheets.
    - iv) Useourcollegeinformationfor theweb pages.

22150H51P-OBJECTORIENTEDANALYSISANDDESIGN

AIM:

Studyandlearntheanalysis techniquesand methodologies.

OBJECTIVES:

- Tostudytheconceptsofmodelinginobjectorientedcontext.
- TolearnabouttheObjectConstraintLanguage.
- TostudytheUsecases, InteractionDiagrams, ClassDiagramsandSystemSequence Diagrams.
- Tostudyimplementationrelatedissues.
- TostudyandlearnhowtoapplyadvancedtechniquesincludingArchitecturalAnalysis and Design Patterns.

UNITI INTRODUCTION 8

An Overview of Object Oriented Systems Development - Object Basics – Object Oriented SystemsDevelopment Life Cycle.

UNITII OBJECTORIENTEDMETHODOLOGIES 12

Rumbaugh Methodology - Booch Methodology - Jacobson Methodology - Patterns – Frameworks – Unified Approach – Unified Modeling Language – Use case - class diagram - Interactive Diagram - Package Diagram - Collaboration Diagram - State Diagram - Activity Diagram.

UNIT III OBJECTORIENTEDANALYSIS 9

Identifyingusecases-Object Analysis-Classification–IdentifyingObject relationships-Attributes and Methods.

UNITIV OBJECTORIENTEDDESIGN 8

Designaxioms-DesigningClasses–AccessLayer-ObjectStorage-Object Interoperability.

UNITV SOFTWAREQUALITYANDUSABILITY 8

Designing Interface Objects – Software Quality Assurance – System Usability - MeasuringUser Satisfaction

TOTAL:45hrs

TEXTBOOKS:

1. AliBahrami, “Object OrientedSystems Development”, Tata McGraw-Hill, 1999 (Unit I, III, IV, V).
2. MartinFowler,“UMLDistilled”,SecondEdition,PHI/PearsonEducation,2002.(UNITII)

REFERENCES:

1. StephenR. Schach, "IntroductiontoObject OrientedAnalysis andDesign", TataMcGraw-Hill, 2003.
2. James Rumbaugh, Ivar Jacobson, Grady Booch "The Unified Modeling LanguageReference Manual", Addison Wesley, 1999.
3. Hans-ErikEriksson, Magnus Penker, BrainLyons, DavidFado, "UML Toolkit", OMG Press Wiley Publishing Inc., 2004.

22150H52P-SOFTWAREQUALITYMANAGEMENT

AIM:-

Tointroduceanintegratedapproachtosoftwaredevelopment incorporatingquality management methodologies.

OBJECTIVES:

- Softwarequalitymodels.
- Qualitymeasurementandmetrics.
- Qualityplan,implementationanddocumentation.
- QualitytoolsincludingCASEtools.
- Qualitycontrolandreliabilityofqualityprocess.
- Qualitymanagementsystemmodels.
- ComplexitymetricsandCustomer Satisfaction.
- Internationalqualitystandards–ISO,CMM.

UNITI INTRODUCTIONTOSOFTWAREQUALITY 9+3

SoftwareQuality–HierarchicalmodelsofBoehmandMcCall–Qualitymeasurement– Metrics measurement and analysis – Gilb's approach – GQM Model

UNITII SOFTWAREQUALITYASSURANCE 9+3

Quality tasks – SQAplan– Teams – Characteristics – Implementation – Documentation– Reviews and Audits

UNIT III QUALITYCONTROLANDRELIABILITY 9+3

Tools for Quality– Ishikawa's basic tools – CASE tools – Defect preventionandremoval – Reliability models – Rayleigh model – Reliability growth models for quality assessment

UNITIV QUALITYMANAGEMENTSYSTEM 9+3

Elements of QMS – Rayleigh modelframework– Reliability Growth models for QMS –Complexity metrics and models – Customer satisfaction analysis.

UNITV QUALITYSTANDARDS 9+3

Need for standards – ISO 9000 Series – ISO 9000-3 for softwaredevelopment – CMM andCMMI – Six Sigma concepts.

TOTAL :60hrs

TEXTBOOKS:

1. AllanC.Gillies,“SoftwareQuality:TheoryandManagement”,ThomsonLearning,2003.(UI :Ch1-4;UV:Ch7-8)
2. Stephen H. Kan, “Metrics and Models in Software Quality Engineering”, Pearson Education (Singapore) PteLtd., 2002. (UI : Ch 3-4; UIII : Ch 5-8 ; UIV: Ch 9-11)

REFERENCES:

1. NormanE.FentonandShariLawrencePfleeger, “SoftwareMetrics”Thomson,2003
2. MordechaiBen –Menachem and Garry S.Marliss,“Software Quality”,ThomsonAsiaPte Ltd, 2003.
3. MaryBethChrissis,MikeKonradandSandyShrum,“CMMI”,PearsonEducation (Singapore) Pte Ltd, 2003.
4. ISO9000-3“NotesfortheapplicationoftheISO9001Standardtosoftwaredevelopment”.

CSE/SemV

22150H53P-GRAPHICSANDMULTIMEDIA

AIM:

Provideanopportunityforstudentstorepresent,designand implement two dimensionaland threedimensionalobjectsand introducing different mediaused in multimedia systems.

.

OBJECTIVES:

- Explaintwoandthreedimensionalconceptsandtheirapplications.
- Identifyalltechniquesrelatedtomoderngraphicsprogrammingconcepts.
- Identifythe media usedin multimedia systems andto assess their relativeadvantages and disadvantages relative to both user and system points of view.
- Explain the interaction problemsintroduced bymultimedia(e.g.,compression and synchronization).

UNITI OUTPUTPRIMITIVES 9+3

Introduction-Line -Curve and Ellipse DrawingAlgorithms–Attributes–Two-Dimensional Geometric Transformations – Two-Dimensional Clipping and Viewing.

UNITII THREE-DIMENSIONALCONCEPTS 9+3

Three-Dimensional Object Representations – Three-Dimensional Geometric and Modeling Transformations – Three-Dimensional Viewing – Color models – Animation.

UNITIIIMULTIMEDIASYSTEMSDESIGN 9+3

An Introduction – Multimedia applications – Multimedia System Architecture –Evolving technologies for Multimedia – Defining objects for Multimedia systems – Multimedia Data interface standards – Multimedia Databases.

UNITIVMULTIMEDIAFILEHANDLING 9+3

Compression & Decompression – Data & File Format standards – Multimedia I/O technologies - Digital voice and audio – Video image and animation – Full motion video – Storage and retrieval Technologies.

UNITVHYPERMEDIA 9+3

Multimedia Authoring & User Interface – Hypermedia messaging - Mobile Messaging – Hypermedia message component – Creating Hypermedia message – Integrated multimedia message standards – Integrated Document management – Distributed Multimedia Systems.

TOTAL:60hrs

TEXTBOOKS:

1. Donald Hearn and M.Pauline Baker,“ComputerGraphicsCVersion”,Pearson Education, 2003. (UNIT I : Chapters 1 to 6;UNIT 2: Chapter 9 – 12, 15, 16)
2. PrabatKAndleighand KiranThakrar, “Multimedia Systems and Design”,PHI, 2003. (UNIT 3 to 5)

REFERENCES:

1. JudithJeffcoate,"MultimediainpracticetechnologyandApplications", PHI,1998.
2. Foley,Vandam,Feiner,Huges,"ComputerGraphics: Principles&Practice",Pearson Education, second edition 2003.

22150L55P-SOFTWAREDEVELOPMENTLAB

IMPLEMENTATIONOFPROJECTUSINGSOFTWAREENGINEERINGTECHNIQUES:

1. PROJECTPLANNING
2. SOFTWAREREQUIREMENTANALYSIS
3. DATAMODELLING&IMPLEMENTATION
4. SOFTWARETESTING
5. SOFTWAREDEBUGGING

LISTOFEXPERIMENTS

DevelopthefollowingsoftwareusingsoftwareEngineering methodology:

1. OnlineRailwayreservationsystem
2. Simulatorsoftwareforparallelprocessingoperation
3. Payrollprocessingapplication
4. Inventorysystem
5. Simulatorsoftwareforcompileroperation
6. AutomatingtheBankingprocess
7. Softwareforgame
8. Librarymanagementsystem
9. Text editor
10. Createadictionary
11. Telephonedirectory
12. CreateanE-Bookofyourchoice.

CSE/SemVI

22150S61P-CRYPTOGRAPHYAND NETWORKSECURITY

OBJECTIVES:

- TounderstandCryptographyTheories,AlgorithmsandSystems.
- TounderstandnecessaryApproachesandTechniquestobuildprotectionmechanisms in order to secure computer networks..

9

UNITI INTRODUCTION

Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, SecurityPolicies - Modelofnetworksecurity– Securityattacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques,transpositiontechniques,steganography-Foundationsofmoderncryptography: perfectsecurity–informationtheory–productcryptosystem–cryptanalysis.

UNITIISYMMETRICKEYCRYPTOGRAPHY 9

MATHEMATICS OF SYMMETRIC KEY CRYPTOGRAPHY: Algebraic structures - Modular arithmetic-Euclid‟s algorithm- Congruence and matrices - Groups, Rings, Fields- Finite fields- SYMMETRIC KEY CIPHERS: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis - Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard - RC4 – Key distribution.

UNIT III PUBLICKEYCRYPTOGRAPHY 9

MATHEMATICSOFASYMMETRICKEYCRYPTOGRAPHY:Primes–Primality Testing – Factorization – Euler‗s totient function, Fermat‗s and Euler‗s Theorem - Chinese Remainder Theorem–Exponentiationandlogarithm-ASYMMETRICKEY CIPHERS:RSA cryptosystem –Key distribution–Keymanagement–DiffieHellman key exchange - ElGamal cryptosystem – Elliptic curve arithmetic-Ellipticcurvecryptography.

UNITIVMESSAGEAUTHENTICATION ANDINTEGRITY 9

Authentication requirement – Authentication function – MAC – Hash function – Security of hashfunctionand MAC – SHA–Digitalsignatureand authenticationprotocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications - Kerberos, X.509

UNITV SECURITYPRACTICEANDSYSTEMSECURITY 9

ElectronicMail security – PGP,S/MIME – IP security – Web Security -SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.

TOTAL:45PERIODS

OUTCOMES:

Attheendofthecourse,thestudentshould beableto:

- Understandthefundamentalsofnetworkssecurity,security architecture, threats and vulnerabilities
- Apply thedifferentcryptographicoperationsof symmetriccryptographic algorithms
- Applythedifferentcryptographicoperationsofpublickeycryptography
- Apply the various Authentication schemes to simulate different applications.
- UnderstandvariousSecuritypracticesand Systemsecuritystandards

TEXTBOOKS:

1. WilliamStallings,CryptographyandNetworkSecurity:PrinciplesandPractice,PHI 3rd Edition, 2006.

REFERENCES:

1. CKShyamala, NHariniandDr. TRPadmanabhan:CryptographyandNetwork Security, Wiley India Pvt.Ltd
2. BehrouzA.Foruzan,CryptographyandNetworkSecurity,TataMcGrawHill2007.
3. CharlieKaufman,RadiaPerlman,andMikeSpeciner,NetworkSecurity:PRIVATE CommunicationinaPUBLIC World,PrenticeHall,ISBN0-13-046019-2

22150H62P-ADVANCEDJAVAPROGRAMMING

AIM:

Toexplore, advancedJava languagefeaturesandpackages.

OBJECTIVES:

- UseJavatoimplementOOAD.
- tohaveindepthknowledgeaboutObjectserialization, reflection,RMI,Swing,JARfiles.
- anabilitytoWriteServletsandJavaServerPages.
- Gainanin-depthunderstandingofdatabaseprogramminginJavausingJDBC.
- LearnJava'ssecuritymodelandhowto dosecurityprogramminginJava.

UNITI JAVAFUNDAMENTALS 9+3

Java I/O streaming – filter and pipe streams – Byte Code interpretation -reflection– Dynamic Reflexive Classes – Threading – Java Native Interfaces- Swing.

UNITII NETWORKPROGRAMMINGINJAVA 9+3

Sockets – secure sockets – custom sockets – UDP datagrams – multicast sockets – URL classes – Reading Data from the server – writing data – configuring the connection – Reading the header– telnet application – Java Messaging services

UNITIII APPLICATIONSINDISTRIBUTEDENVIRONMENT 9+3

Remote method Invocation – activation models – RMI customsockets – ObjectSerialization – RMI – IIOP implementation – CORBA – IDL technology – Naming Services – CORBA programming Models - JAR file creation

UNITIV MULTI-TIERAPPLICATIONDEVELOPMENT 9+3

Server side programming – servlets – Java Server Pages - Applet to Applet communication – applet to Servlet communication - JDBC – Using BLOB and CLOB objects – storing Multimedia data into databases – Multimedia streaming applications – Java Media Framework.

UNITV ENTERPRISEAPPLICATIONS 9+3

Server Side Component Architecture – Introductionto J2EE – SessionBeans – EntityBeans – Persistent Entity Beans – Transactions.

TOTAL:60hrs

TEXTBOOKS:

1. ElliotteRustyHarold, “JavaNetworkProgramming”, O’Reillypublishers, 2000 (UNIT II)
2. EdRoman, “MasteringEnterpriseJava Beans”, JohnWiley& Sons Inc., 1999.(UNIT IIIand UNIT V)

3. Hortsmann& Cornell,"CORE JAVA 2ADVANCEDFEATURES,VOL II",Pearson Education, 2002. (UNIT I and UNIT IV)

REFERENCES:

1. Webreference: http://java.sun.com.
2. PatrickNaughton,"COMPLETEREFERENCE:JAVA2",TataMcGraw-Hill,2003.

CSE/SemVI

AIM:

22150H63P-SOFTWARE TESTING

Itexplains howtoreview, testandmanagetest requirementsandhowtoincorporatetesting into the software development life cycle.

OBJECTIVES:

- Todeterminesoftwaretestingobjectivesandcriteria.
- Todevelopandvalidateatestplan.
- Toselectandpreparetestcases.
- Toidentifytheneedfortesting.
- Topreparetestingpolicies andstandards.
- Tousetestingaidsandtools.
- Totestbeforebuyinga softwarepackageandTestafter maintenanceandenhancement changes.
- Tomeasurethesuccessoftestingefforts.

UNITIINTRODUCTION 9

Testing as an Engineering Activity – Role of Process in Software Quality – Testing as aProcess – Basic Definitions – Software Testing Principles – The Tester's Role in aSoftware Development Organization – Origins of Defects – Defect Classes –TheDefectRepositoryandTest Design – Defect Examples – Developer/Tester Support for Developing a Defect Repository.

UNITIITESTCASE DESIGN 9

Introduction to Testing Design Strategies – The Smarter Tester – Test Case DesignStrategies – Using Black Box Approach to Test Case Design Random Testing –Requirements based testing –positive and negative testing -— Boundary ValueAnalysis – decision tables - Equivalence Class Partitioning state-based testing– causeeffect graphing – error guessing - compatibility testing – user documentation testing –domain testing Using White–Box Approach to Test design – Test Adequacy Criteria –static testing vs. structural testing – code functional testing - Coverage and Control Flow Graphs – Covering Code Logic – Paths – Their Role in White–box Based Test Design –code complexity testing – Evaluating Test Adequacy Criteria.

UNITIIILEVELSOFTESTING 9

TheNeed for Levels of Testing – Unit Test – Unit Test Planning –Designingthe Unit Tests. TheTest Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – scenario testing –defect bash elimination -System Testing – types of system testing - Acceptance testing –performance testing - Regression Testing– internationalization testing – ad-hoc testing -Alpha – Beta Tests – testing OO systems – usability and accessibility testing

UNITIVTESTMANAGEMENT 9

Peopleandorganizationalissuesintesting–organizationstructuresfor testingteams–testingservices - Test Planning – Test Plan Components – Test Plan Attachments –role of three groups in Test PlanningandPolicyDevelopment –Introducingthetest specialist –Skills neededbya testspecialist – Building a Testing Group.

UNITVCONTROLLINGANDMONITORING9

Software test automation – skills needed for automation – scope of automation – design and architecturefor automation – requirements for a test tool– challenges inautomation- Test metrics and measurements –project, progress and productivity metrics – Status Meetings – Reports and Control Issues – Criteria for Test Completion – SCM – Types of reviews – Developing a review program – Components of Review Plans– Reporting Review Results. – evaluating software quality – defect prevention – testing maturity model

TOTAL:45hrs

TEXTBOOKS:

1. SrinivasanDesikanandGopalaswamyRamesh,“SoftwareTesting–Principlesand Practices”, Pearson education, 2006.
2. AdityaP.Mathur,“FoundationsofSoftwareTesting”,PearsonEducation,2008.

REFERENCES:

1. BorisBeizer,“SoftwareTestingTechniques”,SecondEdition,Dreamtech,2003
2. ElfriedeDustin,“EffectiveSoftwareTesting”,FirstEdition,PearsonEducation, 2003.
3. RenuRajani,PradeepOak,“SoftwareTesting–EffectiveMethods,Toolsand Techniques”, Tata McGraw Hill, 2004.

CSE/SemVI

22150L65P-JAVAPROGRAMMINGLAB

LISTOFPRACTICALS

AIM:

TolearnandPracticethebasicsof JAVAlanguage

OBJECTIVES:

1. Tolearn&practicetheObjectOrientedconceptslikeInheritance,Overloadingetc.
2. Tolearn&practiceInterfacesandPackages
3. Tolearn&practiceJavaappletprogramming

JAVA BASICS

1. Programsillustratingvariousdatatypesin Java
2. Programsillustratingclass,objectsandmethods
3. ProgramsforadditionandmultiplicationofMatrices

4. ProgramsillustratingOverloadinginJava
5. ProgramsillustratingtheimplementationofVariousformsofInheritance(Single, Hierarchical, Multilevel)
6. ProgramsillustratingOverridingmethodsinJava
7. ProgramsillustratingExceptionHandling
8. Programstomanipulatestrings

JAVAINTERFACES,PACKAGESandTHREADS

9. ProgramsillustratingInterfacesinJava
10. ProgramstocreatePackagesinJava
11. ProgramsillustratingThreadsinJava

JAVA APPLETS

12. Programstowriteapplets todrawthevariousshapes
13. Programstomanipulatelabels,lists,textfieldsandpanels

22150S71P-TOTALQUALITYMANAGEMENT

AIM:

LearningvariousTQMtechniques totackleandanalyzeproblems inimprovingqualitywith particular reference to their own working environment.

OBJECTIVE:

- Developtheabilitytoadoptnewtechniquesandsynthesizenewknowledge.
- AnalyzebasicoperationalandresearchdatausingTQMtechniquesinasystematicway.
- Cooperate efficiently and effectively in a team to apply TQM techniques and tools for accomplishing pre-determined goals.
- Identify opportunities for improvement in the business, service, administrative and manufacturing environments of applying the methodology such as Six Sigma, Kaizen, and other appropriate tools to achieve breakthrough improvements in these processes.

UNITI FUNDAMENTALS 9

Definition of quality – Dimensions of quality – Quality planning – Quality costs–Analysis techniques for quality costs – Basic concepts of total quality management –Historical review – Principles of TQM – Leadership – Concepts – Role of seniormanagement – Quality council – Quality statements – Strategic planning – Deming philosophy – Barriers toTQM implementation.

UNITII TQMPRINCIPLES 9

Customer Satisfaction – Customer Perception of Quality – Customer Complaints –Service Quality – Customer Retention – Employee Involvement – Motivation –Empowerment – Teams – Recognition andReward–PerformanceAppraisal–Benefits–ContinuousProcessImprovement–JuranTrilogy –PDSACycle–5S–Kaizen–SupplierPartnership–Partnering–Sourcing–SupplierSelection –SupplierRating–RelationshipDevelopment–PerformanceMeasures–BasicConcepts–Strategy –PerformanceMeasure.

UNITIII STATISTICALPROCESSCONTROL(SPC) 9

The Seven Tools of Quality – Statistical Fundamentals – Measures of Central Tendency and dispersion – Population and Sample – Normal Curve – Control Charts for Variables and Attributes – Process Capability – Concept of Six Sigma – New Seven Management Tools.

Benchmarking − Reasons to Benchmark − Benchmarking Process − Quality Function Deployment (QFD) − House of Quality − QFD Process − Benefits − Taguchi Quality Loss Function − Total Productive Maintenance (TPM) − Concept − Improvement Needs − FMEA − Stages of FMEA.

UNITVQUALITYSYSTEMS 9

Need for ISO 9000 and Other Quality Systems − ISO 9000:2000 Quality System – Elements − Implementation of Quality System−Documentation−Quality Auditing−TS 16949−ISO 14000 – Concept−Requirements and Benefits.

Total:45hrs

TEXT BOOK:

1. BesterfiledetalD.H.,"TotalQualityManagement",PearsonEducation, Inc.2003.

REFERENCES:

1. Evans, J.R.andLidsay, W. M.,"TheManagementandControlofQuality", 5thEdition, South-Western (Thomson Learning), 2002
2. Feigenbaum,A.V.,"TotalQualityManagement",McGraw-Hill,1991.
3. Oakland,J.S.,"TotalQualityManagement",3rdEdition,Elsevier,2005.
4. Narayana,V.andSreenivasan, N.S.,"QualityManagement -ConceptsandTasks", NewAge International, 1996.
5. Zeiri,"TotalQualityManagementfor Engineers",WoodHeadPublishers,1991.

22150H72P-GRIDANDCLOUDCOMPUTING

OBJECTIVES:

Thestudentshouldbemadeto:

- UnderstandhowGridcomputinghelpsinsolvinglargescalescientificproblems.
- Gainknowledgeontheconceptofvirtualizationthat is fundamentalto cloud computing.
- Learnhowtoprogramthe grid andthecloud.
- Understandthesecurityissues inthegridandthecloud environment.

UNITI INTRODUCTION 9

EvolutionofDistributedcomputing:ScalablecomputingovertheInternet–Technologiesfor networkbased systems – clusters ofcooperative computers - Grid computing Infrastructures – cloud computing - service oriented architecture – Introduction to Grid Architecture and standards – Elements ofGrid – Overview ofGrid Architecture.

UNITIIGRIDSERVICES 9

Introduction to Open Grid Services Architecture (OGSA) – Motivation – Functionality Requirements–Practical&DetailedviewofOGSA/OGSI –Dataintensivegridservice models – OGSA services.

UNITIIIVIRTUALIZATION 9

Clouddeployment models:public, private, hybrid, community –Categoriesofcloudcomputing:Everything asaservice:Infrastructure, platform, software - ProsandConsofcloud computing –Implementation levelsof virtualization – virtualization structure – virtualizationofCPU, Memory and I/O devices – virtualclusters and Resource Management – Virtualization for data center automation.

UNITIV PROGRAMMINGMODEL 9

Opensourcegrid middlewarepackages–GlobusToolkit (GT4)Architecture,Configuration – Usage of Globus – Main components and Programming model - Introduction to Hadoop Framework – Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job – Design of Hadoop file system, HDFS concepts, command line and java interface, dataflow ofFile read & File write.

UNITV SECURITY 9

TrustmodelsforGridsecurityenvironment –AuthenticationandAuthorizationmethods– Grid security infrastructure – Cloud Infrastructuresecurity: network, host and application level – aspects of data security, provider data and its security, Identityand access management architecture, IAM practices in the cloud, SaaS, PaaS, IaaS availability in the cloud, Key privacy issues in the cloud.

TOTAL: 45PERIODS

OUTCOMES:

Attheendofthecourse,thestudent shouldbeableto:

- Applytechniquestosolvelargescalescientificproblems.
- Applytheconceptofvirtualization.
- Usethegridandcloudtoolkits.
- Applythesecuritymodelsinthe gridand thecloud environment.

TEXTBOOK:

1. KaiHwang,GeofferyC.FoxandJackJ.Dongarra,"DistributedandCloudComputing: Clusters, Grids, Clouds and the Future of Internet", First Edition, Morgan Kaufman Publisher, an Imprint of Elsevier, 2012.

REFERENCES:

1. JasonVenner,"ProHadoop-BuildScalable,DistributedApplicationsintheCloud",A Press, 2009
2. TomWhite,"HadoopTheDefinitiveGuide",FirstEdition. O"Reilly, 2009.
3. BartJacob(Editor),"IntroductiontoGridComputing", IBMRedBooks,Vervante,2005
4. IanFoster,CarlKesselman,"TheGrid:Blueprint foraNewComputing Infrastructure", 2nd Edition, Morgan Kaufmann.
5. FredericMagoulesandJiePan,"IntroductiontoGridComputing"CRCPress,2009.
6. DanielMinoli, "ANetworking Approachto GridComputing",JohnWileyPublication, 2005.
7. BarryWilkinson,"GridComputing:TechniquesandApplications",ChapmanandHall, CRC, Taylor and Francis Group, 2010.

22150H73P-MIDDLEWARETECHNOLOGIES

AIM:

Studentsareabletogainin-depthknowledgepopularmiddlewareplatforms.

OBJECTIVES:

Students canableto

- Understand that middleware is an intermediary software layer between theapplicationand the operating system, which encapsulates the heterogeneity of the underlyingcommunication network, operating system or hardware platform.
- Acquiretheknowledgeofintegratingthesesystemsbyusingmiddlewaretechnologies.

UNITI CLIENT/SERVERCONCEPTS 9+3

Client server – Fileserver – Databaseserver – Group server – Object server – Web server – Middleware–Generalmiddleware–Servicespecific middleware–Client/Server buildingblocks – RPC – Messaging – Peer-to-Peer.

UNITIIEJBARCHITECTURE 9+3

EJB–EJBArchitecture–OverviewofEJBsoftwarearchitecture–View ofEJB–Conversation– Building and deploying EJB – Roles in EJB.

UNITIII EJBAPPLICATIONS 9+3

EJBsessionbeans–EJBentitybeans–EJBclients–EJBdeployment–Buildinganapplication with EJB.

UNITIV CORBA 9+3

CORBA– Distributedsystems – Purpose– Exploring CORBAalternatives – Architectureoverview – CORBAand networking model – CORBAobject model – IDL – ORB – Buildinganapplication with CORBA.

UNITVCOM 9+3

COM – Data types – Interfaces – Proxy and stub – Marshalling – Implementing server / client – Interface pointers – object creation – Invocation – Destruction – Comparison COM and CORBA – Introduction to .NET – Overview of .NET architecture – Marshalling – Remoting.

TOTAL:60hrs

TEXTBOOKS:

1. Robert Orfali, Dan Harkey and Jeri Edwards, "The Essential Client / Server Survival Guide",Galgotia Publications Pvt. Ltd., 2002.2. Tom Valesky, "Enterprise Java Beans", Pearson Education, 2002.

REFERENCES:

1. Mowbray,"InsideCORBA",PearsonEducation,2002.
2. JeremyRosenberger,"TeachYourselfCORBAin14days", TECMedia, 2000.
3. JasonPritchard,"COMandCORBASidebySide", AddisonWesley,2000.
4. JesseLiberty,"ProgrammingC#",2ndEdition,O'ReillyPress, 2002.

SEMESTER-IV(ELECTIVEI)

22150E44AP-THEORYOFCOMPUTATION

AIM:

To introducesbasiccomputationmodelsandthenecessarymathematicaltechniques toexpresscomputer scienceproblemsasmathematicalstatementsandtoformulateproofs

OBJECTIVES:

- Tofocus onthe studyofabstractmodels ofcomputation.
- Toassessviaformal reasoningwhatcouldbeachievedthrough computingwhen theyare using it to solve problems in science and engineering.
- Tointroducefundamental questions aboutproblems,such as whetherthey can or not be computed, and if they can, how efficiently.

UNITI AUTOMATA 9+3

Introductionto formalproof – Additionalforms of proof–Inductive proofs –Finite Automata (FA) – Deterministic Finite Automata (DFA)– Non-deterministic Finite Automata (NFA) – Finite Automata with Epsilon transitions.

UNITII REGULAREXPRESSIONSANDLANGUAGES 9+3

Regular Expression – FA and Regular Expressions – Proving languages not to be regular – Closure properties ofregular languages – Equivalence and minimization of Automata.

UNIT III CONTEXT-FREEGRAMMARANDLANGUAGES 9+3

Context-Free Grammar (CFG) – Parse Trees – Ambiguity in grammars and languages – Definition of the Pushdown automata – Languages of a Pushdown Automata– Equivalence of Pushdown automata and CFG, Deterministic Pushdown Automata.

UNITIV PROPERTIESOFCONTEXT-FREELANGUAGES 9+3

Normal forms for CFG – Pumping Lemma for CFL - Closure Properties of CFL – Turing Machines – Programming Techniques for TM.

UNITV UNDECIDABILITY 9+3

A language that is not Recursively Enumerable (RE) – An undecidable problem that is RE – Undecidable problems about Turing Machine – Post's Correspondence Problem - The classes P and NP.

TOTAL:60hrs

TEXTBOOK:

1. J.E.Hopcroft,R.Motwani andJ.DUllman,"IntroductiontoAutomataTheory, Languages and Computations", Second Edition, Pearson Education, 2003.

REFERENCES:

1. H.R.Lewisand C.H.Papadimitriou, "ElementsofThetheoryofComputation", Second Edition, Pearson Education/PHI, 2003
2. J.Martin, "Introductionto Languages and the TheoryofComputation", Third Edition, TMH, 2003.
3. MichealSipser, "Introduction of the Theory and Computation", Thomson Brokecole, 1997.

22150E44BP-DATAWAREHOUSINGANDDATAMINING

OBJECTIVES:

- Tounderstanddatawarehouseconcepts,architecture,businessanalysisandtools
- Tounderstanddatapre-processinganddatavisualizationtechniques
- Tostudyalgorithmsforfindinghiddenandinterestingpatternsindata
- Tounderstandandapplyvariousclassificationandclusteringtechniquesusingtools.

UNIT I DATAWAREHOUSING,BUSINESSANALYSISANDON-LINE ANALYTICAL PROCESSING(OLAP) 9

BasicConcepts-DataWarehousingComponents–BuildingaDataWarehouse–Database Architectures for Parallel Processing – Parallel DBMS Vendors - Multidimensional Data Model– Data Warehouse Schemas for Decision Support, Concept Hierarchies - CharacteristicsofOLAPSystems–TypicalOLAPOperations, OLAP andOLTP.

UNITIIDATA MINING–INTRODUCTION 9

IntroductiontoDataMiningSystems–KnowledgeDiscoveryProcess–DataMining Techniques–Issues – applications- Data Objects and attribute types, Statisticaldescription of data, DataPreprocessing – Cleaning, Integration, Reduction, Transformationand discretization,Data Visualization, Data similarityand dissimilarity measures.

UNITIIIDATAMINING-FREQUENTPATTERN ANALYSIS 9

MiningFrequentPatterns,AssociationsandCorrelations–MiningMethods-Pattern Evaluation Method–PatternMininginMultilevel,Multi Dimensional Space–Constraint BasedFrequentPatternMining, ClassificationusingFrequentPatterns

UNITIV CLASSIFICATIONANDCLUSTERING 9

Decision Tree Induction - Bayesian Classification – Rule Based Classification–ClassificationbyBackPropagation–SupportVectorMachines—LazyLearners–ModelEvaluationand Selection-Techniques to improve Classification Accuracy.

Clustering Techniques – Cluster analysis-Partitioning Methods - Hierarchical Methods – DensityBasedMethods-GridBasedMethods–Evaluationofclustering–Clusteringhigh dimensionaldata-Clusteringwithconstraints, Outlieranalysis-outlierdetectionmethods.

UNITV WEKATOOL 9

Datasets –Introduction, Iris plantsdatabase, Breast cancer database, Auto imports database - IntroductiontoWEKA,TheExplorer–Gettingstarted,Exploringtheexplorer,Learning algorithms,Clusteringalgorithms,Association–rulelearners.

TOTAL:45PERIODS

OUTCOMES:

Attheendofthecourse,thestudentshould beableto:

- DesignaDatawarehousesystemandperformbusinessanalysiswithOLAP tools.
- Applysuitablepre-processingandvisualizationtechniquesfor dataanalysis
- Applyfrequent patternandassociationruleminingtechniquesfordata analysis
- Applyappropriateclassificationandclusteringtechniquesfordataanalysis

TEXTBOOKS:

1. JiaweiHanandMichelineKamber,—DataMiningConceptsandTechniques‖,Third Edition,Elsevier, 2012.

REFERENCES:

1. AlexBersonandStephenJ.Smith, —DataWarehousing, DataMining&OLA TataMcGraw – Hill Edition, 35thReprint 2016.
2. K.P.Soman,ShyamDiwakarandV.Ajay,—Insightinto DataMiningTheoryand
3. Practice‖,EasternEconomyEdition,PrenticeHallofIndia,2006.
4. IanH.WittenandEibe Frank, —DataMining:PracticalMachineLearningToo andTechniques‖, Elsevier, Second Edition.

22150E44CP-PROFESSIONALETHICSINENGINEERING

OBJECTIVES:

- Toenablethestudentsto createanawarenessonEngineering Ethicsand Human Values, to instillMoraland SocialValuesand Loyaltyand to appreciatetherightsof others.

UNITI HUMAN VALUES 10

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civicvirtue– Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professionalexcellence and stress management.

UNITII ENGINEERINGETHICS 9

Senses of _Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNIT III ENGINEERINGASSOCIALEXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters – CodesofEthics – A Balanced Outlook on Law.

9

UNITIV SAFETY,RESPONSIBILITIESANDRIGHTS

SafetyandRisk–AssessmentofSafetyandRisk–RiskBenefitAnalysisandReducing Risk -Respect forAuthority–CollectiveBargaining–Confidentiality–Conflictsof Interest –OccupationalCrime–ProfessionalRights–EmployeeRights–Intellectual Property Rights (IPR)– Discrimination.

8

UNITV GLOBALISSUES

Development–EngineersasManagers–ConsultingEngineers–EngineersasExpertWitnessesandAdvisors–Moral Leadership–Code ofConduct–CorporateSocial Responsibility.

TOTAL:45PERIODS

OUTCOMES:

Attheendofthecourse,thestudentshould beableto:

- Toapplyethicsinsociety,discussthe ethical issuesrelatedtoengineeringand realize the responsibilities and rights in the society.

TEXTBOOKS:

1. MikeW.MartinandRolandSchinzinger,―EthicsinEngineering‖,TataMcGrawHill, New Delhi,2003.

2. Govindarajan M,Natarajan S,Senthil KumarV.S,―EngineeringEthics‖,Prentice Hall of India,New Delhi, 2004.

REFERENCES:

1. Charles B. Fleddermann, ―Engineering Ethics‖, Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard andMichaelJ.Rabins,―EngineeringEthics – Concepts and Cases‖, Cengage Learning, 2009.
3. John R Boatright, ―Ethics and the Conduct of Business‖, Pearson Education, New Delhi, 2003
4. EdmundGSeebauerandRobertLBarry,―FundamentalsofEthicsfor Scientists andEngineers‖, Oxford UniversityPress, Oxford, 2001.
5. Laura P. Hartman and Joe Desjardins, ―Business Ethics: Decision Making for PersonalIntegrity and Social Responsibility‖ McGraw Hill education, India Pvt. Ltd.,New Delhi, 2013.
6. 6.WorldCommunityServiceCentre,_ValueEducation',Vethathiripublications, Erode, 2011.

CSE/SemIV/Electives

22150E44DP-ADVANCEDDATABASES

AIM:

TohavestrongknowledgeonDatabaseManagementSystems,Databasetechnologies ,anapplication-oriented,system-orientedapproachtowardsdatabasedesign.

OBJECTIVES:

- Beableto designhigh-qualityrelationaldatabasesanddatabaseapplications.
- Havedevelopedskillsinadvancedvisual&conceptualmodelinganddatabase design.
- Beabletotranslatecomplexconceptualdatamodelsinto logicalandphysical database designs.
- Havedevelopedanappreciationofemergingdatabasetrendsastheyapplytosemi-structured data, the internet, and object-oriented databases.

UNITI DISTRIBUTEDDATABASES 9+3

Distributed DBMS Concepts and Design – Introduction – Functions and Architecture of DDBMS – Distributed Relational Database Design – Transparency in DDBMS – Distributed Transaction Management – Concurrency control – Deadlock Management – Database recovery – The X/Open Distributed Transaction Processing Model – Replication servers – Distributed QueryOptimisation - Distribution and Replication in Oracle.

UNITII OBJECTORIENTED DATABASES 9+3

Object Oriented Databases – Introduction – Weakness of RDBMS – Object Oriented Concepts Storing Objects in Relational Databases – Next Generation Database Systems – Object Oriented Data models – OODBMS Perspectives – Persistence – Issues inOODBMS – Object Oriented Database ManagementSystem Manifesto – Advantages and Disadvantages of OODBMS – Object Oriented Database Design – OODBMS Standards and Systems – Object Management Group–Object DatabaseStandardODMG – Object RelationalDBMS – Postgres - Comparison of ORDBMS and OODBMS.

UNIT III WEBDATABASES 9+3

Web Technology And DBMS – Introduction – The Web – The Web as a Database ApplicationPlatform– Scripting languages – CommonGatewayInterface – HTTP Cookies – Extending the Web Server – Java – Microsoft's Web Solution Platform – Oracle Internet Platform – Semi structured Data and XML – XML Related Technologies – XML Query Languages

UNITIV INTELLIGENTDATABASES 9+3

Enhanced Data Models For Advanced Applications – Active Database ConceptsAnd Triggers – TemporalDatabase Concepts – Deductive databases – Knowledge Databases.

UNITV CURRENTTRENDS 9+3

Mobile Database – Geographic Information Systems – Genome Data Management – Multimedia Database – Parallel Database – Spatial Databases - Database administration – Data Warehousing and Data Mining.

TOTAL:60hrs

TEXT BOOK:

1. ThomasM.Connolly,CarolynE.Begg,"DatabaseSystems-APracticalApproachtoDesign ,Implementation,andManagement",ThirdEdition,PearsonEducation, 2003

REFERENCES:

1. RamezElmasri&ShamkantB.Navathe, "Fundamentals of DatabaseSystems", FourthEdition, Pearson Education , 2004.
2. M.TamerOzsu,PatrickUalduriel,"Principles ofDistributedDatabaseSystems",Second Edition, PearsonEducation, 2003.
3. C.S.R.Prabhu,"ObjectOrientedDatabaseSystems",PHI,2003.
4. PeterRobandCorlosCoronel, "DatabaseSystems–Design,Implementationand Management", Thompson Learning, Course Technology, 5th Edition, 2003.

SEMESTER -V(ELECTIVEII)
22150E54AP-ADHOCANDSENSORNETWORKS

OBJECTIVES:
Thestudentshouldbemadeto:

- Understandthedesignissuesinadhocandsensornetworks.
- Learnthedifferenttypes ofMACprotocols.
- Befamiliar withdifferent typesofadhocroutingprotocols.
- Beexposetothe TCPissuesinadhoc networks.
- Learnthe architectureand protocolsofwirelesssensornetworks.

UNITI INTRODUCTION 9

FundamentalsofWirelessCommunicationTechnology–TheElectromagneticSpectrum– Radio propagation Mechanisms – Characteristics of the Wireless Channel -mobile ad hoc networks (MANETs) and wireless sensor networks(WSNs) :concepts and architectures. ApplicationsofAdHocandSensornetworks.DesignChallenges inAd hocandSensor Networks.

UNITII MACPROTOCOLSFOR ADHOCWIRELESSNETWORKS 9

Issues indesigningaMACProtocol- ClassificationofMACProtocols- Contentionbased protocols- Contention based protocols with Reservation Mechanisms- Contention based protocols with Scheduling Mechanisms – Multi channel MAC-IEEE 802.11

UNIT III ROUTING PROTOCOLS AND TRANSPORT LAYER IN AD HOC WIRELESSNETWORKS 9

IssuesindesigningaroutingandTransportLayerprotocolforAdhocnetworks-proactive routing, reactive routing (on-demand), hybrid routing- Classification of Transport Layer solutions-TCP over Ad hoc wireless Networks.

UNITIVWIRELESSSENSORNETWORKS(WSNS)ANDMACPROTOCOLS 9

Single node architecture: hardware and software components of a sensor node - WSN Networkarchitecture:typicalnetworkarchitectures-datarelayingand aggregationstrategies-MAC layerprotocols:self-organizing,HybridTDMA/FDMAandCSMAbasedMAC-IEEE 802.15.4.

UNITV WSNROUTING,LOCALIZATION&QOS 9

IssuesinWSNrouting–OLSR-Localization–IndoorandSensorNetworkLocalization-absolute and relative localization, triangulation-QOS in WSN-Energy Efficient Design-Synchronization-Transport Layer issues

TOTAL: 45PERIODS

OUTCOMES:

Uponcompletion ofthecourse, thestudentshouldbeableto:

- Explaintheconcepts,networkarchitecturesandapplicationsofadhocandwireless sensor networks
- Analyzetheprotocoldesign issues ofadhoc and sensornetworks
- Designroutingprotocols foradhocandwirelesssensornetworkswithrespectto some protocol design issues
- EvaluatetheQoSrelatedperformancemeasurementsofadhocandsensor networks

TEXTBOOK:

1. C.SivaRamMurthy,andB.S.Manoj,"AdHocWirelessNetworks:Architectures and Protocols ", Prentice Hall Professional TechnicalReference, 2008.

REFERENCES:

1. CarlosDeMoraisCordeiro,DharmaPrakashAgrawal“AdHoc&SensorNetworks: Theoryand Applications”, World Scientific Publishing Company, 2006.
2. FengZhao andLeonidesGuibas, "WirelessSensorNetworks",ElsevierPublication-2002.
3. HolgerKarlandAndreasWillig“ProtocolsandArchitecturesforWirelessSensor Networks”, Wiley, 2005
4. KazemSohraby,DanielMinoli,&TaiebZnati,“WirelessSensorNetworks-Technology, Protocols, and Applications”, John Wiley, 2007.

22150E54BP-PRINCIPLESOFCOMPILERDESIGN

AIM:

Tounderstandthedesignandimplementationofasimplecompiler.

OBJECTIVES:

- Tounderstandthefunctionsofthevariousphasesofacomplier.
- Tolearntheoverviewofthedesignoflexicalanalyzerandparser.
- Tostudythedesignoftheotherphasesindetail.
- Tolearntheuseofcompilerconstructiontools.

UNITI INTRODUCTIONTO COMPILING 9+3

Compilers – Analysis of the source program – Phases of a compiler – Cousinsof the Compiler – Grouping of Phases – Compiler construction tools – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens.

UNITII SYNTAX ANALYSIS 9+3

Role of the parser –Writing Grammars –Context-Free Grammars – Top Down parsing – Recursive Descent Parsing – Predictive Parsing – Bottom-up parsing – Shift Reduce Parsing – Operator Precedent Parsing – LR Parsers – SLR Parser – Canonical LR Parser – LALR Parser.

UNIT III INTERMEDIATECODEGENERATION 9+3

Intermediate languages – Declarations – Assignment Statements – Boolean Expressions – Case Statements – Back patching – Procedure calls.

UNITIV CODE GENERATION 9+3

Issues in the design of code generator – The target machine – Runtime Storage management – Basic Blocks and FlowGraphs – Next-useInformation – AsimpleCode generator – DAG representation of Basic Blocks – Peephole Optimization.

UNITVCODEOPTIMIZATIONANDRUNTIMEENVIRONMENTS9+3

Introduction– Principal Sources of Optimization – Optimization of basic Blocks – Introduction to Global Data Flow Analysis – RuntimeEnvironments – Source Language issues–Storage Organization – Storage Allocation strategies – Access to non-local names – Parameter Passing.

TOTAL:60hrs

TEXTBOOK:

1. Alfred Aho,Ravi Sethi,Jeffrey DUllman,"Compilers Principles,Techniquesand Tools", Pearson Education Asia, 2003.

REFERENCES:

1. AllenI. Holub"CompilerDesigninC", PrenticeHallofIndia, 2003.
2. C.N.Fischer andR.J.LeBlanc,"CraftingacompilerwithC",BenjaminCummings, 2003.
3. J.P.Bennet,"IntroductiontoCompilerTechniques",SecondEdition,TataMcGraw-Hill, 2003.
4. HenkAlblasandAlbertNymeyer,"Practice andPrinciplesofCompilerBuildingwithC", PHI, 2001.
5. Kenneth C. Louden, "Compiler Construction: Principles and Practice", Thompson Learning, 2003

22150E54CP- DISTRIBUTEDSYSTEMS

AIM:

Thiscoursediscussthefundamentalaspects ondesignof distributedsystems,andthe principles underlying them with an emphasis on fault tolerance and security.

OBJECTIVES:

- Tounderstanddistributedcomputingsystemmodelsandintroductiontodistributes databases.
- Tohaveanin-depthknowledgeofdistributedalgorithms.
- Tounderstandasynchronoussharedmemorymodel, mutualexclusion,resourceallocation, consensus, asynchronous network model, basic asynchronous network algorithms, shared memory Vs networks and introduction to parallel distributed processing.
- Tounderstandthevarioussecurityalgorithmsindistributing environment.

UNITI INTRODUCTION 9+3

Introduction to Distributed systems-examples of distributed systems, challenges-architectural models-fundamental models - Introduction to interprocess communications-external data representation and marshalling- client server communication-group communication – Case study: IPC in UNIX

UNITII DISTRIBUTEDOBJECTSANDFILESYSTEM 9+3

Introduction-Communicationbetweendistributedobjects-Remoteprocedurecall-Eventsand notifications-JavaRMIcase Study-IntroductiontoDFS-File service architecture-Sunnetwork

filesystem-IntroductiontoNameServices-NameservicesandDNS-Directoryanddirectory services

.

UNIT III DISTRIBUTEDOPERATINGSYSTEMSUPPORT 11+3

The operating system layer – Protection - Process and threads - Communication and invocation - Operating system architecture - Introduction to time and global states - Clocks, Events and Process states - Synchronizing physical clocks - Logical time and logical clocks - Global states - Distributed debugging – Distributed mutual exclusion.

UNIT IV TRANSACTIONANDCONCURRENCY CONTROL –DISTRIBUTED TRANSACTIONS 8+3

Transactions – Nested transaction – Locks - Optimistic concurrency control - Timestamp ordering - Comparison of methods for concurrency control - Introduction to distributed transactions - Flat and nested distributed transactions - Atomic commit protocols - Concurrency control in distributed transactions - Distributed deadlocks - Transaction recovery

UNIT –V SECURITYANDREPLICATION 8+3

Overview of security techniques - Cryptographic algorithms – Digital signatures - Cryptography pragmatics – Replication- System model and group communications – Fault tolerant services – Highly available services – Transactions with replicated data

TOTAL:60hrs

TEXTBOOK:

1. George Coulouris,Jean Dollimore,Tim Kindberg“Distributed SystemsConceptsand Design” Third Edition – 2002- Pearson Education Asia.

REFERENCES:

1. A.S.Tanenbaum,M.VanSteen“DistributedSystems”PearsonEducation2004
2. MukeshSinghal,OhioStateUniversity,Columbus “Advanced ConceptsIn Operating Systems” McGraw-Hill Series in Computer Science, 1994.

22150E54DP-MOBILECOMPUTING

AIM:

The aim of the course is to make student to be familiar with the basics concept of Mobile Communication and mobile devices .Focus will be on cellular mobile system units and different aspects of cellular communication.

OBJECTIVES:

- Topresentnecessaryconceptsfor MobileCommunication.
- Understandingdifferentmobiledevicesandsystem.
- UnderstandingtheCellularSystemdesign.
- StudyCo-channelandNonCo-channelInterference.
- Understandingchannelassignmentandhandoff.
- StudyDigitalCellular System.

UNITI WIRELESSCOMMUNICATIONFUNDAMENTALS 9+3

Introduction – Wireless transmission – Frequencies for radio transmission – Signals – Antennas –SignalPropagation–Multiplexing–Modulations –Spreadspectrum–MAC – SDMA – FDMA – TDMA – CDMA – Cellular Wireless Networks.

UNITII TELECOMMUNICATIONNETWORKS 11+3

Telecommunication systems – GSM – GPRS – DECT – UMTS – IMT-2000 – Satellite Networks -Basics–ParametersandConfigurations –CapacityAllocation–FAMAand DAMA – Broadcast Systems – DAB - DVB.

UNITIII WIRLESSLAN 9+3

WirelessLAN–IEEE802.11-Architecture–services–MAC –Physicallayer–IEEE 802.11a-802.11bstandards–HIPERLAN–BlueTooth.

UNITIV MOBILENETWORKLAYER 9+3

MobileIP –DynamicHostConfigurationProtocol-Routing–DSDV–DSR–Alternative Metrics.

UNITV TRANSPORTANDAPPLICATIONLAYERS 7+3

TraditionalTCP–ClassicalTCPimprovements–WAP,WAP 2.0.

Total:60hrs

TEXTBOOKS:

1. Jochen Schiller, “Mobile Communications”, PHI/Pearson Education, Second Edition, 2003.(UnitIChap1,2&3-UnitIIchap4,5&6-UnitIII Chap7.UnitIVChap8-Unit VChap 9&10.)

2. WilliamStallings,“WirelessCommunicationsandNetworks”,PHI/PearsonEducation,2002. (Unit I Chapter – 7&10-Unit II Chap 9)

REFERENCES:

1. KavehPahlavan, PrasanthKrishnamoorthy, “Principles ofWireless Networks”, PHI/Pearson Education, 2003.

2. UweHansmann,LotharMerk,Martin S.NicklonsandThomasStober,“PrinciplesofMobile Computing”, Springer, New York, 2003.
3. HazysztofWesolowshi,“MobileCommunicationSystems”,JohnWileyandSonsLtd,2002.

SEMESTER-VI
(ELECTIVE III)

22160E64AP-PRINCIPLESOFMANAGEMENT

AIM:

Tounderstandthebasicprinciplesofmanagement.

OBJECTIVES:

Knowledge ontheprinciples of management is essentialfor all kinds of people inallkinds of organizations. After studying this course, students will be able to have a clear understanding of the managerial functions like planning, organizing, staffing, leading and controlling. Students will also gain some basic knowledge on international aspect of management.

UNITI HISTORICALDEVELOPMENT 9

Definition of Management – Science or Art – Management and Administration – Development of Management Thought – contribution of Taylor and Fayol – Functions of Management – Types of Business Organization.

UNITII PLANNING 9

Nature & Purpose – Steps involved in planning – Objective – Setting Objectives – Process of ManagingbyObjectives–Strategies, Policies&Planningpremise–Forecasting–Decision-making.

UNITIII ORGANISING 9

Natureandpurpose – Formaland informal organization – OrganizationChart – StructureandProcess – Departmentation by difference strategies – Line and Staff authority – Benefits and Limitations – Selection Process – Techniques – HRD – Managerial Effectiveness.

UNITIV DIRECTING 9

Scope – Human Factors – Creativity and Innovation – Harmonizing Objectives – Leadership – Types of Leadership Motivation – Hierarchy of needs – Motivation theories– Motivational Techniques– JobEnrichment – Communication–Process ofCommunication–BarriersandBreakdown–Effective Communication – Electronic media in Communication.

UNITV CONTROLLING 9

System and process of Controlling – Requirements for effective control – The Budget as Control Technique– Information TechnologyinControlling –Useof computers inhandlingtheinformation – Productivity – Problems and Management – Control of overall Performance

– Direct and Preventive Control – Reporting – The Global Environment – Globalization and Liberalization – International Management and Global theory of Management.

TOTAL:45hrs

TEXTBOOKS:

1. HaroldKooritz&HeinzWeihrich“EssentialsofManagement”,TataMcGraw-Hill, 1998.
2. JosephLMassie“EssentialsofManagement”,PrenticeHallofIndia,(pearson)Fourth Edition, 2003.

REFERENCES

1. TripathyPCAndReddyPN,“PrinciplesofManagement”,TataMcGraw-Hill,1999.
2. DecenzoDavid,RobbinStephenA,“PersonnelandHumanReasonsManagement”, Prentice Hall of India, 1996.
3. JAFStomer, FreemanR.EandDanielRGillbertManagement,pearsonEducation, Sixth Edition,2004.
4. FraidoonMazda,“EngineeringManagement”,AddisonWesley,2000.

22150E64BP-UNIX INTERNALS

AIM:

This coursefocus to bend the learning curvefor those systemprogrammers who need to cast free software kernels.

OBJECTIVES:

- Anabilitytounderstanddesignandimplementationofamulti-programmableoperating system.
- Agoodunderstandingofthefundamentalsofamonolithickernel.
- Abasic-to-intermediateexperienceinkernelanddriver/moduleprogramming.

UNITI 9

General Review of theSystem-History-System structure-User Perspective-OperatingSystem Services-Assumptions About Hardware. Introduction to the Kernel-ArchitectureSystem Concepts-Data Structures- System Administration.

UNITII 9

The Buffer Cache-Headers-Buffer Pool-Buffer Retrieval-Reading and Writing DiskBlocks-Advantages and Disadvantages. Internal Representation of Files-Inodes-Structure-Directories-Path Name to Inode- Super Block-Inode Assignment-Allocation ofDisk Blocks -Other File Types.

UNITIII 9

SystemCalls for theFileSystem-Open-Read-Write-Lseek-Close-Create-SpecialfilesCreation-Change Directory and Change Root-Change Owner and Change Mode- Stat-Fstat-Pipes-Dup-Mount-Unmount-Link-Unlink-File System Abstraction-Maintenance.

UNITIV 9

The System Representation of Processes-States-Transitions-System Memory-Contextof a Process-Saving the Context-Manipulation of a Process Address Space-SleepProcess Control-signals-Process Termination-Awaiting-Invoking other Programs-TheShell-System Boot and the INIT Process.

UNITV 9

Memory Management Policies-Swapping-Demand Paging-a Hybrid System-I/OSubsystem-Driver Interfaces-Disk Drivers-Terminal Drivers.

TOTAL:45hrs

TEXTBOOK:

1. MauriceJ.Bach,"TheDesignoftheUnixOperatingSystem", PearsonEducation, 2002.

REFERENCES:

1. UreshVahalia,"UNIXInternals:TheNewFrontiers",PrenticeHall,2000.
2. JohnLion,"Lion'sCommentaryonUNIX",6thedition,Peer-to-PeerCommunications,2004.
3. DanielP.Bovet & MarcoCesati, "UnderstandingtheLinux Kernel", O'REILLY, ShroffPublishers &Distributors Pvt. Ltd, 2000.
4. M.Becketal,"LinuxKernelProgramming",PearsonEducationAsia,2002

22150E64CP-GRAPHTHEORYANDAPPLICATIONS

OBJECTIVES:

- Tounderstandfundamentalsofgraphtheory.
- Tostudyprooftechniques relatedtovarious concepts ingraphs.
- Toexplore modernapplications ofgraphtheory.

UNITI **9**

Introduction - Graph Terminologies - Types of Graphs - Sub Graph- Multi Graph - Regular Graph - Isomorphism - Isomorphic Graphs - Sub-graph - Euler graph - Hamiltonian Graph - Related Theorems.

UNITII **9**

Trees -Properties- Distance and Centres - Types -Rooted Tree--Tree Enumeration-LabeledTree - Unlabeled Tree -Spanning Tree - Fundamental Circuits-Cut Sets -Properties-Fundamental CircuitandCut-set-Connectivity-Separability-Related Theorems.

UNITIII **9**

Network Flows - Planar Graph -Representation - Detection - Dual Graph - Geometric and CombinatorialDual- Related Theorems - Digraph - Properties - Euler Digraph.

UNITIV **9**

MatrixRepresentation-Adjacencymatrix-Incidencematrix-Circuitmatrix-Cut-setmatrix - Path Matrix- Properties - Related Theorems - Correlations. Graph Coloring - Chromatic Polynomial- Chromatic Partitioning - Matching - Covering - Related Theorems.

UNITV **9**

Graph Algorithms- Connectedness and Components- Spanning Tree- Fundamental Circuits- Cut Vertices- Directed Circuits- Shortest Path - Applications overview.

TOTAL:45PERIODS

OUTCOMES:

Attheendofthecourse,thestudentshould beableto:

- Understandthebasicconceptsofgraphs,and differenttypesofgraphs
- Understandtheproperties,theoremsandbeabletoprovetheorems.
- Applysuitablegraphmodelandalgorithmforsolvingapplications.

22150E64CP-GRAPHTHEORYANDAPPLICATIONS

OBJECTIVES:

- Tounderstandfundamentalsofgraphtheory.
- Tostudyprooftechniques relatedtovarious concepts ingraphs.
- Toexplore modernapplications ofgraphtheory.

UNITI 9

Introduction - Graph Terminologies - Types of Graphs - Sub Graph- Multi Graph - Regular Graph - Isomorphism - Isomorphic Graphs - Sub-graph - Euler graph - Hamiltonian Graph - Related Theorems.

UNITII 9

Trees -Properties- Distance and Centres - Types -Rooted Tree--Tree Enumeration-LabeledTree - Unlabeled Tree -Spanning Tree - Fundamental Circuits-Cut Sets -Properties-Fundamental CircuitandCut-set-Connectivity-Separability-Related Theorems.

UNITIII 9

Network Flows - Planar Graph -Representation - Detection - Dual Graph - Geometric and CombinatorialDual- Related Theorems - Digraph - Properties - Euler Digraph.

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MatrixRepresentation-Adjacencymatrix-Incidencematrix-Circuitmatrix-Cut-setmatrix - Path Matrix- Properties - Related Theorems - Correlations. Graph Coloring - Chromatic Polynomial- Chromatic Partitioning - Matching - Covering - Related Theorems.

UNITV 9

Graph Algorithms- Connectedness and Components- Spanning Tree- Fundamental Circuits- Cut Vertices- Directed Circuits- Shortest Path - Applications overview.

TOTAL:45PERIODS

OUTCOMES:

Attheendofthecourse,thestudentshould beableto:

- Understandthebasicconceptsofgraphs,and differenttypesofgraphs
- Understandtheproperties,theoremsandbeabletoprovetheorems.
- Applysuitablegraphmodelandalgorithmforsolvingapplications.

TEXTBOOKS:

1. NarsinghDeo,"GraphTheorywithApplicationtoEngineering andComputer Science", Prentice-Hall of India Pvt.Ltd, 2003.
2. L.R.Foulds,"GraphTheoryApplications",Springer,2016.

REFERENCES:

1. Bondy,J.A.andMurty,U.S.R.,"GraphTheorywithApplications",NorthHolland Publication,2008.
2. West,D.B.,―IntroductiontoGraphTheory‖, PearsonEducation,2011.
3. JohnClark,DerekAllanHolton,―AFirst LookatGraphTheory‖,WorldScientific Publishing Company, 1991.
4. Diestel,R,"GraphTheory", Springer,3rdEdition,2006.
5. KennethH.Rosen,"DiscreteMathematicsandItsApplications", McGrawHill, 2007.

CSE/SemVI/Electives

22150E64DP-PROGRAMMINGPARADIGMS

AIM:

Developagreater understandingoftheissuesinvolvedinprogramminglanguage Design and implementation

OBJECTIVES:

- Developanin-depthunderstandingoffunctional,logic,andobject-orientedprogramming paradigms.
- Implementseveralprogramsinlanguages other thantheoneemphasizedinthecorecurriculum (Java/C++).
- Understanddesign/implementationissuesinvolvedwithvariableallocationandbinding,control flow, types, subroutines, parameter passing.
- Developanunderstandingofthecompilationprocess.

UNITI OBJECT-ORIENTEDPROGRAMMING–FUNDAMENTALS 9

Review of OOP - Objects and classes in Java – defining classes – methods - access specifiers – static members–constructors–finalizemethod–Arrays–Strings-Packages–JavaDoccomments

UNITII OBJECT-ORIENTEDPROGRAMMING–INHERITANCE 9

Inheritance – class hierarchy – polymorphism – dynamic binding – final keyword – abstract classes – the Object class– Reflection – interfaces – object cloning – innerclasses – proxies

UNITIII EVENT-DRIVENPROGRAMMING 9

Graphics programming – Frame – Components – working with 2D shapes – Using color, fonts, and images -Basics ofevent handling– event handlers –adapter classes – actions – mouseevents – AWT event hierarchy – introduction to Swing – Model-View- Controller design pattern – buttons – layout management – Swing Components

UNITIV GENERIC PROGRAMMING 9

Motivationfor genericprogramming–genericclasses –generic methods–genericcodeandvirtual machine – inheritance and generics – reflection and generics – exceptions – exception hierarchy – throwing and catching exceptions – StackTrace Elements - assertions – logging

UNITV CONCURRENTPROGRAMMING 9

Multi-threadedprogramming–interruptingthreads–threadstates–threadproperties–thread

synchronization–thread-safeCollections–Executors–synchronizers–threadsandevent-driven programming.

] **TOTAL:45hrs**

TEXT BOOK:

1. CayS. HorstmannandGaryCornell, "CoreJava:VolumeI –Fundamentals", EighthEdition, Sun Microsystems Press, 2008.

REFERENCES:

1. D.M.Dhamdhere,"SystemsProgrammingandOperatingSystems",SecondRevisedEdition,Tata McGraw-Hill, 2000.
2. JohnJ.Donovan"SystemsProgramming",TataMcGraw-HillEdition,2000.
3. JohnR.Levine,Linkers&Loaders–HarcourtIndiaPvt.Ltd.,MorganKaufmannPublishers,2000.

SEMESTER-VII(ELECTIVEVI)
22150E73AP-HIGHSPEEDNETWORKS

AIM:

Thiscourseprovidesintroductiontoemerginghighspeednetworktechnologiesandfacilitates thestudents identifywherethenewtechnologycanbeusedtoenhanceperformanceofbusiness networks.

OBJECTIVES:

- Goodunderstandingofpacket-switchednetworkingconceptsandprinciplesof operation.
- GoodunderstandingofInternetprotocolsandarchitectures(e.g.,IPprotocolstack).
- Solidfoundationincomputeroperatingsystemsfundamentals.
- Abilitytoperformindependentresearch,analyzefindingsinhighspeed networks.

UNITI HIGHSPEEDNETWORKS 9

Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture, ATM logical Connection,ATMCell–ATMServiceCategories–AAL.HighSpeedLAN's:FastEthernet, Gigabit Ethernet, Fibre Channel – Wireless LAN's: applications, requirements – Architecture of 802.11

UNITII CONGESTIONANDTRAFFICMANAGEMENT 8

Queuing Analysis- Queuing Models – Single Server Queues – Effects of Congestion – Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks – Frame Relay Congestion Control.

UNITIII TCPANDATMCONGESTIONCONTROL 12

TCP Flow control – TCP Congestion Control – Retransmission – Timer Management – Exponential RTO backoff – KARN's Algorithm – Window management – Performance of TCP overATM.Traffic and Congestion control in ATM – Requirements – Attributes – Traffic Management Frame work, Traffic Control – ABR traffic Management – ABR rate control, RM cell formats,ABR Capacity allocations – GFR traffic management.

UNITIV INTEGRATEDANDDIFFERENTIATEDSERVICES 8

IntegratedServices Architecture–Approach,Components,Services-QueuingDiscipline,FQ,PS, BRFQ, GPS, WFQ – Random Early Detection, Differentiated Services

UNITV PROTOCOLSFORQOSSUPPORT 8

RSVP –Goals &Characteristics, DataFlow, RSVPoperations, ProtocolMechanisms – Multiprotocol Label Switching – Operations, Label Stacking, Protocol details – RTP – Protocol Architecture, Data Transfer Protocol, RTCP.

TOTAL:45hrs

TEXT BOOK:

1. WilliamStallings,"HIGHSPEEDNETWORKSANDINTERNET",PearsonEducation, Second Edition, 2002. [Chapter – 4-6, 8, 10, 12, 13, 17,18]

REFERENCES:

1. Warland&PravinVaraiya,"HIGHPERFORMANCECOMMUNICATIONNETWORKS",Jean Harcourt Asia Pvt. Ltd., II Edition, 2001.
2. IrvanPepelnjk,JimGuichardandJeffApcar,"MPLSandVPNarchitecture", CiscoPress, Volume 1 and 2, 2003

CSE/SemVII/Electives

22150E73BP-INFORMATIONRETRIEVALTECHNIQUES

OBJECTIVES:

- TounderstandthebasicsofInformationRetrieval.
- Tounderstandmachine learningtechniques fortextclassificationandclustering.
- Tounderstandvarioussearchenginesystemoperations.
- Tolearndifferenttechniquesofrecommendersystem.

UNITI INTRODUCTION 9

Information Retrieval – Early Developments – The IR Problem – The User_s Task – Information versus Data Retrieval - The IR System – The Software Architecture of the IR System– The Retrieval and Ranking Processes - The Web – The e-Publishing Era – Howthe web changedSearch –Practical Issues on the Web–How PeopleSearch–Search Interfaces Today – Visualization in Search Interfaces.

UNITII MODELINGANDRETRIEVALEVALUATION 9

Basic IR Models - Boolean Model - TF-IDF(TermFrequency/InverseDocument Frequency) Weighting - Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference Collection–User-basedEvaluation–RelevanceFeedbackandQueryExpansion – Explicit Relevance Feedback.

UNIT III TEXTCLASSIFICATIONANDCLUSTERING 9

A Characterization of Text Classification – Unsupervised Algorithms: Clustering – Naïve Text Classification – Supervised Algorithms – Decision Tree – k-NN Classifier – SVM Classifier–Feature SelectionorDimensionality Reduction–Evaluationmetrics– Accuracy and Error – Organizing the classes – Indexing and Searching – Inverted Indexes – Sequential Searching – Multi-dimensional Indexing.

UNITIV WEBRETRIEVALANDWEBCRAWLING 9

TheWeb–SearchEngineArchitectures–ClusterbasedArchitecture–Distributed Architectures– Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank –Evaluations -- SearchEngine Ranking – SearchEngine User Interaction – Browsing – Applications ofaWeb Crawler– Taxonomy–Architecture and Implementation – Scheduling Algorithms –Evaluation.

UNITV RECOMMENDERSYSTEM 9

RecommenderSystemsFunctions–DataandKnowledgeSources– Recommendation Techniques – Basics of Content-based Recommender Systems –High Level Architecture –Advantages and Drawbacks ofContent-based Filtering –
CollaborativeFiltering–Matrixfactorizationmodels–Neighborhoodmodels..

TOTAL:45PERIODS

OUTCOMES:

Attheendofthecourse,thestudentshould beableto:

- Useanopensourcesearchengineframework andexploreitscapabilities
- Applyappropriatemethodofclassificationorclustering.
- Designandimplementinnovativefeaturesinasearchengine.
- Designandimplementarecommendersystem.

TEXTBOOKS:

1. 1.RicardoBaeza-YatesandBerthierRibeiro-Neto,―ModernInformationRetrieval: TheConceptsand Technologybehind Search, Second Edition, ACMPressBooks, 2011.
2. Ricci,F,Rokach,L.Shapira,B.Kantor,―RecommenderSystemsHandbook‖,First

Edition,2011.

REFERENCES:

1. C.Manning,P.Raghavan,andH.Schütze,—IntroductiontoInformationRetrieval, CambridgeUniversity Press, 2008.
2. StefanBuettcher,CharlesL.A.ClarkeandGordonV.Cormack,—Information Retrieval:ImplementingandEvaluatingSearchEngines, TheMITPress, 2010.

22150E73CP-SOFTWAREPROJECTMANAGEMENT

AIM:

SoftwareProject Managementprovidesinsighttothe importanceofcareful projectmanagement

OBJECTIVES:

- UnderstandProjectplanningandmanagement
- IdentifyClientmanagementandprojectdefinition
- Understandtestingbasedapproachtodevelopment
- Teammanagementandongoingscheduletracking

UNIT1SOFTWAREMANAGEMENT 9

Conventional Software Management - The Waterfall Model - Conventional Software Management Performance. Evolution of Software Economics - Pragmatic Software Cost Estimation. Reducing Software Product Size – Languages -Object-Oriented Methods and Visual Modeling - Reuse. Improving Software Processes - TeamEffectiveness - AutomationthroughSoftwareEnvironments -Achieving Required Quality. ModernSoftware Management -Transitioning to an Iterative Process

UNIT2SOFTWAREMANAGEMENTPROCESS FRAMEWORK 9

Life-Cycle Phases-EngineeringandProductionStages- InceptionPhase-ElaborationPhase - ConstructionPhase -Transition Phase. Artifacts ofthe Process - Artifact Sets - Management Set -Engineering Sets - Artifact Evolutionover the Life Cycle - Test Artifacts - Management Artifacts - Engineering Artifacts - Pragmatic Artifacts. Model-BasedSoftware Architectures - Management Perspective - Technical Perspective. Workflows of the Process - Software ProcessWorkflows - Iteration Workflows - Checkpoints of the Process.

UNIT3SOFTWAREMANAGEMENTDISCIPLINES 9

Iterative Process Planning - Work Breakdown Structures - Conventional WBS Issues - Planning Guidelines - Cost and Schedule Estimating Process - Iteration Planning Process. Project Organizations and Responsibilities - Line-of-BusinessOrganizations - Project Organizations - Evolution of Organizations. Process Automation - Tools: Automation BuildingBlocks - Project Environment - Round-Trip Engineering - Change Management. Project Control and ProcessInstrumentation - Seven Core Metrics - Management Indicators - QualityIndicators-.PragmaticSoftwareMetrics-MetricsAutomation

UNIT4 PROJECTPROFILES 9

Continuous Integration - Early Risk Resolution - Evolutionary Requirements - Teamwork among Stakeholders - Top 10 Software Management Principles - Software Management Best Practices - Next-Generation Software Economics - Next-Generation Cost Models - Modern Software Economics
-ModernProcess Transitions.

UNIT5PROJECTEXECUTIONAND CLOSURE 9

Review Process – Planning - Overview and Preparation - Group Review Meeting - Rework and Follow-up–Guidelines forReviews inProjects - AnalysisandControlGuidelines –Case Studies. Project Monitoring and Control – ProjectTracking - Activities Tracking - Defect Tracking - Issues Tracking - Status Reports - Milestone Analysis. DefectAnalysis and Prevention - Process Monitoring and Audit. Project Closure – Analysis - Analysis Report.

TOTAL 45hrs

TEXTBOOKS:

1. WalkerRoyce,“*SoftwareProjectManagement:AUnifiedFramework*”,Pearson,2000
2. PankajJalote,“*SoftwareProjectManagementinPractice*”,Pearson,2002.

REFERENCES:

1. JoelHenry,“*SoftwareProjectManagement:AReal-WorldGuidetoSuccess*”. Pearson,2004.
2. KathySchwalbe,“*InformationTechnologyProjectManagement*”,CourseTechnology,2005

CSE/SemVII/Electives

22150E73DP-CYBERFORENSICS

OBJECTIVES:

- Tolearncomputerforensics
- Tobecomefamiliarwithforensicstools
- Tolearntoanalyzeandvalidateforensicsdata.

UNITI INTRODUCTIONTOCOMPUTERFORENSICS 9

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. IntroductiontoIdentityTheft &IdentityFraud.TypesofCFtechniques -Incident and incident response methodology - Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. - Forensics TechnologyandSystems-Understanding Computer Investigation – Data Acquisition.

UNITII EVIDENCECOLLECTIONANDFORENSICSTOOLS 9

Processing Crime and Incident Scenes – Working with Windows and DOS Systems.Current Computer Forensics Tools: Software/ Hardware Tools.

UNIT III ANALYSISANDVALIDATION 9

ValidatingForensicsData–DataHidingTechniques–PerformingRemoteAcquisition– Network Forensics – EmailInvestigations – CellPhone and Mobile Devices Forensics

UNITIV ETHICAL HACKING 9

Introduction toEthical Hacking-Footprintingand Reconnaissance-ScanningNetworks - Enumeration - System Hacking - Malware Threats - Sniffing.

UNITV ETHICALHACKINGINWEB 9

SocialEngineering-DenialofService-SessionHijacking-HackingWebservers–Hacking WebApplications–SQL Injection -HackingWireless Networks -HackingMobile Platforms.

TOTAL:45PERIODS

OUTCOMES:

Attheendofthecourse,thestudentshould beableto:

- Understandthebasicsofcomputerforensics
- Applyanumber ofdifferentcomputerforensictoolstoagivenscenario
- Analyzeand validateforensicsdata
- Identifythevulnerabilitiesinagivennetworkinfrastructure
- Implementreal-worldhackingtechniquestotestsystemsecurity.

TEXTBOOKS:

1. BillNelson,AmeliaPhillips,FrankEnfinger,ChristopherSteuart, ―ComputerForensicsandInvestigations‖,CengageLearning,IndiaEdition,2016.
2. CEHofficialCertfiedEthicalHackingReviewGuide, WileyIndiaEdition, 2015.

REFERENCES:

1. JohnR.Vacca,―ComputerForensics‖,CengageLearning,2005
2. MarjieT.Britz,―ComputerForensicsandCyberCrime‖:AnIntroduction‖,3rd Edition, Prentice Hall, 2013.
3. AnkitFadia―EthicalHacking‖SecondEdition,MacmillanIndiaLtd,2006
4. KennethC.Brancik―InsiderComputerFraud‖AuerbachPublicationsTaylor& Francis Group–2008.

PRIST

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THANJAVUR – 613 403 - TAMIL NADU

DEPARTMENT OF

COMPUTER SCIENCE & ENGINEERING

PROGRAM HANDBOOK

M.Tech

COMPUTER SCIENCE AND ENGINEERING

[FULL TIME]

[REGULATION 2022]

[For candidates admitted to M.Tech CSE program from June 2022 onwards]

DEAN	**HOD**
ENGINEERING AND TECHNOLOGY	**DEPT.OF CSE**

COURSE STRUCTURE

SEMESTER – I

Semester. no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
I	22248S11A	Higher Mathematics	4	1	0	4
I	22250H12	Modern Operating System	4	0	0	4
I	22250H13	MachineLearningTechniques	4	0	0	4
I	22250H14	Adhoc and Sensor Network	4	0	0	4
I	22250H15	Advanced Data Structures and Algorithms	4	1	0	4
I	22250E16_	Elective - I	3	0	0	3
Practical						
I	22250L17	Advanced Web Technologies Lab	-	-	3	3
Total no of Credit					**26**	

SEMESTER – II

Semester. no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
II	22250H21	Middleware Technologies	3	1	0	4
II	22250H22	Object Oriented Software Engineering	4	0	0	4
II	22250H23	Internet of Things	4	0	0	4
II	22250E24_	Elective II	3	0	0	3
II	22250E25_	Elective – III	3	0	0	3
Practical						
II	22250L26	.NET Technologies Lab	-	-	3	3
II	222TECWR	Technical Writing /Seminars	-	-	3	3
Total no of Credit						**24**

SEMESTER – III

Semester.no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
III	22250H31	Software Project Management	4	0	0	4
III	22250E32_	Elective-IV	3	0	0	3
III	22250E33_	Elective-V	3	0	0	3
III	22250E34_	Elective-VI	3	0	0	3
III	22250P35	Project Work- Phase I*	-	-	10	10
Total no of Credit						**23**

SEMESTER – IV

Semester no.	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
IV	22250P41	Project Work- Phase II*	-	-	15	15
Total no of Credit						**15**

*** - Only review will be conducted**

List of Electives

Semester – I - Elective – I

Semester no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
I	22250E16A	Multimedia Systems	3	0	0	3
I	22250E16B	Web Engineering	3	0	0	3
I	22250E16C	Software Metrics	3	0	0	3

SEMESTER – II - Elective – II

Semester no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
II	22250E24A	Advanced Distributed Computing	3	0	0	3
II	22250E24B	Data Warehousing & Data Mining	3	0	0	3
II	22250E24C	Information Retrieval Techniques	3	0	0	3

SEMESTER – II - Elective – III

Semester no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
II	22250E25A	Service Oriented Architecture	3	0	0	3
II	22250E25B	High Speed Networks	3	0	0	3
II	22250E25C	Language Technologies	3	0	0	3

SEMESTER – III - Elective – IV

Semester no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
III	22250E32A	Cloud Computing	3	0	0	3
III	22250E32B	Speech Processing and Synthesis	3	0	0	3
III	22250E32C	Soft Computing	3	0	0	3

SEMESTER – III - Elective – V

Semester no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
III	22250E33A	Advanced Database Technology	3	0	0	3
III	22250E33B	Reconfigurable Computing	3	0	0	3
III	22250E33C	Green Computing	3	0	0	3

SEMESTER – III - Elective – VI

Semester no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
III	22250E34A	Software Quality Assurance	3	0	0	3
III	22250E34B	Bio-inspired Computing	3	0	0	3
III	22250E34C	Wireless Application Protocols	3	0	0	3

CREDITS DISTRIBUTION

Semester	Theory Courses		Elective Courses		Practical Courses		Total Credits
	Nos.	**Credits**	**Nos.**	**Credits**	**Nos.**	**Credits**	
I	05	**20**	01	**03**	01	**03**	26
II	03	**12**	02	**06**	02	**06**	24
III	01	**04**	03	**9**	01	**10**	23
IV	-	**-**	-	**-**	01	**15**	15
TOTAL							**88**

TOTAL CREDITS	
Semester – I	26
Semester – II	24
Semester – III	23
Semester – IV	15
TOTAL	**88**

22248S11A - HIGHER MATHEMATICS

L T P C
3 1 0 4

AIM

To extend student's mathematical maturity and ability to deal with abstraction and to introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.

OBJECTIVES

At the end of the course, students would

- Have knowledge of the concepts needed to test the logic of a program.
- Have gained knowledge which has application in expert system, in data base and a basic for the prolog language.
- Have an understanding in identifying patterns on many levels.
- Be aware of a class of functions which transform a finite set into another finite set which relates to input output functions in computer science.
- Be exposed to concepts and properties of algebraic structures such as semigroups, monoids and groups.

UNIT I SETS, RELATIONS AND FUNCTIONS 9

Basic Concepts – Relationships between sets-Operations on sets-Principles of inclusion and exclusion – Minterms and Maxterms of a set – Relations partial ordering relation-Equivalence relation-Binary relations-Cyclic order relation – a= (mod m) relations: Partitions sets – Hassee diagram- functions: Properties- Composition - inverse function

UNIT II LOGIC 9

Propositional logic – Logical connectivity's-Truth table-Normal forms(Connective and disjunctive)-Predicate logic-Universal and existential quantifiers induction.

UNIT III COMBINATORICS 9

Basic of counting - counting arguments - Pigeonhole principle - Permutations and combinations - Recursion and Recurrence relations - Generating functions.

UNIT IV MODELLING COMPUTATION AND LANGUAGES 9

Finite state machines-Deterministic and Non-Deterministic finite state machines-Turing Machines-Formal Languages-Classes of Grammars-Type_0 – Context Sensitive-Context-Free-Regular Grammars-Ambiguity.

UNIT V LATICE AND BOOLEAN ALGEBRA 9

Partial order relation, poset-lattices, Hasse diagram-Boolean Algebra

Total No of periods: 45

REFERENCES

1. J.P.Tremblay and R.Manohar, " Discrete Mathematical Structures with Application to Computer Science", TMH,NY-1997
2. M.K.Venkatraman, N.Sridharan and N.Chandrasekaran, " Discrete Mathematics", The National Publishing Company,2003
3. K.H.Rosen, Discrete Mathematics and its Applications, Mc-Graw Hill Book, 1999.

22250H12 - MODERN OPERATING SYSTEM

L T P C
4 0 0 4

AIM:

To have a thorough knowledge of processes, scheduling concepts, memory management, I/O and file systems, multimedia operating system and recent operating systems.

OBJECTIVES:

- To have an overview of different types of operating systems.
- To know the components of an operating system.
- To have a thorough knowledge of process management.
- To have a thorough knowledge of storage management.
- To know the concepts of I/O and file systems.
- To know the concepts of multimedia operating systems.

UNIT I **9**

Introduction – computer hardware review – operating system zoo - Operating System Concepts - System Calls - Operating System Structure -.Process And Threads : Processes – Threads - Interprocess Communication - Scheduling.

Unit II **9**

Memory Management Memory Abstraction:Address Spaces, No Memory Abstraction - Virtual Memory - Page Replacement Algorithms - Modeling Page Replacement Algorithms - Design Issues For Paging Systems – Segmentation. File Systems:File Directories File System Implementation

Unit III **9**

Deadlocks - Introduction To Deadlocks - The Ostrich Algorithm - Deadlock Detection And Recovery - Deadlock Avoidance - Deadlock Prevention - Other Issues – Input/output Principles of I/O Hardware – Principles of I/O Software – I/O Software Layers – Disks – Clocks – Thin Clients.

Unit IV **9**

Multiple processor systems - multiprocessors - multicomputers - virtulazitation - distributed systems - multimedia operating systems . Multimedia files - video compression audio compression – multimedia scheduling - disk scheduling for multimedia.

Unit V **9**

Case Study – LINUX , WINDOWS VISTA , SYMBIAN OS

Total : 45 hrs

TEXT BOOK:

1. Andrew S. Tanenbaum , “Modern Operating Systems “ , Pearson Education , 3rd Edition , 2009

REFERENCE BOOKS:

1. Silberschatz, Galvin, Gagne " Operating System Concepts" Sixth Edition, 2003 .

2. Achut S. Godbole and KahateAtul , "Operating Systems & Systems Programming ", Tata Mcgraw Hill, 2003.
3. Charles Crowley, " Operating systems: A Design Oriented Approach", Tata McGraw Hill, 999.

22250H13 - MACHINE LEARNING TECHNIQUES

L T P C 4 0 0 4

AIM:

The main objective of this paper is to make the students to know the need of Machine Learning Techniques.

OBJECTIVES:

To introduce students to the basic concepts and techniques of Machine Learning.
To have a thorough understanding of the Supervised and Unsupervised learning techniques
To study the various probability based learning techniques
To understand graphical models of machine learning algorithms

UNITI INTRODUCTION 9

Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron –DesignaLearningSystem –PerspectivesandIssuesinMachineLearning – ConceptLearningTask–ConceptLearningasSearch–FindingaMaximallySpecificHypothesis–VersionSpacesand the Candidate Elimination Algorithm – Linear Discriminants – Perceptron – LinearSeparability–LinearRegression.

UNITII LINEARMODELS 9

Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multi-layer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back-Propagation–RadialBasisFunctionsandSplines–Concepts–RBFNetwork–CurseofDimensionality–InterpolationsandBasisFunctions–SupportVectorMachines.

UNITIII TREE ANDPROBABILISTICMODELS 9

Learning with Trees – Decision Trees – Constructing Decision Trees – Classification andRegression Trees – Ensemble Learning – Boosting – Bagging – Different ways to CombineClassifiers – Probability and Learning – Data into Probabilities – Basic Statistics – GaussianMixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms –VectorQuantization–SelfOrganizingFeatureMap

UNITIV DIMENSIONALITYREDUCTIONANDEVOLUTIONARYMODELS 9

Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – FactorAnalysis – Independent Component Analysis – Locally Linear Embedding – Isomap – LeastSquares Optimization – Evolutionary Learning – Genetic algorithms – Genetic Offspring: - GeneticOperators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting LostExample–MarkovDecisionProcess

UNITV GRAPHICALMODELS 9

Markov ChainMonteCarloMethods–Sampling–ProposalDistribution–MarkovChainMonte Carlo–GraphicalModels–BayesianNetworks–MarkovRandomFields– HiddenMarkovModels–TrackingMethods

Total : 45 hrs

REFERENCES:

EthemAlpaydin,—IntroductiontoMachineLearning3e(AdaptiveComputationandMachineLearning Series)‖, ThirdEdition,MITPress,2014
JasonBell,—Machinelearning–HandsonforDevelopersandTechnicalProfessionals‖,FirstEdition,Wiley, 2014
PeterFlach,—MachineLearning:TheArtandScienceofAlgorithmsthatMakeSenseofData‖,FirstEdition,CambridgeUniversity Press,2012.
StephenMarsland,—MachineLearning–AnAlgorithmicPerspective‖,SecondEdition,ChapmanandHall/CRCMachineLearningandPatternRecognitionSeries,2014.
TomMMitchell,—MachineLearning‖,FirstEdition,McGrawHillEducation,2013.

22250H14 –ADHOC AND SENSOR NETWORK

L T P C
4 0 0 4

AIM:

To understand the current and emerging applications of the adhoc sensor networks.

OBJECTIVE:

To understand

- A broad overview of the state of wireless and ad hoc networking.
- The overview of the physical, networking and architectural issues of ad hoc networks.
- The technologies that will enable the next generation of ad hoc networks and the proliferation of ubiquitous computing.
- The sensor networks and the unique set of design challenges that they introduce.

UNIT I AD-HOC MAC 9

Introduction – Issues in Ad-Hoc Wireless Networks. MAC Protocols – Issues, Classifications of MAC protocols, Multi channel MAC & Power control MAC protocol.

UNIT II AD-HOC NETWORK ROUTING & TCP 9

Issues – Classifications of routing protocols – Hierarchical and Power aware. Multicast routing – Classifications, Tree based, Mesh based. Ad Hoc Transport Layer Issues. TCP Over Ad Hoc – Feedback based, TCP with explicit link, TCP-BuS, Ad Hoc TCP, and Split TCP.

UNIT III WSN -MAC 9

Introduction – Sensor Network Architecture, Data dissemination, Gathering. MAC Protocols – self-organizing, Hybrid TDMA/FDMA and CSMA based MAC.

UNIT IV WSN ROUTING, LOCALIZATION & QOS 9

Issues in WSN routing – OLSR, AODV. Localization – Indoor and Sensor Network Localization. QoS in WSN.

UNIT V MESH NETWORKS 9

Necessity for Mesh Networks – MAC enhancements – IEEE 802.11s Architecture – Opportunistic routing – Self configuration and Auto configuration – Capacity Models – Fairness – Heterogeneous Mesh Networks – Vehicular Mesh Networks.

Total : 45 hrs

REFERENCES:

1. C.Siva Ram Murthy and B.Smanoj, “ Ad Hoc Wireless Networks – Architectures and Protocols”, Pearson Education, 2004.
2. Feng Zhao and Leonidas Guibas, “Wireless Sensor Networks”, Morgan Kaufman Publishers, 2004.
3. C.K.Toh, “Ad Hoc Mobile Wireless Networks”, Pearson Education, 2002.
4. Thomas Krag and SebastinBuettrich, “Wireless Mesh Networking”, O’Reilly Publishers, 2007.

22250H15 - ADVANCED DATA STRUCTURES AND ALGORITHMS

L T P C
3 1 0 4

AIM:

To make the learners to understand the Analysis of algorithms and Data Structures.

OBJECTIVES :

To Understand

- The Different Heap Structures, Search Structures and Multimedia Structures.
- The various coding scheduling and algorithms.
- The various multimedia structures.

UNIT I FUNDAMENTALS : 9+3

Mathematical Induction -Asymptotic Notations –Properties of Big-oh Notation –Conditional Asymptotic Notation –Algorithm Analysis –Amortized Analysis –NP-Completeness –NP-Hard –Recurrence Equations –Solving Recurrence Equations –Memory Representation of Multi-dimensional Arrays –Time-Space Tradeoff.

UNIT II HEAP STRUCTURES : 9+3

Min/Max heaps –Deaps –Leftist Heaps –Binomial Heaps –Fibonacci Heaps –Skew Heaps –Lazy-Binomial Heaps.

UNIT III SEARCH STRUCTURE : 9+3

Binary Search Trees –AVL Trees –Red-Black trees –Multi-way Search Trees –B-Trees –Splay Trees –Tries.

UNIT IV MULTIMEDIA STRUCTURES : 9+3

Segment Trees –k-d Trees – Point Quad Trees –MX -Quad Trees – R-Trees –TV -Trees.

UNIT V ALGORITHMS : 9+3

Huffman Coding –Convex Hull –Topological Sort –Tree Vertex Splitting –Activity Networks –Flow Shop Scheduling –Counting Binary Trees –Introduction toRandomized Algorithms.

Total :60hrs

REFERENCES

1. E. Horowitz, S.Sahni and Dinesh Mehta, Fundamentals of Data structures inC++, Uiversity Press, 2007.
2. E. Horowitz, S. Sahni and S. Rajasekaran, Computer Algorithms/C++, Second Edition, University Press, 2007.
3. G. Brassard and P. Bratley, Algorithmics: Theory and Practice, Printice –Hall,1988.
4. V.S. Subramanian, Principles of Multimedia Database systems, MorganKaufman, 1998.

22250L17 -ADVANCED WEB TECHNOLOGIES LAB

L T P C
0 0 3 3

1. Creation of HTML pages with frames, links, tables and other tags.
2. Usage of internal and external CSS along with HTML pages.
3. Client side Programming
   i. Java script for displaying date and comparing two dates.
   ii. Form Validation including text field, radio buttons, check boxes, list box and other controls.
4. Usage of ASP/JSP objects response, Request, Application, Session, Server, ADO etc.
   i. Writing online applications such as shopping, railway/air/bus ticket reservation system with set of ASP/JSP pages.
   ii. Using sessions and cookies as part of the web application.
5. Writing Servlet Program using HTTP Servlet.
6. Any online application with database access.
7. Creation of XML document for a specific domain.
8. Writing DTD or XML schema for the domain specific XML document.
9. Parsing an XML document using DOM and SAX Parsers.
10. Sample web application development in the open source environment.

22250H21 - MIDDLEWARE TECHNOLOGIES

L T P C
3 1 0 4

AIM:

The aim of the course is to teach the role of middleware in the distributed environment and its common services.

OBJECTIVES:

- To study the set of services that a middleware system constitutes of.
- To understand how middleware facilitates the development of distributed applications in heterogeneous environments.
- To study how it helps to incorporate application portability, distributed application component interoperability and integration.
- To learn the object oriented middleware basics through the example of the following CORBA objects.
- To understand the basics of Web services that is the most often-used middleware technique.

UNIT – I **9+3**

Introduction : What is a distributed system- Client server Architecture – Multi-tier Architecture-Middleware - Classification of middleware- Event based middleware-Object based Middleware - Message based middleware and its Principal functions- Introduction to concepts of database middleware.

UNIT – II **9+3**

RPC & message Passing middleware - Introduction to procedure calls - Principles of RPC Architecture- Structure of Communication - Java RMI

UNIT – III **9+3**

Other middleware: Introduction to EJB- Introduction to JDBC &ODBC **Interface Definition Language:** Introduction to specification - IDL Identifiers-Attributes type correction -Classes-Arrays- Documentation -Any type-Modules -Interfaces- Exceptionhandling -pre Compiler Directives -OO Design using IDL.

UNIT – IV **9+3**

CORBA: CORBA 2 Standard- Standard Object model- CORBA Architecture-CORBAClient and Object Implementation- Interface & Implementation repository-CORBA Services- Key Issues- Naming Services -Relationships- Event Services- life Cycle services- ObjectQuery Services-properties Services-Time Services- CORBA facilities & CORBA Domains.

UNIT –V **9+3**

COM: Classes- Objects-Query Interface-Dynamic Composition-Apartments-In processActivation -Server Lifetime-Server Lifetime-COM Security-Access Control-Tokenmanagement- Introduction to DCOM.

Total :60hrs

REFERENCE BOOKS:

1. Daniel Serian, “Middleware”, Springer Verlag, 1999.
2. Troy Bryan Downing, “Java RMI: Remote Method Invocation”, IDG Books India, 2000.
3. Thomas J Mowbray& William A Ruh, “Inside CORBA Distributed Objects and Application”, Addison Wesley, 1999.
4. Alan Pope, “CORBA Complete Reference Guide”, Addison Wesley, 1998.
5. Don Box, “Essential Com”, Addison Wesley, 1999

22250H22 - OBJECT ORIENTED SOFTWARE ENGINEERING

AIM:

To learn the advanced software engineering principles and methodologies for effectivesoftware development.

OBJECTIVES:

- To learn about software prototyping, analysis and design.
- To learn UML and its usage.
- Case studies to apply the principles.

UNIT - 1 INTRODUCTION 8

Software Engineering Paradigms - Software Development process models - Project & Process - Project management – Process & Project metrics - Object Oriented concepts & Principles.

UNIT - 2 PLANNING & SCHEDULING 9

Software prototyping - Software project planning – Scope – Resources - Software Estimation - Empirical Estimation Models-Planning-Risk Management - Software Project Scheduling – ObjectOriented Estimation & Scheduling.

UNIT - 3 ANALYSIS & DESIGN 12

Analysis Modeling - Data Modeling - Functional Modeling & Information Flow-Behavioral Modeling-Structured Analysis - Object Oriented Analysis - Domain Analysis-Object oriented Analysis process - Object Relationship Model - Object Behaviour Model. Design Concepts & Principles - Design Process - Design Concepts - Modular Design –Design Effective Modularity - Introduction to Software Architecture - Data Design – Transform Mapping – Transaction Mapping – OOD - Design System design process- Object design process -Design Patterns.

UNIT - 4 IMPLEMENTATION & TESTING 8

Top-Down, Bottom-Up, object oriented product Implementation& Integration. Software testing methods-White Box, Basis Path-Control Structure –Black Box-Unit Testing- Integration testing-Validation & System testing. Testing OOA & OOD models-Object oriented testing strategies.

UNIT – 5 MAINTENANCE 8

Maintenance process-System documentation-program evolution dynamics-Maintenance costs-Maintainability measurement – Case StudiesThe laboratory shall include development of systems applying the Software Engineering principles and methods for specific applications.

Total: 45 hrs

TEXT BOOKS:

1. Roger S. Pressman, “ Software Engineering A Practitioner’s Approach” , Fifth Edition,Tata McGraw Hill.

2. Grady Booch, James Rumbaugh, Ivar Jacobson –“the Unified Modeling Language User Guide” – Addison Wesley,1999. (Unit III)

REFERENCE BOOKS:

1. Ian Sommerville, “Software Engineering”, V Edition Addison- Wesley 1996.
2. PankajJalote “An Integrated Approach to Software Engineering” Narosa Publishing House 1991
3. Carlo Ghezzi Mehdi Jazayer, Dino Mandrioli “Fudamentals of Software Engineering”Prentice Hall of India 2002.
4. Fairley, “Software Engineering Concepts”, Mc.Graw Hill 1985.

22250H23 - INTERNET OF THINGS

L T P C
4 0 0 4

AIM:

To introduce the student to various IOT techniques.

OBJECTIVES:

- To understand the fundamentals of Internet of Things
- To learn about thebasicsofIOT protocols
- To build a smal lowcost embeddedsystem using Raspberry Pi.

UNITI INTRODUCTION TO IoT 9

Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels &Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG-IoT Platforms Design Methodology

UNITII IoT ARCHITECTURE 9

M2Mhigh – level ETSI architecture- IETF architecture for IoT- OGC architecture- IoTreferencemodel-Domainmodel-informationmodel-functionalmodel-communicationmodel- IoT reference architecture To apply the concept to Internet of Things, in the real world scenario.

UNITIII IoT PROTOCOLS 9

Protocol Standardization for IoT– Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BAC Net Protocol – Modbus–ZigbeeArchitecture–Networklayer–6LowPAN-CoAP-Security

UNITIV BUILDING IoT WITH RASPBERRY PI&ARDUINO 9

Building IOT with RASPERRY PI-IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi –Raspberry Pi Interfaces –Programming Raspberry Pi with Python- Other IoT Platforms- Arduino.

UNITV CASE STUDIESAND REAL-WORLD APPLICATIONS 9

Real world design constraints-Applications-
Assetmanagement,Industrialautomation,smartgrid,Commercialbuildingautomation,Smartcities-participatory sensing-Data Analyticsfor IoT
–Software& Managemen t Tools fo rIoT Cloud Storage Models&CommunicationAPIs–Cloud forIoT-Amazon Web Services for IoT.

TOTAL: 45PERIODS

REFERENCES:

1. ArshdeepBahga,VijayMadisetti,—InternetofThings–Ahands-on approach‖,UniversitiesPress,2015
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting theInternetofThings‖,Springer,2011.
3. HonboZhou,—TheInternetofThingsintheCloud:AMiddlewarePerspective‖,CRCPress,2012.
4. Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, StefanAvesand .David Boyle,"FromMachine-to-Machine totheInternetofThings-Introductiontoa NewAgeof Intelligence",Elsevier, 2014.
5. Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things – KeyapplicationsandProtocols‖,Wiley,2012

22250L26 - .NET TECHNOLOGIES LAB

Develop the following in ASP .NET or VB.NET.

1. Query textbox and Displaying records
2. Display records by using database
3. Datalist link control
4. Databinding using dropdownlist control
5. Datagrid paging

Develop the following in C#.NET.

1. Demonstrate Use Of Virtual and override keyword in C# with a simple Program.
2. Write a Program in C# to implement Stack operations.
3. Write a Program to demonstrate Operator overloading.
4. Demonstrate arrays of interface types with a C# program.
5. Write a Program in C# to build a class which implements an interface which already exists.

22250H31 - SOFTWARE PROJECT MANAGEMENT

AIM:

Software Project Management provides insight to the importance of careful project management

OBJECTIVES:

- Understand Project planning and management.
- Identify Client management and project definition.
- Understand testing based approach to development.
- Team management and ongoing schedule tracking.

UNIT I FUNDAMENTALS 9

Conventional Software Management – Evolution of Software Economics – Improving Software Economics – Conventional versus Modern Software Project Management.

UNIT II SOFTWARE MANAGEMENT PROCESS FRAMEWORK 9

Lifecycle Phases – Artifacts of the Process – Model Based Software Architectures – Workflows of the Process – Checkpoints of the Process.

UNIT III SOFTWARE MANAGEMENT DISCIPLINES 9

Iterative Process Planning – Organization and Responsibilities – Process Automation – Process Control and Process Instrumentation – Tailoring the Process.

UNIT IV MANAGED AND OPTIMIZED PROCESS 9

Data Gathering and Analysis – Principles of Data Gathering – Data Gathering Process – Software Measures – Data Analysis – Managing Software Quality – Defect Prevention.

UNIT V CASE STUDIES 9

COCOMO Cost Estimation Model – Change Metrics – CCPDS–R.

Total: 45hrs

TEXT BOOKS:

1. Walker Royce “Software Project Management A Unified Framework”, Pearson Education, 2004
2. Humphrey Watts, “Managing the software process”, Addison Wesley, 1989. (Unit IV)

REFERENCES:

1. Ramesh Gopalaswamy, “Managing Global Projects”, Tata McGraw Hill, 2001.
2. Bob Hughes, Mikecotterell, “Software Project Management”, 3rd Edition, Tata cGraw Hill, 2004.

SEMESTER – I - ELECTIVE – I 22250E16A - MULTIMEDIA SYSTEMS

AIM:

To impart knowledge on Multimedia system and design.

OBJECTIVES:

- To study the graphics techniques and algorithms.
- To study the multimedia concepts and various I/O technologies

UNIT 1 Introduction 9

Line - Curve and Ellipse Drawing Algorithms – Attributes – Two-Dimensional Geometric Transformations – Two-Dimensional Clipping and Viewing.

UNIT II Three-Dimensional Concepts 9

Three-Dimensional Object Representations – Three-Dimensional Geometric and Modeling Transformations – Three-Dimensional Viewing – Color models – Animation.

UNIT IIIMultimedia Systems Design 9

An Introduction – Multimedia applications – Multimedia System Architecture – Evolving technologies for Multimedia – Defining objects for Multimedia systems – Multimedia Data interface standards – Multimedia Databases.

UNIT IVMultimedia File Handling 9

Compression & Decompression – Data & File Format standards – Multimedia I/O technologies - Digital voice and audio – Video image and animation – Full motion video – Storage and retrieval Technologies.

UNIT V Hypermedia 9

Multimedia Authoring & User Interface – Hypermedia messaging - Mobile Messaging – Hypermedia message component – Creating Hypermedia message – Integrated multimedia message standards – Integrated Document management – Distributed Multimedia Systems.

Total: 45 Hours

REFERENCES:

1. Donald Hearn and M.Pauline Baker, "Computer Graphics C Version", Pearson Education, 2003. (UNIT I : Chapters 1 to 6; UNIT 2: Chapter 9 – 12, 15, 16)
2. Prabat K Andleigh and KiranThakrar, "Multimedia Systems and Design", PHI, 2003.(UNIT 3 to 5)
3. Judith Jeffcoate, "Multimedia in practice technology and Applications", PHI, 1998.
4. Foley, Vandam, Feiner, Huges, "Computer Graphics: Principles & Practice", Pearson Education, second edition 2003.

22250E16B- WEB ENGINEERING

AIM:

OBJECTIVES:

- Understand the characteristics of web applications
- Learn to Model web applications
- Be aware of Systematic design methods
- Be familiar with the testing techniques for web applications

UNITI INTRODUCTIONTOWEBENGINEERING 9

Motivation,CategoriesofWebApplications,CharacteristicsofWebApplications.Requirements of Engineering in Web Applications- Web Engineering-Components of Web Engineering-Web EngineeringProcess-Communication-Planning.

UNITII WEB APPLICATION ARCHITECTURES & MODELLING WEBAPPLICATIONS 9

Introduction-Categorizing Architectures- Specifics of Web Application Architectures, Components of a Generic Web ApplicationArchitecture-Layered Architectures, 2-LayerArchitectures,N-LayerArchitectures-Data-aspect Architectures, Database-centric Architectures- Architectures for Web Document Management- Architectures for Multimedia Data-Modeling Specifics in Web Engineering, Levels,Aspects,PhasesCustomization,ModelingRequirements,HypertextModeling,Hypertext Structure Modeling Concepts ,Access Modeling Concepts, Relation to Content Modeling, Presentation Modeling, Relation to Hypertext Modeling, Customization Modeling, Modelling Framework-Modeling languages-Analysis Modeling for Web Apps-The Content Model-TheInteraction Model-Configuration Model.

UNITIII WEB APPLICATIONDESIGN 9

Design for Web Apps- Goals-Design Process-Interactive Design- Principles and Guidelines-Workflow-Preliminaries-DesignSteps-Usability-Issues-InformationDesign-Information Architecture- structuring- Accessing Information-Navigation Design-FunctionalDesign-Wep App Functionality-Design Process-Functional Architecture-Detailed FunctionalDesign.

UNITIV TESTINGWEBAPPLICATIONS 9

Introduction-Fundamentals-TestSpecificsinWebEngineering-TestApproaches-ConventionalApproaches,AgileApproaches-Testingconcepts-TestingProcess-TestScheme-Test Methods and Techniques- Link Testing- Browser Testing-Usability Testing-Load, Stress, and Continuous Testing, Testing Security, Test-driven Development, -ContentTesting-UserInterfacetesting-UsabilityTesting-CompatibilityTesting- Component Level Testing-Navigation Testing-Configuration testing-Security and Performance Testing- Test Automation.

UNITV PROMOTINGWEBAPPLICATIONS ANDWEBPROJECT MANAGEMENT 9

Introduction-challengesinlaunchingthewebApplication-PromotingWebApplication-ContentManagement-UsageAnalysis-WebProjectManagement-ChallengesinWebProject Management-Managing Web Team- Managing the Development Process of a Web Application- Risk, Developing a Schedule, Managing Quality, Managing Change, Tracking the Project .Introduction to nodeJS-websockets.

TOTAL: 45 PERIODS

OUTCOMES:

Uponcompletionofthis course,thestudentsshouldbeableto:

- Explainthecharacteristicsof webapplications.
- Modelwebapplications.
- Designweb applications.
- Testweb applications.

REFERENCES:

1. ChrisBates,―WebProgramming:BuildingInternetApplications‖,ThirdEdition,WileyIndiaEdition,2007.
2. GertiKappel,BirgitProll,―WebEngineering‖,JohnWileyandSonsLtd,2006.
3. GuyW.Lecky-Thompson,―WebProgramming‖,CengageLearning,2008.
4. JohnPaulMueller,―WebDevelopmentwithMicrosoftVisualStudio2005‖,Wiley Dream tech,2006.
5. RogerS.Pressman,DavidLowe,―WebEngineering‖,TataMcGrawHillPublication,2007.

22250E16C - SOFTWARE METRICS

AIM:

To understand software quality metrics.

OBJECTIVES:

- To introduce an integrated approach to software development incorporating quality management methodologies.
- To study about the quality improvements in software
- To understand the Software Quality software standards

UNIT I MEASUREMENTS THEORY 9

- Measurements In Software Engineering - Scope Of Software Metrics - Measurements Theory - Goal Based Framework – Software Measurement Validation.

UNIT II DATA COLLECTION AND ANALYSIS 9

Empirical Investigation - Planning Experiments - Software Metrics Data Collection - Analysis Methods – Statistical Methods.

UNIT III PRODUCTS METRICS 9

Measurement Of Internet Product Attributes - Size And Structure - External Product Attributes - Measurement Of Quality.

UNIT IV QUALITY METRICS 9

Software Quality Metrics - Product Quality - Process Quality - Metrics For Software Maintenance - Case Studies Of Metrics Program - Motorola - Hp And IBM.

UNIT V MANAGEMENT METRICS 9

Quality Management Models - Rayleigh Model - Problem Tracking Report (PTR) Model - Reliability Growth Model - Model Evaluation - Orthogonal Classification.

TOTAL = 45

REFERENCES:

1. Norman E – Fentar, Share Lawrence Pflieger, "Software Metrics", International Thomson Computer Press, 1997.

2. Stephen H. Kin, "Metric and Models in Software Quality Engineering", Addison Wesley

SEMESTER – II - ELECTIVE – II

22250E24A - ADVANCED DISTRIBUTED COMPUTING

AIM:

This course discusses the depth concepts of distributed computing and its features.

OBJECTIVES:

Understanding the concepts of

- processing .distributed systems, operating system issues.
- learn about distributed transaction
- study about the distributed databases.

UNIT-I INTRODUCTION 9

Characterization of Distributed Systems - Examples - Resource Sharing and the Web - Challenges – System Models - Architectural and Fundamental Models - Networking and Internetworking - Types of Networks - Network Principles - Internet Protocols - Case Studies: Ethernet, WiFi.

UNIT-II PROCESSES AND DISTRIBUTED OBJECTS 9

Interprocess Communication - The API for the Internet Protocols - External Data Representation and Marshalling - Client-Server Communication - Group Communication - Case Study: Interprocess communication in UNIX - Distributed Objects and Remote Invocation - Communication Between Distributed Objects - Remote Procedure Call - Events and Notifications - Case Study: Java RMI.

UNIT-III OPERATING SYSTEM ISSUES 9

The OS Layer - Protection - Processes and Threads - Communication and Invocation – OS Architecture - Security - Overview - Cryptographic Algorithms - Digital Signatures - Cryptography Pragmatics – Case Studies Kerberos, 802.11 WiFi - Distributed File Systems - File Service Architecture - Sun Network File System - Distributed Debugging - Distributed Mutual Exclusion – Elections – Multicast Communication Related Problems.

UNIT-IV DISTRIBUTED TRANSACTION PROCESSING 9

Transactions - Nested Transactions - Locks - Optimistic Concurrency Control - Timestamp Ordering - Comparison - Flat and Nested Distributed Transactions - Atomic Commit Protocols - Concurrency Control in Distributed Transactions - Transaction Recovery - Overview of Replication And Distributed Multimedia Systems.

UNIT-V DISTRIBUTED DATABASES 9

Features of Distributed versus Centralized Databases -Principles of Distributed Databases -Levels of Distribution Transparency -Reference Architecture for Distributed Databases - Types of Data Fragmentation - Integrity Constraints in Distributed Databases.

Total : 45 hrs

TEXT BOOKS :

1 George Coulouris, Jean Dollimore and Tim Kindberg, “Distributed Systems Concepts and Design”, Pearson Education, 4th Edition, 2005.

1. Distributed Database Principles & Systems, Stefano Ceri, Giuseppe Pelagatti McGraw -Hill

REFERENCES:

1 SapeMullender, “Distributed Systems”, Addison Wesley, 2 nd Edition, 1993.

2 Albert Fleishman, “Distributes Systems - Software Design and Implementation”, Springer -Verlag, 1994.

3 M.L.Liu, “Distributed Computing Principles and Applications”, Pearson Education, 2004.

4 Andrew S Tanenbaum, Maartenvan Steen,”Distibuted Systems –Principles and Pardigms”,Pearson Education, 2002.

5 MugeshSinghal,Niranjan G Shivaratri,”Advanced Concepts in Operating Systems”,Tata McGraw Hill Edition, 2001.

6. Principles of Distributed Database Systems, M.TamerOzsu, Patrick Valduriez –Pearson Education

22250E24B- DATA WAREHOUSING & DATA MINING

AIM:

To serve the students with an emphasis on the design aspects of Data Mining and Data Warehousing.

OBJECTIVES:

- To introduce the concept of data mining with in detail coverage of basic tasks, metrics, issues, and implication. Core topics like classification, clustering and association rules are exhaustively dealt with.
- To introduce the concept of data warehousing with special emphasis on architecture and design.

UNIT-I INTRODUCTION 9

Introduction: Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Major issues in Data Mining, Data Warehousing and Business Analysis: - Data warehousing Components –Building a Data warehouse – Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata – reporting – Query tools and Applications – Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.

UNIT-II DATA MINING AND ASSOCIATION RULE MINING 9

Data Mining: - Data Mining Functionalities – Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation.
Association Rule Mining: - Efficient and Scalable Frequent Item set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint-Based Association Mining.

UNIT-III CLASSIFICATION AND PREDICTION 9

Classification and Prediction: - Issues Regarding Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.

UNIT IV CLUSTER ANALYSIS 9

Cluster Analysis: - Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering High- Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis.

UNIT V MINING OTHER DATA 9

Mining Object, Spatial, Multimedia, Text and Web Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Spatial Data Mining – Multimedia Data Mining – Text Mining – Mining the World Wide Web.

TOTAL = 45HRS

REFERENCES:

1. Jiawei Han and MichelineKamber "Data Mining Concepts and Techniques" Second Edition, Elsevier,

Reprinted 2008.

2. Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition, Tenth Reprint 2007.

3. K.P. Soman, ShyamDiwakar and V. Ajay "Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2006.

4. G. K. Gupta "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.

5. Pang-Ning Tan, Michael Steinbach and Vipin Kumar "Introduction to Data Mining", Pearson Education, 2007.

22250E24C- INFORMATIONRETRIEVALTECHNIQUES

L T P C
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OBJECTIVES:

- Tounderstandthebasicsofinformationretrievalwithpertinencetomodeling,queryoperationsand indexing
- Toget an understandingofmachine learningtechniquesfortextclassificationandclustering.
- Tounderstandthevariousapplicationsofinformationretrievalgivingemphasistomultimedia IR,web search
- Tounderstandtheconceptsofdigitallibraries

UNITI INTRODUCTION:MOTIVATION 9

Basic Concepts – Practical Issues - Retrieval Process – Architecture - Boolean Retrieval – RetrievalEvaluation–OpenSourceIRSystems–HistoryofWebSearch–WebCharacteristics–TheimpactofthewebonIR—IRVersusWebSearch–ComponentsofaSearchengine

UNITII MODELING 9

TaxonomyandCharacterizationofIRModels–BooleanModel–VectorModel-TermWeighting –ScoringandRanking–LanguageModels–SetTheoreticModels-ProbabilisticModels–AlgebraicModels–StructuredTextRetrievalModels–ModelsforBrowsing

UNITIII INDEXING 9

StaticandDynamicInvertedIndices –IndexConstructionandIndexCompression.Searching-Sequential Searching and Pattern Matching. Query Operations -Query Languages – QueryProcessing - Relevance Feedback and Query Expansion - Automatic Local and Global Analysis –MeasuringEffectivenessandEfficiency

UNITIV CLASSIFICATIONANDCLUSTERING 9

Text Classification and Naïve Bayes–Vector Space Classification– Support vector machines and Machine learning on documents. FlatClustering–HierarchicalClustering–Matrixdecompositionsandlatentsemanticindexing–FusionandMetalearning

9
UNITV SEARCHINGTHEWEB

Searching the Web –Structure of the Web –IR and web search – Static and Dynamic Ranking –Web Crawling and Indexing – Link Analysis - XML Retrieval Multimedia IR: Models andLanguages–IndexingandSearchingParallelandDistributedIR–DigitalLibraries

TOTAL: 45PERIODS

OUTCOMES:

Uponcompletionofthis course,thestudentsshouldbe ableto:

- BuildanInformation Retrievalsystem usingtheavailabletools.
- Identifyanddesignthevarious componentsofanInformation Retrievalsystem.
- ApplymachinelearningtechniquestotextclassificationandclusteringwhichisusedforefficientInformation Retrieval.
- Design an efficientsearchengineandanalyzetheWebcontentstructure.

REFERENCES:

1. ChristopherD.Manning,PrabhakarRaghavan,HinrichSchutze,―IntroductiontoInformation Retrieval‖,Cambridge UniversityPress,First SouthAsianEdition,2008.
2. Implementing and Evaluating Search Engines‖, The MIT Press, Cambridge,MassachusettsLondon,England,2010
3. RicardoBaeza–Yates,BerthierRibeiro–Neto,―ModernInformationRetrieval:Theconcepts and Technology behindSearch‖(ACMPressBooks),Second Edition,2011.
4. StefanButtcher,CharlesL.A.Clarke,GordonV.Cormack,―InformationRetrieval

22250E25A- SERVICE ORIENTED ARCHITECTURE

AIM:

To familiarize the students with the concepts of service oriented architectures. (SOA).

OBJECTIVES:

- Understand SOA, service orientation and web services
- Analyzing and designing business based on SOA principles.
- Learning the concepts of XML.

UNIT I **9**

Software Architecture – Types of IT Architecture – SOA – Evolution – Key components – perspective of SOA – Enterprise-wide SOA – Architecture – Enterprise Applications – Solution Architecture for enterprise application – Software platforms for enterprise Applications – Patterns for SOA – SOA programming models.

UNIT II **9**

Service-oriented Analysis and Design – Design of Activity, Data, Client and business process services – Technologies of SOA – SOAP – WSDL – JAX – WS – XML WS for .NET – Service integration with ESB – Scenario – Business case for SOA – stakeholder objectives – benefits of SPA – Cost Savings

UNIT III **9**

SOA implementation and Governance – strategy – SOA development – SOA governance – trends in SOA – event-driven architecture – software s a service – SOA technologies – proof-of-concept – process orchestration – SOA best practices

UNIT IV **9**

Meta data management – XML security – XML signature – XML Encryption – SAML – XACML – XKMS – WS-Security – Security in web service framework – advanced messaging

UNIT V **9**

Transaction processing – paradigm – protocols and coodination – transaction specifications – SOA in mobile – research issues

Total: 45 hrs

REFERENCES:

1. Shankar Kambhampaly, "Service –Oriented Architecture for Enterprise Applications", Wiley India Pvt Ltd, 2008.
2. Eric Newcomer, Greg Lomow, "Understanding SOA with Web Services", Pearson Education.
3. Mark O' Neill, et al. , "Web Services Security", Tata McGraw-Hill Edition, 2003.

22250E25B - HIGH SPEED NETWORKS

AIM:

To study the various performance and analysis issues involved in high-speed data transmission.

OBJECTIVES:

Be able to

- Describe and interpret the basics of high speed networking technologies.
- Apply the concept learnt in this course to optimize and troubleshoot high-speed network.
- Demonstrate the knowledge of network planning and optimization

UNIT - 1 : HIGH SPEED NETWORKS 9

Frame Relay Networks - Asynchronous transfer mode - ATM Protocol Architecture, ATM logical Connection, ATM Cell - ATM Service Categories - AAL. High Speed LANs: Fast Ethernet, Gigabit Ethernet, Fiber Channel - Wireless LANs: applications, requirements - Architecture of 802.11

UNIT - 2 : CONGESTION AND TRAFFIC MANAGEMENT 9

Queuing Analysis- Queuing Models - Single Server Queues - Effects of Congestion - Congestion Control - Traffic Management - Congestion Control in Packet Switching Networks - Frame Relay Congestion Control.

UNIT - 3 : TCP AND ATM CONGESTION CONTROL 9

TCP Flow control - TCP Congestion Control - Retransmission - Timer Management - Exponential RTO backoff - KARN's Algorithm - Window management - Performance of TCP over ATM. Traffic and Congestion control in ATM - Requirements - Attributes - Traffic Management Frame work, Traffic Control - ABR traffic Management - ABR rate control, RM cell formats, ABR Capacity allocations - GFR traffic management.

UNIT - 4 : INTEGRATED AND DIFFERENTIATED SERVICES 9

Integrated Services Architecture - Approach, Components, Services- Queuing Discipline, FQ, PS, BRFQ, GPS, WFQ - Random Early Detection, Differentiated Services

UNIT - 5 : PROTOCOLS FOR QOS SUPPORT 9

RSVP - Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms - Multiprotocol Label Switching - Operations, Label Stacking, Protocol details - RTP - Protocol Architecture, Data Transfer Protocol, RTCP.

Total: 45 hrs

TEXT BOOK:

1. William Stallings, "HIGH SPEED NETWORKS AND INTERNET", Pearson Education, Second Edition, 2002.

REFERENCES:

1. Warland&PravinVaraiya, "HIGH PERFORMANCE COMMUNICATION NETWORKS", Jean Harcourt Asia Pvt. Ltd., II Edition, 2001.
2. IrvanPepelnjk, Jim Guichard and Jeff Apcar, "MPLS and VPN architecture", Cisco Press, Volume 1 and 2, 2003

22250E25C- LANGUAGETECHNOLOGIES

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OBJECTIVES:

- To learn the fundamentals of natural language processing
- To appreciate the use of CFG and PCFG in NLP
- To understand the role of semantics and pragmatics

UNITI INTRODUCTION 9

Words-RegularExpressionsandAutomata-WordsandTransducers-N-grams-Part-of-Speech–Tagging-Hidden Markov and Maximum Entropy Models.

UNITII SPEECH 9

Speech–Phonetics-SpeechSynthesis-AutomaticSpeechRecognition-SpeechRecognition:-Advanced Topics-Computational Phonology.

UNITIII SYNTAX 9

FormalGrammarsofEnglish-SyntacticParsing-StatisticalParsing-FeaturesandUnification – Language and Complexity.

UNITIV SEMANTICSANDPRAGMATICS 9

TheRepresentationofMeaning-ComputationalSemantics-LexicalSemantics- Computational Lexical Semantics –Computational Discourse.

UNITV APPLICATIONS 9

Information Extraction- Question Answering and Summarization- Dialogue and Conversational Agents-Machine Translation.

TOTAL:45PERIODS

OUTCOMES:

Upon completion of this course ,the students should be able to:

- To tag given text with basic Language features
- To design a nin novative application using NLP components
- To implementa rule based system to t acklemorphology/syntax of a language
- To designa tag set to be used for statistical processingforreal-time applications
- To compa re and contrast use of different statistical approaches for different typesof NLP applications.

REFERENCES:

1. Breck Baldwin, "Language Processing with Java and LingPipe Cookbook", AtlanticPublisher,2015.
2. DanielJurafsky,"SpeechandLanguageProcessing:An IntroductiontoNaturalLanguage Processing, Computational Linguistics and Speech", Pearson Publication,2014.
3. NitinIndurkhya and Fred J. Damerau, "Handbook of Natural Language Processing",SecondEdition,ChapmanandHall/CRCPress,2010.
4. RichardM Reese,"NaturalLanguage Processing withJava",O_ReillyMedia,2015.
5. Steven Bird, Ewan Klein and Edward Loper, -"Natural Language Processing withPython",FirstEdition,O_ReillyMedia,326009.

22250E32A - CLOUD COMPUTING

AIM:

To acquire basic knowledge on cloud computing and its applications

OBJECTIVES:

- Identify cloud computing models, characteristics, and technologies.
- Get knowledge about the different architectures in cloud.
- Identify the information about service management and cloud securities.

UNIT-I **9**

Overview of Computing Paradigm- Recent trends in Computing - Evolution of cloud computing - Introduction to Cloud Computing -Cloud Computing (NIST Model)- Properties, Characteristics & Disadvantages - Cloud computing vs. Cluster computing vs. Grid computing - Role of Open Standards

UNIT-II **9**

Cloud Computing Architecture - Cloud computing stack - Service Models (XaaS) - Infrastructure as a Service(IaaS) - Platform as a Service(PaaS) - Software as a Service(SaaS)- Deployment Models

UNIT-III **9**

Infrastructure as a Service(IaaS) - Introduction to IaaS - Resource Virtualization – Examples. Platform as a Service(PaaS) - Introduction to PaaS - Cloud Platform and Management –Examples - Software as a Service(SaaS) - Introduction to SaaS

UNIT-IV **9**

Service Management in Cloud Computing - Service Level Agreements(SLAs)- Identity & Access Management - Access Control - Trust, Reputation, Risk - Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations - Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations.

UNIT-V **9**

Cloud Security - Infrastructure Security - Network level security - Host level security - Application level security - Data security and Storage - Data privacy and security Issues, Jurisdictional issues raised by Data location - Case Study on Open Source & Commercial Clouds – Eucalyptus - Microsoft Azure - Amazon EC2.

Total:45hrs

REFERENCE BOOKS:

1. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
2. Cloud Computing: Principles and Paradigms, Editors: RajkumarBuyya, James Broberg, Andrzej M. Goscinski, Wile, 2011
3. Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012
4. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010

22250E32B - SPEECH PROCESSING AND SYNTHESIS

AIM:

To study about the Speech Processing and Synthesis

JECTIVES

To understand the mathematical foundations needed for speech processing
To understand the basic concepts and algorithms of speech processing and synthesis
To familiarize the students with the various speech signal representation, coding and recognition techniques

To appreciate the use of speech processing in current technologies and to expose the students to real–world applications of speech processing

UNITI FUNDAMENTALSOFSPEECHPROCESSING 9

Introduction – Spoken Language Structure – Phonetics and Phonology – Syllables andWords–SyntaxandSemantics–Probability,StatisticsandInformationTheory–ProbabilityTheory–EstimationTheory–SignificanceTesting–InformationTheory.

UNITII SPEECHSIGNALREPRESENTATIONSANDCODING 9

Overview of Digital Signal Processing – Speech Signal Representations – Short time Fourier Analysis – Acoustic Model of Speech Production – Linear Predictive Coding – CepstralProcessing–FormantFrequencies–TheRoleofPitch–SpeechCoding–LPCCoder.

UNITIII SPEECHRECOGNITION 9

Hidden Markov Models – Definition – Continuous and Discontinuous HMMs – Practical Issues – Limitations. Acoustic Modeling – Variability in the Speech Signal – Extracting Features – Phonetic Modeling – Adaptive Techniques – Confidence Measures – Other Techniques.

UNITIV TEXTANALYSIS 9

Lexicon – Document Structure Detection – Text Normalization – Linguistic Analysis – Homograph Disambiguation–Morphological Analysis–Letter-to-sound Conversion–Prosody–Generationschematic–SpeakingStyle–SymbolicProsody–Duration Assignment–Pitch Generation

UNITV SPEECHSYNTHESIS 9

Attributes–FormantSpeechSynthesis–ConcatenativeSpeechSynthesis–Prosodic Modification of Speech–Source-filter Models for Prosody Modification–Evaluation of TTS Systems.

TOTAL: 45 PERIODS

REFERENCES:

1. JosephMariani,―LanguageandSpeechProcessing‖,Wiley,2009.
2. Lawrence RabinerandBiing – Hwang Juang,―Fundamentals of Speech Recognition‖ ,Prentice Hall Signal ProcessingSeries,1993.
3. SadaokiFurui,―DigitalSpeechProcessing:Synthesis,andRecognition,SecondEdition,(Signal Processing and Communications)‖, Marcel Dekker,2000.
4. ThomasF.Quatieri,―Discrete-TimeSpeechSignalProcessing‖,PearsonEducation,2002.

22250E32C - SOFT COMPUTING

AIM:

To understand the concepts of Artificial Intelligence , ANN , Genetic Algorithms and Fuzzy systems and its applications.

OBJECTIVES:

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- To introduce the ideas of Neural networks, fuzzy logic and use of heuristics base on human experience.
- To have a general understanding of soft computing methodologies, including artificial neural networks, fuzzy sets, fuzzy logic, fuzzy clustering techniques and genetic algorithms;
- To Design and development of certain scientific and commercial application using computational neural network models, fuzzy models, fuzzy clustering applications and genetic algorithms in specified applications.

UNIT-I FUZZY SET THEORY 10

Introduction to Neuro – Fuzzy and Soft Computing – Fuzzy Sets – Basic Definition and Terminology – Set–Theoretic Operations – Member Function Formulation and Parameterization – Fuzzy Rules and Fuzzy Reasoning – Extension Principle and Fuzzy Relations – Fuzzy If Then Rules – Fuzzy Reasoning – Fuzzy Inference Systems – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models – Input Space Partitioning and Fuzzy Modeling.

UNIT-II OPTIMIZATION 8

Derivative based Optimization – Descent Methods – The Method of Steepest Descent – Classical Newton's Method – Step Size Determination – Derivative Free Optimization – Genetic Algorithms – Simulated Annealing – Random Search – Downhill Simplex Search.

UNIT-III NEURAL NETWORKS 10

Supervised Learning Neural Networks – Perceptrons – Adaline – Backpropagation Multilayer perceptrons – Radial Basis Function Networks – Unsupervised Learning and Other Neural Networks – Competitive Learning Networks – Kohonen Self – Organizing Networks – Learning Vector Quantization – Hebbian Learning.

UNIT-IV NEURO FUZZY MODELING 9

Adaptive Neuro – Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm – Learning Methods that Cross fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling – Framework – Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum.

UNIT-V APPLICATION OF COMPUTATIONAL INTELLIGENCE 8

Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency Prediction – Soft Computing for Color Recipe Prediction.

Total: 45 hrs

TEXTBOOK:

1. J. S. R. Jang, C. T. Sun and E. Mizutani, “Neuro Fuzzy and Soft Computing”, PHI, Pearson Education, 2004.

REFERENCES:

1. Timothy J. Ross, “Fuzzy Logic with Engineering Application “, McGraw Hill, 1977.
2. Davis E. Goldberg, “Genetic Algorithms Search, Optimization and Machine Learning”,Addison Wesley, 1989.
3. S. Rajasekaran and G. A. V. Pai, ”Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI, 2003.
4. R. Beernaert, P. Simpson and R. Dobbins, ”Computational Intelligence PC Tools”, APProfessional, Boston, 1996.

22250E33A – ADVANCED DATABASE TECHNOLOGY

L T P C
4 0 0 4

AIM:

To prepare the student to understand, develop, and manage more advanced database applications.

OBJECTIVES:

Be able to

- Know the operations of parallel and distributed databases.
- Understand the structure s and standards of object relational databases.
- Get familiar with the concepts of XML, Mobile and Multimedia Databases.

UNIT-I PARALLEL AND DISTRIBUTED DATABASES 9

Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Distributed Database Concepts - Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing – Three Tier Client Server Architecture- Case Studies.

UNIT-II OBJECT AND OBJECT RELATIONAL DATABASES 9

Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects – Object Database Standards, Languages and Design: ODMG Model – ODL – OQL – Object Relational and Extended – Relational Systems : Object Relational features in SQL/Oracle – Case Studies.

UNIT-III XML DATABASES 9

XML Databases: XML Data Model – DTD - XML Schema - XML Querying – Web Databases – JDBC – Information Retrieval – Data Warehousing – Data Mining

UNIT-IV MOBILE DATABASES 9

Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management - Location Dependent Data Distribution - Mobile Transaction Models - Concurrency Control - Transaction Commit Protocols- Mobile Database Recovery Schemes.

UNIT-V MULTIMEDIA DATABASES 9

Multidimensional Data Structures – Image Databases – Text/Document Databases- Video Databases – Audio Databases – Multimedia Database Design.

Total = 45 hrs

REFERENCES:

1. R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Fifth Edition, Pearson Education/Addison Wesley, 2007.
2. Thomas Cannolly and Carolyn Begg, " Database Systems, A Practical Approach to Design, Implementation and Management", Third Edition, Pearson Education, 2007.
3. Henry F Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", Fifth Edition, McGraw Hill, 2006.
4. C.J.Date, A.Kannan and S.Swamynathan,"An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.

22250E33B - RECONFIGURABLE COMPUTIN

AIM:

To understand about the Reconfigurable Computing.

OBJECTIVES:

- To understand the need for reconfigurable computing
- To expose the students to various device architectures
- To examine the various reconfigurable computing systems
- To understand the different types of compute models for programming reconfigurable
- architectures
- To expose the students to HDL programming and familiarize with the development
- environment
- To expose the students to the various placement and routing protocols
- To develop applications with FPGAs

UNITI DEVICEARCHITECTURE 9

GeneralPurposeComputingVsReconfigurableComputing–SimpleProgrammableLogicDevices–ComplexProgrammableLogicDevices–FPGAs–DeviceArchitecture-CaseStudies.

UNITII RECONFIGURABLECOMPUTINGARCHITECTURESANDSYSTEMS 9

ReconfigurableProcessingFabricArchitectures–RPFIntegrationintoTraditionalComputingSystems–ReconfigurableComputingSystems–CaseStudies–ReconfigurationManagement.

UNITIII PROGRAMMINGRECONFIGURABLESYSTEMS 9

ComputeModels-ProgrammingFPGAApplicationsinHDL–CompilingCforSpatialComputing – Operating System Support for Reconfigurable Computing.

UNITIV MAPPINGDESIGNS TORECONFIGURABLEPLATFORMS 9

The Design Flow -Technology Mapping– FPGA Placement and Routing–ConfigurationBitstreamGeneration–CaseStudieswithAppropriateTools.

UNITV APPLICATIONDEVELOPMENTWITH FPGAS 9

CaseStudiesofFPGAApplications–SystemonaProgrammableChip (SoPC)Designs.

TOTAL:45PERIODS

REFERENCES:

1. Christophe Bobda,―Introduction to Reconfigurable Computing–Architectures,AlgorithmsandApplications‖,Springer,2010.
2. Maya B. Gokhaleand PaulS.Graham,―Reconfigurable Computing:AcceleratingCo mutation with Field-Programmable GateArrays‖,Springer,2005.
3. FPGAFrontiers:NewApplicationsinReconfigurableComputing,2017,NicoleHemsoth,Timothy PrickettMorgan, Next Platform.
4. Reconfigurable Computing:FromFPGAs to Hardware/Software Code sign 2011EditionbyJoaoCardoso(Editor),Michael Hübne ,Springer

5. ScottHauckandAndreDehon(Eds.), —ReconfigurableComputing–TheTheory andPracticeofFPGA-BasedComputation‖,Elsevier/MorganKaufmann,2008.

22250E33C - GREEN COMPUTING

AIM:

To Understand Green Technology and to implement Green computing practices to efficiently use the computers and its resources.

OBJECTIVES:

- Understanding scientific and social environment.
- Minimizing energy consumption from the IT estate.
- Purchasing green energy and using green suppliers.
- Reducing the paper and other consumables used.
- Minimizing equipment disposal requirements.

UNIT-I **9**

Origins, Regulations and industry initiatives- Government, Industry.

UNIT-II **9**

Approaches to green computing- Product longevity, Algorithmic efficiency.

UNIT-III **9**

Resource allocation, Virtualization.

UNIT-IV **9**

Terminal servers, Power management, Operating system support, Power supply, Storage, Video card, Display.

UNIT-V **9**

Web, Temporal and Spatial Data Mining Materials recycling, Telecommuting, Middleware support for green computing, Tools for monitoring, HPC computing, Green Mobile, embedded computing and networking, Management Frameworks Standards and metrics for computing green

Total: 45hrs

REFERENCES:

1. Green Computing and Green IT Best Practices on Regulations and Industry Initiatives, Virtualization, Power Management, Materials Recycling and Telecommuting by Jason Harris.
2. Green IT: Reduce Your Information System's Environmental Impact While Adding to the Bottom Line. By Toby Velte (Author), Anthony Velte (Author), Robert Elsenpeter (Author), MC-Grow Hill
3. The Greening of IT-How Companies Can Make a Difference for the Environment by John Lamb.

22250E34A - SOFTWARE QUALITY ASSURANCE

AIM:

To develop the ability to analyze and estimate the quality of the software.

OBJECTIVES:

- To introduce an integrated approach to software development incorporating quality management methodologies.
- To study about the quality improvements in software
- To understand the Software Quality software standards

UNIT I 9

Introduction to software quality - challenges – objectives – quality factors – components of SQA– contract review – development and quality plans – SQA components in project life cycle –SQA defect removal policies – Reviews

UNIT II 9

Basics of software testing – test generation from requirements – finite state models –combinatorial designs - test selection, minimization and prioritization for regression testing – test adequacy, assessment and enhancement

UNIT III 9

Testing strategies – white box and black box approach – integration testing – system and acceptance testing – performance testing – regression testing - internationalization testing – adhoc testing – website testing – usability testing – accessibility testing Test plan – management – execution and reporting – software test automation – automated testing tools

UNIT IV 9

Hierarchical models of software quality – software quality metrics –function points –Software product quality – software maintenance quality – effect of case tools – software quality infrastructure – procedures – certifications – configuration management – documentation control.

UNIT V 9

Project progress control – costs – quality management standards – project process standards –management and its role in SQA – SQA unit

Total = 45hrs

REFERENCES

1. 1.Daniel Galin, Software quality assurance – from theory to implementation, Pearson education, 2009.
2. AdityaMathur, Foundations of software testing, Pearson Education, 2008.
3. SrinivasanDesikan and Gopalaswamy Ramesh, Software testing – principles and practices , Pearson education, 2006.
4. Ron Patton, Software Testing , second edition, Pearson education, 2007.

19250E34B - Bio-Informatics

AIM:

To impart knowledge, on basic techniques of Bioinformatics.

OBJECTIVES:

- Build a solid foundation and acquire the vocabulary you need to supervise or to communicate with others who use these tools.
- To have ability to design drugs.
- To understand Evolutionary Trees and Phylogeny.
- Learn the key methods and tools used in bioinformatics.

UNIT I FUNDAMENTALS 7

The Central Dogma – Killer Application – Parallel Universes – Watson's Definition – Top Down Vs Bottom Up Approach – Information Flow – Conversance – Communications.

UNIT II DATABASE AND NETWORKS 9

Definition – Data Management – Data Life Cycle – Database Technology – Interfaces – Implementation – Networks Communication Models – Transmission Technology – Protocols – Bandwidth – Topology – Contents – Security – Ownership – Implementation.

UNIT III SEARCH ENGINES AND DATA VISUALIZATION 10

Search Process – Technologies – Searching and Information Theory – Computational Methods – Knowledge Management – Sequence Visualizations – Structure Visualizations – User Interfaces – Animation Vs Simulation.

UNIT IV STATISTICS– DATA MINING AND PATTERN MATCHING 11

Statistical Concepts – Micro Arrays – Imperfect Data – Basics – Quantifying – Randomness – Data Analysis – Tools Selection – Alignment – Clustering – Classification – Data Mining Methods – Technology – Infrastructure Pattern Recognition – Discovery – Machine Learning – Text Mining – Pattern Matching Fundamentals – Dot Matrix Analysis – Substitution Matrix – Dynamic Programming – Word Method – Bayesian Method – Multiple Sequence Alignment Tools.

UNIT V MODELING SIMULATION AND COLLABORATION 8

Drug Discovery Fundamentals – Protein Structure – System Biology Tools – Collaboration and Communication – Standards – Issues – Case Study.

Total: 45hrs

TEXT BOOK:

1. Bryan Bergeron, "Bio Informatics Computing", Prentice Hall, 2003.

REFERENCES:

1. T.K. Affward, D.J. Parry Smith, "Introduction to Bio Informatics", Pearson Education, 2001.
2. Pierre Baldi, SorenBrunak, "Bio Informatics The Machine Learning Approach", 2nd Edition, First East West Press, 2003.

22250E34C - WIRELESS APPLICATION PROTOCOLS

AIM:

To introduction the advanced element in the field of wireless communication.

OBJECTIVE:

- Be able to discuss current and emerging technology in Wireless technology.
- Understand fundamental trends of technological evolution of Wireless technology.
- Have hands-on knowledge in developing simple and comprehensive WAP contents.
- Be able to create simple Wireless applicaitions.

UNIT-I: 9

Wireless Concepts - Technologies - An Overview of WAP - WAP Application Environment - WAP Gateways - WAP Gateway Services and Security.

UNIT-II: 9

WAP Components - Specification - Standard Execution Environment - Agent Characters - Main Protocols - WTP/WSP/WDP(UDPYWEMP Transportation and WTLS Protocol.

UNIT- III: 9

WAP Design and Development - The Development Tools - WML Language - WML Script Language.

UNIT-IV: 9

Implementing an Enterprise WAP Strategy, Wireless transmission- Spread spectrum - MAC - SDMA - FDMA - TDMA - CDMA - Cellular Wireless Networks.

UNIT-V: 9

Application Area of WAP: Wireless Operator's Interrelated Services -Mailbox Management - Searching the Phone Directory - Managing Personal Information.

Total:45hrs

TEXT BOOKS :

1. Steve Mann & Scott Sbihli, - Wireless Application Protocols - Wiley Computer Publishing - 2000
2. S.Ruseyev - WAP Technology & Applications - Easwar Press - 2003 .

REFERENCE BOOKS :

1. Sandeepsinghal , JariAlwinen., -The Wireless Application Protocol: Writing Applications for the Mobile Internet - Addison Wesley Publications - 2000 .

RESEARCH INTEGRATED CURRICULUM

The relationship between teacher and learner is completely different in higher education from what it is in school. At the higher level, the teacher is not there for the sake of the students; both have their justification in the common pursuit of knowledge.

Integrating research skills or Inquiry based learning becomes apparent to meet the changing needs of learners and their teachers, professional practice and society. For the students who are the professionals of the future, developing the ability to investigate problems, make judgments on the basis of sound evidences, take decisions on a rational basis and understand what they are doing and why is vital.

Research and inquiry is not just for those who choose to pursue an academic career. It is central to professional life in the twenty-first century.

It is observed that the modern world is characterized by heightened levels of complexity and uncertainty. Fluidity, fuzziness, instability, fragility, unpredictability, indeterminacy, turbulence, changeability, contestability these are some of the terms that mark out the world of the twenty-first century.

Teaching and research is correlated when they are co-relatedsuggests that one way of achieving this is to 'exploit further the link betweenteaching and research in the design of curricula.

Growing out of the research on Teaching- Research relations, the following framework has been developed and widely adopted to help individual staff, course teams and whole institutions to analyze their curricula and consider ways of strengthening students understanding through research.

The Curricula can be:

Research – Led: Learning about current research in the discipline

Here the curriculum focus is to ensure that what students learn clearly reflects current and ongoing research in their discipline. This may include research done by staff teaching them.

Research – Oriented: Developing research skills and techniques

Here the focus is on developing student's knowledge of and ability to carry out the research methodologies and methods appropriate to their discipline(s)

Research – Based: Undertaking research and inquiry

Here the curriculum focus is on ensuring that as much as possible the student learns in research and or inquiry mode (i.e. the students become producers of knowledge not just consumers). The strongest curricula form of this is in those special undergraduate programmesfor selected students, but such research and inquiry may also be mainstreamed for all or many students.

Research- Tutored: engaging in research discussions

Here the focus is on students and staff critically discussing ongoing research in the discipline.

All four ways of engaging students with research and inquiry are valid and valuable and curricula can and should contain elements of them.

Moreover, the student participation in research may be classified as,

- Level 1: Prescribed Research
- Level 2: Bounded Research
- Level 3: Scaffolded Research
- Level 4: Self actuated Research
- Level 5: Open Research

Taking into consideration the above mentioned facts in respect of integrating research into the B .Tech. (CSE) curriculum, the following Research Skill Based Courses are introduced in the curriculum.

Semester	**RSB Courses**	**Credits**
I	Research Led Seminar	1
II	Research Methodology	3
II	Participation in Bounded Research	2
III	Design Project/ Socio Technical Project (Scaffolded Research)	4
IV	Project Work	12

- **Blueprint for assessment of student's performance in Research Led Seminar Course**

  - **Internal Assessment: 40 Marks**
    - Seminar Report (UG)/Concept Note(PG) : 5 X 4= 20 Marks
    - Seminar Review Presentation : 10 Marks
    - Literature Survey : 10 Marks
  - **Semester Examination : 60 Marks**

    (Essay type Questions set by the concerned resource persons)

- **Blueprint for assessment of student's performance in Design Project**

  - **Continuous Internal Assessment through Reviews: 40 Marks**
    - Review I : 10 Marks
    - Review II : 10 Marks

- Review III : 20 Marks

- **Evaluation of Socio Technical Practicum Final Report: 40 Marks**
- **Viva- Voce Examination: 20 Marks**
- **Total: 100 Marks**

➢ **Blueprint for assessment of student's performance in Research Methodology Courses**

Continuous Internal Assessment: 20 Marks

- Research Tools(Lab) : 10 Marks
- Tutorial : 10 Marks

Model Paper Writing: 40 Marks

- Abstract : 5 Marks
- Introduction : 10 Marks
- Discussion : 10 Marks
- Review of Literature : 5 Marks
- Presentation : 10 Marks

Semester Examination: 40 Marks

Total: 100 Marks

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PRISTUNIVERSITY

VALLAM, THANJAVUR.

DEPARTMENT OF

COMPUTER SCIENCE & ENGINEERING

PROGRAM HANDBOOK

M.Tech

COMPUTER SCIENCE AND ENGINEERING

[PART TIME]

[REGULATION 2022]

[**for candidates admitted to M.Tech CSE program from June 2017 onwards**]

DEAN	**HOD**
ENGINEERING AND TECHNOLOGY	**DEPT.OF CSE**

COURSE STRUCTURE

SEMESTER - I

Semester. no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
I	22248S11AP	Higher Mathematics	4	1	0	4
I	22250H12P	Adhoc & Sensor Networks	4	0	0	4
I	22250H13P	Advanced Data Structures	4	0	0	4
Practical						
I	22250L14P	Advanced Web Technologies Lab	-	-	3	3
Total no of Credits					15	

SEMESTER - II

Semester. no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
II	22250H21P	Middleware Technologies	3	1	0	4
II	22250H22P	Internet of Things	4	0	0	4
II	22250E23_P	Elective I	3	0	0	3
Practical						
II	22250L24P	.NET Technologies Lab	-	-	3	3
II	222TECWRP	Technical Writing /Seminars	-	-	3	3
Total no of Credits					17	

SEMESTER - III

Semester.no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
III	22250H31P	Modern Operating System	4	0	0	4
III	22250E32P	Machine Learning Techniques	4	0	0	4
III	22250E33_P	Elective-II	3	0	0	3
Total no of Credits					11	

SEMESTER - IV

Semester no.	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
IV	22250H41P	Object Oriented Software Engineering	4	0	0	4
IV	22250H42P	Software Project Management	4	0	0	4
IV	22250E43_P	Elective-V	3	0	0	3
IV	22250P44P	Project Work- Phase I	-	-	6	10
Total no of Credits						**21**

SEMESTER - V

Semester no.	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
V	22250E51_P	Elective-IV	3	0	0	3
V	22250E52_P	Elective-V	3	0	0	3
V	22250E53_P	Elective-VI	3	0	0	3
Total no of Credits						**9**

SEMESTER - VI

Semester no.	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
VI	22250P61P	Project Work- Phase II	0	0	15	15
Total no of Credits						**15**

LIST OF ELECTIVES

SEMESTER - II ELECTIVE - I

Semester no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
II	22250E23AP	Advanced Distributed Computing	3	0	0	3
II	22250E23BP	Data Warehousing & Data Mining	3	0	0	3
II	22250E23CP	Information Retrieval Techniques	3	0	0	3

SEMESTER - III ELECTIVE - II

Semester no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
III	22250E33AP	Multimedia Systems	3	0	0	3
III	22250E33BP	Web Engineering	3	0	0	3
III	22250E33CP	Software Metrics	3	0	0	3

SEMESTER - IV - ELECTIVE - III

Semester no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
II	22250E43AP	Service Oriented Architecture	3	0	0	3
II	22250E43BP	High Speed Networks	3	0	0	3
II	22250E43CP	Language Technologies	3	0	0	3

SEMESTER - V - ELECTIVE - IV

Semester no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
III	22250E51AP	Cloud Computing	3	0	0	3
III	22250E51BP	Speech Processing and Synthesis	3	0	0	3
III	22250E51CP	Soft Computing	3	0	0	3

SEMESTER - V - ELECTIVE - V

Semester no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
III	22250E52AP	Advanced Database Technology	3	0	0	3
III	22250E52BP	Reconfigurable Computing	3	0	0	3
III	22250E52CP	Green Computing	3	0	0	3

SEMESTER - V - ELECTIVE - VI

Semester no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
III	22250E53AP	Software Quality Assurance	3	0	0	3
III	22250E53BP	Bio-inspired Computing	3	0	0	3
III	22250E53CP	Wireless Application Protocols	3	0	0	3

CREDITS DISTRIBUTION

Semester	Theory Courses		Elective Courses		Practical Courses		Project	Total Credit
	Nos	Credit	Nos	Credit	Nos	Credit	Credit	
I	3	**12**	-	**-**	1	**03**	-	**15**
II	2	**08**	1	**03**	2	**06**	-	**17**
III	2	**08**	1	**03**	-	**-**	-	**11**
IV	2	**08**	1	**03**	1	**-**	**10**	**21**
V	-	**-**	3	**9**	-	**-**	-	**9**
VI	-	**-**	-	**-**	-	**-**	**15**	**15**
TOTAL	9	**36**	6	**18**	3	**9**	**21**	**87**
TOTAL CREDITS								**88**

TOTALCREDITS	
Semester – I	**15**
Semester – II	**17**
Semester – III	**11**
Semester – IV	**21**
Semester –V	**9**
Semester –VI	**15**
TOTAL	**88**

22248S11AP - HIGHER MATHEMATICS

L T P C
31 0 4

AIM

To extend student's mathematical maturity and ability to deal with abstraction and to introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.

OBJECTIVES

At the end of the course, students would

- Have knowledge of the concepts needed to test the logic of a program.
- Have gained knowledge which has application in expert system, in data base and a basic for the prolog language.
- Have an understanding in identifying patterns on many levels.
- Be aware of a class of functions which transform a finite set into another finite set which relates to input output functions in computer science.
- Be exposed to concepts and properties of algebraic structures such as semigroups, monoids and groups.

UNIT I SETS, RELATIONS AND FUNCTIONS 9

Basic Concepts – Relationships between sets-Operations on sets-Principles of inclusion and exclusion – Minterms and Maxterms of a set – Relations partial ordering relation-Equivalence relation-Binary relations-Cyclic order relation – a= (mod m) relations: Partitions sets – Hassee diagram- functions: Properties- Composition - inverse function

UNIT II LOGIC 9

Propositional logic – Logical connectivity's-Truth table-Normal forms(Connective and disjunctive)-Predicate logic-Universal and existential quantifiers induction.

UNIT III COMBINATORICS 9

Basic of counting - counting arguments - Pigeonhole principle - Permutations and combinations - Recursion and Recurrence relations - Generating functions.

UNIT IV MODELLING COMPUTATION AND LANGUAGES 9

Finite state machines-Deterministic and Non-Deterministic finite state machines-Turing Machines-Formal Languages-Classes of Grammars-Type_0 – Context Sensitive-Context-Free-Regular Grammars-Ambiguity.

UNIT V LATICE AND BOOLEAN ALGEBRA 9

Partial order relation, poset-lattices, Hasse diagram-Boolean Algebra

Total No of periods: 45

REFERENCES:

1. J.P.Tremblay and R.Manohar, " Discrete Mathematical Structures with Application to Computer Science", TMH,NY-1997
2. M.K.Venkatraman, N.Sridharan and N.Chandrasekaran, " Discrete Mathematics", The National Publishing Company,2003
3. K.H.Rosen, Discrete Mathematics and its Applications, Mc-Graw Hill Book, 1999.

22250H12P-ADHOC & SENSOR NETWORKS **LTPC**

AIM:

To understand the current and emerging applications of the adhoc sensor networks.

OBJECTIVE:

To understand

- A broad overview of the state of wireless and ad hoc networking.
- The overview of the physical, networking and architectural issues of ad hoc networks.
- The technologies that will enable the next generation of ad hoc networks and the proliferation of ubiquitous computing.
- The sensor networks and the unique set of design challenges that they introduce.

UNIT I AD-HOC MAC 9

Introduction – Issues in Ad-Hoc Wireless Networks. MAC Protocols – Issues, Classifications of MAC protocols, Multi channel MAC & Power control MAC protocol.

UNIT II AD-HOC NETWORK ROUTING & TCP 9

Issues – Classifications of routing protocols – Hierarchical and Power aware. Multicast routing – Classifications, Tree based, Mesh based. Ad Hoc Transport Layer Issues. TCP Over Ad Hoc – Feedback based, TCP with explicit link, TCP-BuS, Ad Hoc TCP, and Split TCP.

UNIT III WSN -MAC 9

Introduction – Sensor Network Architecture, Data dissemination, Gathering. MAC Protocols – self-organizing, Hybrid TDMA/FDMA and CSMA based MAC.

UNIT IV WSN ROUTING, LOCALIZATION & QOS 9

Issues in WSN routing – OLSR, AODV. Localization – Indoor and Sensor Network Localization. QoS in WSN.

UNIT V MESH NETWORKS 9

Necessity for Mesh Networks – MAC enhancements – IEEE 802.11s Architecture – Opportunistic routing – Self configuration and Auto configuration – Capacity Models – Fairness – Heterogeneous Mesh Networks – Vehicular Mesh Networks.

Total : 45 hrs

REFERENCES:

1. C.Siva Ram Murthy and B.Smanoj, “ Ad Hoc Wireless Networks – Architectures and Protocols”, Pearson Education, 2004.
2. Feng Zhao and Leonidas Guibas, “Wireless Sensor Networks”, Morgan Kaufman Publishers, 2004.
3. C.K.Toh, “Ad Hoc Mobile Wireless Networks”, Pearson Education, 2002.
4. Thomas Krag and SebastinBuettrich, “Wireless Mesh Networking”, O’Reilly Publishers, 2007.

22250H13P - ADVANCED DATA STRUCTURES

L T P C
31 0 4

AIM:

To make the learners to understand the Analysis of algorithms and Data Structures.

OBJECTIVES :

To Understand

- The Different Heap Structures, Search Structures and Multimedia Structures.
- The various coding scheduling and algorithms.
- The various multimedia structures.

UNIT I FUNDAMENTALS : 9+3

Mathematical Induction -Asymptotic Notations –Properties of Big-oh Notation –Conditional Asymptotic Notation –Algorithm Analysis –Amortized Analysis –NP-Completeness –NP-Hard –Recurrence Equations –Solving Recurrence Equations –Memory Representation of Multi-dimensional Arrays –Time-Space Tradeoff.

UNIT II HEAP STRUCTURES : 9+3

Min/Max heaps –Deaps –Leftist Heaps –Binomial Heaps –Fibonacci Heaps –Skew Heaps –Lazy-Binomial Heaps.

UNIT III SEARCH STRUCTURE : 9+3

Binary Search Trees –AVL Trees –Red-Black trees –Multi-way Search Trees –B-Trees –Splay Trees –Tries.

UNIT IV MULTIMEDIA STRUCTURES : 9+3

Segment Trees –k-d Trees – Point Quad Trees –MX -Quad Trees – R-Trees –TV -Trees.

UNIT V ALGORITHMS : 9+3

Huffman Coding –Convex Hull –Topological Sort –Tree Vertex Splitting –Activity Networks –Flow Shop Scheduling –Counting Binary Trees –Introduction toRandomized Algorithms.

Total :60 hrs

REFERENCES

1. E. Horowitz, S.Sahni and Dinesh Mehta, Fundamentals of Data structures inC++, Uiversity Press, 2007.
2. E. Horowitz, S. Sahni and S. Rajasekaran, Computer Algorithms/C++, Second Edition, University Press, 2007.
3. G. Brassard and P. Bratley, Algorithmics: Theory and Practice, Printice –Hall,1988.
4. V.S. Subramanian, Principles of Multimedia Database systems, MorganKaufman,1998

22250L14P -ADVANCED WEB TECHNOLOGIES LAB

L T P C
0033

1. Creation of HTML pages with frames, links, tables and other tags.
2. Usage of internal and external CSS along with HTML pages.
3. Client side Programming
   i. Java script for displaying date and comparing two dates.
   ii. Form Validation including text field, radio buttons, check boxes, list box and other controls.
4. Usage of ASP/JSP objects response, Request, Application, Session, Server, ADO etc.
   i. Writing online applications such as shopping, railway/air/bus ticket reservation system with set of ASP/JSP pages.
   ii. Using sessions and cookies as part of the web application.

5. Writing Servlet Program using HTTP Servlet.
6. Any online application with database access.
7. Creation of XML document for a specific domain.
8. Writing DTD or XML schema for the domain specific XML document.
9. Parsing an XML document using DOM and SAX Parsers.
10. Sample web application development in the open source environment.

22250H21P - MIDDLEWARE TECHNOLOGIES

L T P C
31 0 4

AIM:

The aim of the course is to teach the role of middleware in the distributed environment and its common services.

OBJECTIVES:

- To study the set of services that a middleware system constitutes of.
- To understand how middleware facilitates the development of distributed applications in heterogeneous environments.
- To study how it helps to incorporate application portability, distributed application component interoperability and integration.
- To learn the object oriented middleware basics through the example of the following CORBA objects.
- To understand the basics of Web services that is the most often-used middleware technique.

UNIT – I **9+3**

Introduction : What is a distributed system- Client server Architecture – Multi-tierArchitecture-Middleware - Classification of middleware- Event based middleware-Object based Middleware - Message based middleware and its Principal functions- Introduction to concepts of database middleware.

UNIT – II **9+3**

RPC & message Passing middleware - Introduction to procedure calls - Principles of RPC Architecture- Structure of Communication - Java RMI

UNIT – III **9+3**

Other middleware: Introduction to EJB- Introduction to JDBC &ODBC **Interface Definition Language:** Introduction to specification - IDL Identifiers-Attributes type correction -Classes-Arrays- Documentation -Any type-Modules -Interfaces- Exceptionhandling -pre Compiler Directives -OO Design using IDL.

UNIT – IV **9+3**

CORBA: CORBA 2 Standard- Standard Object model- CORBA Architecture-CORBAClient and Object Implementation- Interface & Implementation repository-CORBA Services- Key Issues- Naming Services -Relationships- Event Services- life Cycle services- ObjectQuery Services-properties Services-Time Services- CORBA facilities & CORBA Domains.

UNIT –V **9+3**

COM: Classes- Objects-Query Interface-Dynamic Composition-Apartments-In processActivation -Server Lifetime-Server Lifetime-COM Security-Access Control-Tokenmanagement- Introduction to DCOM.

Total :60hrs

REFERENCE BOOKS:

1. Daniel Serian, “Middleware”, Springer Verlag, 1999.
2. Troy Bryan Downing, “Java RMI: Remote Method Invocation”, IDG Books India, 2000.
3. Thomas J Mowbray& William A Ruh, “Inside CORBA Distributed Objects and Application”, Addison Wesley, 1999.
4. Alan Pope, “CORBA Complete Reference Guide”, Addison Wesley, 1998.
5. Don Box, “Essential Com”, Addison Wesley, 1999

22250H22P - INTERNET OF THINGS

L T P C
4 0 0 4

AIM:

To introduce the student to various IOT techniques.

OBJECTIVES:

- TounderstandthefundamentalsofInternetofThings
- Tolearn about thebasicsofIOT protocols
- Tobuild asmalllowcostembeddedsystem usingRaspberry Pi.

Toapply theconceptofInternetofThingsinthereal worldscenario.

UNITI INTRODUCTION TOIoT 9

Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels &Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management withNETCONF-YANG-IoTPlatformsDesign Methodology

UNITII IoT ARCHITECTURE 9

M2Mhigh-levelETSIarchitecture-IETFarchitectureforIoT-OGCarchitecture-IoTreference model-Domainmodel-informationmodel-functionalmodel-communicationmodel-IoTreferencearchitecture

UNITIII IoTPROTOCOLS 9

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFIDProtocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus–ZigbeeArchitecture–Networklayer–6LowPAN-CoAP-Security

UNITIV BUILDINGIoTWITH RASPBERRY PI&ARDUINO 9

Building IOT with RASPERRY PI-IoT Systems - Logical Design using Python – IoT PhysicalDevices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi -RaspberryPi Interfaces -ProgrammingRaspberryPi with Python- Other IoT Platforms- Arduino.

UNITV CASE STUDIESAND REAL-WORLD APPLICATIONS 9

Realworlddesignconstraints-Applications-Assetmanagement,Industrialautomation,smartgrid,Commercialbuildingautomation,Smartcities-participatorysensing-DataAnalyticsforIoT –Software& ManagementToolsforIoT CloudStorageModels&CommunicationAPIs–Cloud for IoT-AmazonWeb ServicesforIoT.

TOTAL: 45PERIODS

REFERENCES:

1. ArshdeepBahga,VijayMadisetti,―InternetofThings–Ahands-on approach‖,UniversitiesPress,2015

2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), ―Architecting theInternetofThings‖,Springer,2011.
3. HonboZhou,―TheInternetofThingsintheCloud:AMiddlewarePerspective‖, CRCPress,2012.
4. Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, StefanAvesand.DavidBoyle,"FromMachine-to-Machine totheInternetofThings-Introductiontoa NewAgeofIntelligence",Elsevier, 2014.
5. Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things – KeyapplicationsandProtocols‖,Wiley,2012

22250L24P - .NET TECHNOLOGIES LAB

L T P C
0033

Develop the following in ASP .NET or VB.NET.

1. Query textbox and Displaying records
2. Display records by using database
3. Datalist link control
4. Databinding using dropdownlist control
5. Datagrid paging

Develop the following in C#.NET.

1. Demonstrate Use Of Virtual and override keyword in C# with a simple Program.
2. Write a Program in C# to implement Stack operations.
3. Write a Program to demonstrate Operator overloading.
4. Demonstrate arrays of interface types with a C# program.
5. Write a Program in C# to build a class which implements an interface which already exists.

22250H31P - MODERN OPERATING SYSTEM

L T P C
40 0 4

AIM:

To have a thorough knowledge of processes, scheduling concepts, memory management, I/O and file systems, multimedia operating system and recent operating systems.

OBJECTIVES:

- To have an overview of different types of operating systems.
- To know the components of an operating system.
- To have a thorough knowledge of process management.
- To have a thorough knowledge of storage management.
- To know the concepts of I/O and file systems.
- To know the concepts of multimedia operating systems.

UNIT I **9**

Introduction – computer hardware review – operating system zoo - Operating System Concepts - System Calls - Operating System Structure -.Process And Threads : Processes – Threads - Interprocess Communication - Scheduling.

Unit II **9**

Memory Management Memory Abstraction:Address Spaces, No Memory Abstraction - Virtual Memory - Page Replacement Algorithms - Modeling Page Replacement Algorithms - Design Issues For Paging Systems – Segmentation. File Systems:File Directories File System Implementation

Unit III **9**

Deadlocks - Introduction To Deadlocks - The Ostrich Algorithm - Deadlock Detection And Recovery - Deadlock Avoidance - Deadlock Prevention - Other Issues – Input/output Principles of I/O Hardware – Principles of I/O Software – I/O Software Layers – Disks – Clocks – Thin Clients.

Unit IV **9**

Multiple processor systems - multiprocessors - multicomputers - virtulazitation - distributed systems - multimedia operating systems . Multimedia files - video compression audio compression – multimedia scheduling - disk scheduling for multimedia.

Unit V **9**

Case Study – LINUX , WINDOWS VISTA , SYMBIAN OS

Total : 45 hrs

TEXT BOOK:

1. Andrew S. Tanenbaum , “Modern Operating Systems “ , Pearson Education , 3rd Edition , 2009

REFERENCE BOOKS:

1. Silberschatz, Galvin, Gagne " Operating System Concepts" Sixth Edition, 2003 .

2. Achut S. Godbole and KahateAtul , "Operating Systems & Systems Programming ", Tata Mcgraw Hill, 2003.
3. Charles Crowley, " Operating systems: A Design Oriented Approach", Tata McGraw Hill, 999.

22250E32P - MACHINE LEARNING TECHNIQUES

AIM:

The main objective of this paper is to make the students to know the need of MachineLearning Techniques.

OBJECTIVES:

- To introduce students to the basic concepts and techniques of Machine Learning.
- To have a thorough understanding of the Supervised and Unsupervised learning techniquesTo study the various probability based learning techniques
- To understand graphical models of machine learning algorithms

UNITI INTRODUCTION 9

Learning – Types of Machine Learning – Supervised Learning – The Brain and theNeuron –DesignaLearningSystem –PerspectivesandIssuesinMachineLearning –LinearSeparability–LinearRegression.

UNITII LINEARMODELS 9

Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multi-layer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back-Propagation–RadialBasisFunctionsandSplines–Concepts–RBFNetwork– CurseofDimensionality–InterpolationsandBasisFunctions–SupportVectorMachines.

UNITIII TREE ANDPROBABILISTICMODELS 9

Learning with Trees – Decision Trees – Constructing Decision Trees – Classification andRegression Trees – Ensemble Learning – Boosting – Bagging – Different ways to CombineClassifiers – Probability and Learning – Data into Probabilities – Basic Statistics –GaussianMixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms –VectorQuantization–SelfOrganizingFeatureMap

UNITIV DIMENSIONALITYREDUCTIONANDEVOLUTIONARYMODELS 9

Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – FactorAnalysis – Independent Component Analysis – Locally Linear Embedding – Isomap – LeastSquares Optimization – Evolutionary Learning – Genetic algorithms – Genetic Offspring: - GeneticOperators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting LostExample–MarkovDecisionProcess

UNITV GRAPHICALMODELS 9

Markov ChainMonteCarloMethods–Sampling–ProposalDistribution–MarkovChainMonteCarlo–GraphicalModels–BayesianNetworks–MarkovRandomFields– HiddenMarkovModels–TrackingMethods

Total : 45 hrs

REFERENCES:

EthemAlpaydin,—IntroductiontoMachineLearning3e(AdaptiveComputationandMachineLearning Series)‖, ThirdEdition,MITPress,2014
JasonBell,—Machinelearning–HandsonforDevelopersandTechnicalProfessionals‖,FirstEdition,Wiley, 2014
PeterFlach,—MachineLearning:TheArtandScienceofAlgorithmsthatMakeSenseofData‖,FirstEdition,CambridgeUniversity Press,2012.
StephenMarsland,—MachineLearning–AnAlgorithmicPerspective‖,SecondEdition,ChapmanandHall/CRCMachineLearningandPatternRecognitionSeries,2014.
TomMMitchell,—MachineLearning‖,FirstEdition,McGrawHillEducation,2013.

22250H41P - OBJECT ORIENTED SOFTWARE ENGINEERING

L T P C
40 0 4

AIM:

To learn the advanced software engineering principles and methodologies for Effective software development.

OBJECTIVES:

- To learn about software prototyping, analysis and design.
- To learn UML and its usage.
- Case studies to apply the principles.

UNIT - 1 INTRODUCTION 8

Software Engineering Paradigms - Software Development process models - Project & Process - Project management – Process & Project metrics - Object Oriented concepts & Principles.

UNIT - 2 PLANNING & SCHEDULING 9

Software prototyping - Software project planning – Scope – Resources - Software Estimation - Empirical Estimation Models-Planning-Risk Management - Software Project Scheduling – ObjectOriented Estimation & Scheduling.

UNIT - 3 ANALYSIS & DESIGN 12

Analysis Modeling - Data Modeling - Functional Modeling & Information Flow-Behavioral Modeling-Structured Analysis - Object Oriented Analysis - Domain Analysis-Objectoriented Analysis process - Object Relationship Model - Object Behaviour Model. Design Concepts & Principles - Design Process - Design Concepts - Modular Design –Design Effective Modularity - Introduction to Software Architecture - Data Design – TransformMapping – Transaction Mapping – OOD - Design System design process- Object design process -Design Patterns.

UNIT - 4 IMPLEMENTATION & TESTING 8

Top-Down, Bottom-Up, object oriented product Implementation& Integration. Software testingmethods-White Box, Basis Path-Control Structure –Black Box-Unit Testing- Integration testing-Validation & System testing. Testing OOA & OOD models-Object oriented testing strategies.

UNIT – 5 MAINTENANCE 8

Maintenance process-System documentation-program evolution dynamics-Maintenance costs-Maintainability measurement – Case StudiesThe laboratory shall include development of systems applying the Software Engineering principlesand methods for specific applications.

Total: 45 hrs

TEXT BOOKS:

1. Roger S. Pressman, " Software Engineering A Practitioner's Approach" , Fifth Edition,Tata McGraw Hill.
2. Grady Booch,JamesRumbaugh,Ivar Jacobson –"the Unified Modeling Language User Guide" – Addison Wesley,1999. (Unit III)

REFERENCE BOOKS:

1. Ian Sommerville, "Software Engineering", V Edition Addison- Wesley 1996.
2. PankajJalote "An Integrated Approach to Software Engineering" Narosa Publishing House 1991
3. Carlo Ghezzi Mehdi Jazayer, Dino Mandrioli "Fudamentals of Software Engineering"Prentice Hall of India 2002.
4. Fairley, "Software Engineering Concepts", Mc.Graw Hill 1985.

22250H42P - SOFTWARE PROJECT MANAGEMENT

L T P C
40 0 4

AIM:

Software Project Management provides insight to the importance of careful project management

OBJECTIVES:

- Understand Project planning and management.
- Identify Client management and project definition.
- Understand testing based approach to development.
- Team management and ongoing schedule tracking.

UNIT I FUNDAMENTALS 9

Conventional Software Management – Evolution of Software Economics – Improving Software Economics – Conventional versus Modern Software Project Management.

UNIT II SOFTWARE MANAGEMENT PROCESS FRAMEWORK 9

Lifecycle Phases – Artifacts of the Process – Model Based Software Architectures – Workflows of the Process – Checkpoints of the Process.

UNIT III SOFTWARE MANAGEMENT DISCIPLINES 9

Iterative Process Planning – Organization and Responsibilities – Process Automation – Process Control and Process Instrumentation – Tailoring the Process.

UNIT IV MANAGED AND OPTIMIZED PROCESS 9

Data Gathering and Analysis – Principles of Data Gathering – Data Gathering Process – Software Measures – Data Analysis – Managing Software Quality – Defect Prevention.

UNIT V CASE STUDIES 9

COCOMO Cost Estimation Model – Change Metrics – CCPDS–R.

Total: 45hrs

TEXT BOOKS:

1. Walker Royce "Software Project Management A Unified Framework", Pearson Education, 2004
2. Humphrey Watts, "Managing the software process", Addison Wesley, 1989. (Unit IV)

REFERENCES:

1. Ramesh Gopalaswamy, "Managing Global Projects", Tata McGraw Hill, 2001.
2. Bob Hughes, Mikecotterell, "Software Project Management", 3rd Edition, Tata cGraw Hill, 2004.

22250CRM- RESEARCH METHODOLOGY

AIM

To give an exposure to development of research questions and the various statistical methods suitable to address them through available literature, with basic computational operators.

OBJECTIVES:

- To understand the approaches towards and constraints in good research.
- To identify various statistical tools used in research methodology
- To appreciate and compose the manuscript for publication
- To train in basic computational and excel- skills for research in engineering.

OUTCOME:

Ability to develop research questions and the various research strategies, and compile research results in terms of journal manuscripts.

PREREQUISITES:

Research Methodology course in UG level or equivalent knowledge.

UNIT I

Introduction to Research — Criteria of Good Research, Research Problem: Definition of research problem, selecting the problem - Necessity of defining the problem - Techniques involved in defining the problem-Basic principles of experimental designs-Descriptive and experimental design – different types of experimental design – Validity of findings – internal and external validity – Variables in Research – Measurement and Scaling – Different scales. Ethics & Misconduct in research, Plagiarism,

UNIT II

Formulation of Hypothesis – Sampling techniques –Sampling error and sample size-Methods of data collection – Primary and secondary data – observation – Collection of literature, manual collection from library, usage of library, collection of literature from Scopus, Science Direct etc., compiling literature, software utilization in literature collection- Processing and analysis of data – editing – coding – transcription – tabulation –outline of statistical analysis.

UNIT III

Data Analysis using Excel- Tabulation of Data in excel (Creating Master Table and Sub Table), Formulas and Functions, Filters and Sort and Validation Lists, Data from External Sources. Data Analysis Using Charts and Graphs(Pivot Table & Charts), Time Value of Money, Measure of central tendency: mean, median, mode, Measure of dispersion: variance, standard deviation, Coefficient of variation. Correlation, regression lines. Z-test, t- test F-test, ANOVA one way classification, Chi square test, independence of attributes. Time series: forecasting Method of least squares, Moving average method, Introduction to presentation tool, features and functions, Creating Presentation, Customizing presentation.

UNIT IV

Various research methods-Design of Experiments, Response Surface Methodology, Taguchi Methods- Modeling & Simulation of Engineering Systems, Artificial Neural Networks, Fuzzy Logic, MATLAB - Graph Theory- Finite Element Methods, Computational Fluid Dynamics -R programming in Statistics- open source software

UNIT V

Review of literature, Report writing – target audience – types of reports – contents of reports – styles and Conventions in reporting – steps in drafting a report. Basic concept of research paper writing for Journals and formats of publications in Journals, Report Structure - writing research abstract - introduction, review of literature, result, conclusions, Concepts of Bibliography and references

References:

1. C. R. Kothari, Research Methodology, New Age International Publishers. New Delhi, 2004.

2. Rajammal.P. Devadas, 1976, A hand book of methodology of research, RMM Vidyalaya Press.

3. R.A Day and A.L. Underwood, Quantitative analysis, Prentice Hall, 1999.

4. R. Gopalan, Thesis writing, Vijay Nicole Imprints Private Ltd., 2005.

5. W.J. DeCoursey, Statistics and Probability for Engineering Applications With Microsoft® Excel, Newnes, 2003.

6. Archibald Fripp, Jon Fripp, Michael Fripp; Just-in-Time Math for Engineers, Elsevier Science & Technology Books, 2003.

SEMESTER - I - ELECTIVE - I 22250E23AP -
ADVANCED DISTRIBUTED COMPUTING

L T P C
40 0 4

AIM:

This course discusses the depth concepts of distributed computing and its features.

OBJECTIVES:

Understanding the concepts of

- processing . distributed systems, operating system issues.
- learn about distributed transaction
- study about the distributed databases.

UNIT-I INTRODUCTION 9

Characterization of Distributed Systems - Examples - Resource Sharing and the Web - Challenges – System Models - Architectural and Fundamental Models - Networking and Internetworking - Types of Networks - Network Principles - Internet Protocols - Case Studies: Ethernet, WiFi.

UNIT-II PROCESSES AND DISTRIBUTED OBJECTS 9

Interprocess Communication - The API for the Internet Protocols - External Data Representation and Marshalling - Client-Server Communication - Group Communication - Case Study: Interprocess communication in UNIX - Distributed Objects and Remote Invocation - Communication Between Distributed Objects - Remote Procedure Call - Events and Notifications - Case Study: Java RMI.

UNIT-III OPERATING SYSTEM ISSUES 9

The OS Layer - Protection - Processes and Threads - Communication and Invocation – OS Architecture - Security - Overview - Cryptographic Algorithms - Digital Signatures - Cryptography Pragmatics – Case Studies Kerberos, 802.11 WiFi - Distributed File Systems - File Service Architecture - Sun Network File System - Distributed Debugging - Distributed Mutual Exclusion – Elections – Multicast Communication Related Problems.

UNIT-IV DISTRIBUTED TRANSACTION PROCESSING 9

Transactions - Nested Transactions - Locks - Optimistic Concurrency Control - Timestamp Ordering - Comparison - Flat and Nested Distributed Transactions - Atomic Commit Protocols - Concurrency Control in Distributed Transactions - Transaction Recovery - Overview of Replication And Distributed Multimedia Systems.

UNIT-V DISTRIBUTED DATABASES 9

Features of Distributed versus Centralized Databases -Principles of Distributed Databases - Levels of Distribution Transparency -Reference Architecture for Distributed Databases - Types of Data Fragmentation - Integrity Constraints in Distributed Databases.

Total : 45 hrs

TEXT BOOKS :

1 George Coulouris, Jean Dollimore and Tim Kindberg, “Distributed Systems Concepts and Design”, Pearson Education, 4th Edition, 2005.

1. Distributed Database Principles & Systems, Stefano Ceri, Giuseppe Pelagatti McGraw -Hill

REFERENCES:

1 SapeMullender, “Distributed Systems”, Addison Wesley, 2 nd Edition, 1993.

2 Albert Fleishman, “Distributes Systems - Software Design and Implementation”, Springer - Verlag, 1994.

3 M.L.Liu, “Distributed Computing Principles and Applications”, Pearson Education, 2004.

4 Andrew S Tanenbaum, Maartenvan Steen,”Distibuted Systems –Principles and Pardigms”,Pearson Education, 2002.

5 Mugesh Singhal,Niranjan G Shivaratri,”Advanced Concepts in Operating Systems”,Tata McGraw Hill Edition, 2001.

6. Principles of Distributed Database Systems, M.Tamer Ozsu, Patrick Valduriez –Pearson Education

22250E23BP- DATA WAREHOUSING & DATA MINING

L T P C 4 0 0 4

AIM:

To serve the students with an emphasis on the design aspects of Data Mining and Data Warehousing.

OBJECTIVES:

- To introduce the concept of data mining with in detail coverage of basic tasks, metrics, issues, and implication. Core topics like classification, clustering and association rules are exhaustively dealt with.
- To introduce the concept of data warehousing with special emphasis on architecture and design.

UNIT-I INTRODUCTION 9

Introduction: Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Major issues in Data Mining, Data Warehousing and Business Analysis: - Data warehousing Components –Building a Data warehouse – Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata – reporting – Query tools and Applications – OnlineAnalytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.

UNIT-II DATA MINING AND ASSOCIATION RULE MINING 9

Data Mining: - Data Mining Functionalities – Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation.

Association Rule Mining: - Efficient and Scalable Frequent Item set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint-Based Association Mining.

UNIT-III CLASSIFICATION AND PREDICTION 9

Classification and Prediction: - Issues Regarding Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification –

Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.

UNIT IV CLUSTER ANALYSIS 9

Cluster Analysis: - Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering High- Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis.

UNIT V MINING OTHER DATA 9

Mining Object, Spatial, Multimedia, Text and Web Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Spatial Data Mining – Multimedia Data Mining

– Text Mining – Mining the World Wide Web.

TOTAL = 45HRS

REFERENCES:

1. Jiawei Han and Micheline Kamber "Data Mining Concepts and Techniques" Second Edition, Elsevier, Reprinted 2008.
2. Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition, Tenth Reprint 2007.
3. K.P. Soman, Shyam Diwakar and V. Ajay "Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2006.
4. G. K. Gupta "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.
5. Pang-Ning Tan, Michael Steinbach and Vipin Kumar "Introduction to Data Mining", Pearson Education, 2007.

22250E23C- ARTIFICIAL NEURAL NETWORKS

L T P C
4 0 0 4

AIM:

To give out the students with an importance on the various aspects of artificial neural networks.

OBJECTIVES:

- To introduce the concepts of artificial neural networks such as biological neural networks, clustering and structures
- To study the linear models for regression , classification, kernel methods and feed forward neural networks

UNIT-I Introduction to artificial neural networks 9

Biological neural networks - Pattern analysis tasks: Classification, Regression, Clustering - Computational models of neurons - Structures of neural networks - Learning principles.

UNIT-II Linear models for regression and classification 9

Polynomial curve fitting - Bayesian curve fitting - Linear basis function models – Bias - variance decomposition - Bayesian linear regression - Least squares for classification - Logistic regression for classification - Bayesian logistic regression for classification

UNIT-III Feedforward neural networks 9

Pattern classification using perception - Multilayer feed forward neural networks (MLFFNNs) - Pattern classification and regression using MLFFNNs - Error back propagation learning - Fast learning methods: Conjugate gradient method – Auto associative neural networks - Bayesian neural networks.

UNIT-IV Kernel methods for pattern analysis 9

Statistical learning theory - Support vector machines for pattern classification - Support vector regression for function approximation - Relevance vector machines for classification and regression - **Self-organizing maps:** Pattern clustering - Topological mapping - Kohonen's self-organizing map.

UNIT-V Feedback neural networks 9

Pattern storage and retrieval - Hopfield model - Boltzmann machine - Recurrent neural networks.

Total: 45 hrs

TEXT BOOKS:

1. B.Yegnanarayana, Artificial Neural Networks, Prentice Hall of India, 1999
2. Satish Kumar, Neural Networks – A Classroom Approach, Tata McGraw-Hill, 2003
3. S.Haykin, Neural Networks – A Comprehensive Foundation, Prentice Hall, 1998
4. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006

SEMESTER - III - ELECTIVE - II

22250E33AP - MULTIMEDIA SYSTEMS

L T P C
40 0 4

AIM:

To impart knowledge on Multimedia system and design.

OBJECTIVES:

- To study the graphics techniques and algorithms.
- To study the multimedia concepts and various I/O technologies

UNIT 1 Introduction 9

Line - Curve and Ellipse Drawing Algorithms – Attributes – Two-Dimensional Geometric Transformations – Two-Dimensional Clipping and Viewing.

UNIT II Three-Dimensional Concepts 9

Three-Dimensional Object Representations – Three-Dimensional Geometric and Modeling Transformations – Three-Dimensional Viewing – Color models – Animation.

UNIT IIIMultimedia Systems Design 9

An Introduction – Multimedia applications – Multimedia System Architecture – Evolving technologies for Multimedia – Defining objects for Multimedia systems – Multimedia Data interface standards – Multimedia Databases.

UNIT IVMultimedia File Handling 9

Compression & Decompression – Data & File Format standards – Multimedia I/O technologies - Digital voice and audio – Video image and animation – Full motion video – Storage and retrieval Technologies.

UNIT V Hypermedia 9

Multimedia Authoring & User Interface – Hypermedia messaging - Mobile Messaging – Hypermedia message component – Creating Hypermedia message – Integrated multimedia message standards – Integrated Document management – Distributed Multimedia Systems.

Total: 45 Hours

REFERENCES:

1. Donald Hearn and M.Pauline Baker, “Computer Graphics C Version”, Pearson Education, 2003. (UNIT I : Chapters 1 to 6; UNIT 2: Chapter 9 – 12, 15, 16)
2. Prabat K Andleigh and Kiran Thakrar, “Multimedia Systems and Design”, PHI, 2003.(UNIT 3 to 5)
3. Judith Jeffcoate, “Multimedia in practice technology and Applications”, PHI, 1998.
4. Foley, Vandam, Feiner, Huges, “Computer Graphics: Principles & Practice”, Pearson Education, second edition 2003.

22250E33BP- GENETIC ALGORITHMS

L T P C
40 0 4

AIM:

To make the students learn the fundamentals of Genetic Algorithms and search technique used in computing.

OBJECTIVES:

1. Understand and be able to apply fundamental GA theory.
2. be able to implement or modify simple genetic algorithms.
3. be able to apply GAs to problems in the student's field.
4. to find exact or approximate solutions to optimization and search problems.

UNIT-I **9**

Introduction : Abrief history of evolutionary computation, Elements of Genetic Algorithms, A simple genetic algorithm, Applications of genetic algorithms. Genetic Algorithms in Scientific models - Evolving computer programs, data analysis & prediction, evolving neural networks, modeling interaction between learning & evolution, modeling sexual selection, measuring evolutionary activity.

UNIT-II **9**

Theoretical Foundation of genetic algorithm : Schemas & Two-Armed and k-armed problem, royal roads, exact mathematical models of simple genetic algorithms, Statistical- Mechanics Approaches.

UNIT-III **9**

Computer Implementation of Genetic Algorithm : Data structures, Reproduction, crossover & mutation, mapping objective functions to fitness form, fitness scaling, coding, a multiparameter, mapped, fixed point coding, discretization and constraints.

UNIT-IV **9**

Some applications of genetic algorithms : The risk of genetic algorithms, De Jong & function optimization, Improvement in basic techniques, current application of genetic algorithms

UNIT-V **9**

Advanced operators & techniques in genetic search : Dominance, duplicity, & abeyance, inversion &otherreordering operators, other micro operators, Niche & speciation, multi objective optimization, knowledge based techniques, genetic algorithms & parallel processors.

Total : 45hrs

TEXT BOOKS:

1. David E. Goldberg, “Genetic algorithms in search, optimization & Machine Learning” Pearson Education, 2006

REFERENCE BOOKS:

1. Melanle Mitchell, “An introduction to genetic algorithms”, Prentice HallIndia, 2002.
2. Michael D. Vose, “The simple genetic algorithm foundations and theory, Prentice Hall India, 1999.
3. Masatoshi Sakawa, “Genetic Algorithms & Fuzzy Multiobjective Optimization”, Kluwer Academic Publisher, 2001
4. D. Quagliarella, J Periaux, C Poloni& G Winter, “Genetic Algorithms in Engineering & Computer science”, John Wiley & Sons, First edition, 1997

22250E33CP-SOFTWARE METRICS

L T P C
40 0 4

AIM:

To understand software quality metrics.

OBJECTIVES:

- To introduce an integrated approach to software development incorporating quality management methodologies.
- To study about the quality improvements in software
- To understand the Software Quality software standards

UNIT I MEASUREMENTS THEORY 9

- Measurements In Software Engineering - Scope Of Software Metrics - Measurements Theory - Goal Based Framework – SoftwareMeasurement Validation.

UNIT II DATA COLLECTION AND ANALYSIS 9

Empirical Investigation - Planning Experiments - Software Metrics Data Collection - Analysis Methods – Statistical Methods.

UNIT III PRODUCTS METRICS 9

Measurement Of Internet Product Attributes - Size And Structure - External Product Attributes - Measurement Of Quality.

UNIT IV QUALITY METRICS 9

Software Quality Metrics - Product Quality - Process Quality - Metrics For Software Maintenance - Case Studies Of Metrics Program - Motorola - Hp And IBM.UNIT V MANAGEMENT METRICS 9

Quality Management Models - Rayleigh Model - Problem Tracking Report (PTR) Model - Reliability Growth Model - Model Evaluation - Orthogonal Classification.

TOTAL = 45

REFERENCES:

1. Norman E – Fentar, Share Lawrence Pflieger, "Software Metrics", International Thomson Computer Press, 1997.

2. Stephen H. Kin, "Metric and Models in Software Quality Engineering", Addison Wesley

SEMESTER - IV - ELECTIVE - III

22250E43AP- SERVICE ORIENTED ARCHITECTURE

AIM:

To familiarize the students with the concepts of service oriented architectures. (SOA).

OBJECTIVES:

- Understand SOA, service orientation and web services
- Analyzing and designing business based on SOA principles.
- Learning the concepts of XML.

UNIT I **9**

Software Architecture – Types of IT Architecture – SOA – Evolution – Key components – perspective of SOA – Enterprise-wide SOA – Architecture – Enterprise Applications –Solution Architecture for enterprise application – Software platforms for enterpriseApplications – Patterns for SOA – SOA programming models.

UNIT II **9**

Service-oriented Analysis and Design – Design of Activity, Data, Client and businessprocess services – Technologies of SOA – SOAP – WSDL – JAX – WS – XML WS for.NET – Service integration with ESB – Scenario – Business case for SOA – stakeholderobjectives – benefits of SPA – Cost Savings

UNIT III **9**

SOA implementation and Governance – strategy – SOA development – SOAgovernance – trends in SOA – event-driven architecture – software s a service – SOAtechnologies – proof-of-concept – process orchestration – SOA best practices

UNIT IV **9**

Meta data management – XML security – XML signature – XML Encryption – SAML – XACML – XKMS – WS-Security – Security in web service framework – advancedmessaging

UNIT V **9**

Transaction processing – paradigm – protocols and coodination – transactionspecifications – SOA in mobile – research issues

Total: 45 hrs

REFERENCES:

1. Shankar Kambhampaly, “Service –Oriented Architecture for Enterprise Applications”,Wiley India Pvt Ltd, 2008.
2. Eric Newcomer, Greg Lomow, “Understanding SOA with Web Services”, PearsonEducation.
3. Mark O’ Neill, et al. , “Web Services Security”, Tata McGraw-Hill Edition, 2003.

22250E43BP - HIGH SPEED NETWORKS L T P C 4 0 0 4

AIM:

To study the various performance and analysis issues involved in high-speed data transmission.

OBJECTIVES:

Be able to

- Describe and interpret the basics of high speed networking technologies.
- Apply the concept learnt in this course to optimize and troubleshoot high-speed network.
- Demonstrate the knowledge of network planning and optimization

UNIT - 1 : HIGH SPEED NETWORKS 9

Frame Relay Networks - Asynchronous transfer mode - ATM Protocol Architecture, ATM logical Connection, ATM Cell - ATM Service Categories - AAL. High Speed LANs: Fast Ethernet, Gigabit Ethernet, Fiber Channel - Wireless LANs: applications, requirements - Architecture of 802.11

UNIT - 2 : CONGESTION AND TRAFFIC MANAGEMENT 9

Queuing Analysis- Queuing Models - Single Server Queues - Effects of Congestion - Congestion Control - Traffic Management - Congestion Control in Packet Switching Networks - Frame Relay Congestion Control.

UNIT - 3 : TCP AND ATM CONGESTION CONTROL 9

TCP Flow control - TCP Congestion Control - Retransmission - Timer Management - Exponential RTO backoff - KARN's Algorithm - Window management - Performance of TCP over ATM. Traffic and Congestion control in ATM - Requirements - Attributes - Traffic Management Frame work, Traffic Control - ABR traffic Management - ABR rate control, RM cell formats, ABR Capacity allocations - GFR traffic management.

UNIT - 4 : INTEGRATED AND DIFFERENTIATED SERVICES 9

Integrated Services Architecture - Approach, Components, Services- Queuing Discipline, FQ, PS, BRFQ, GPS, WFQ - Random Early Detection, Differentiated Services

UNIT - 5 : PROTOCOLS FOR QOS SUPPORT 9

RSVP - Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms - Multiprotocol Label Switching - Operations, Label Stacking, Protocol details - RTP - Protocol Architecture, Data Transfer Protocol, RTCP.

Total: 45 hrs

TEXT BOOK:

1. William Stallings, "HIGH SPEED NETWORKS AND INTERNET", Pearson Education,

Second Edition, 2002.

REFERENCES:
1. Warland & Pravin Varaiya, "HIGH PERFORMANCE COMMUNICATION NETWORKS", Jean Harcourt Asia Pvt. Ltd., II Edition, 2001.
2. Irvan Pepelnjk, Jim Guichard and Jeff Apcar, "MPLS and VPN architecture", Cisco Press, Volume 1 and 2, 2003

22250E43CP- EMBEDDED SYSTEMS LTPC4004

AIM:

To give sufficient background for embedded systems design.

OBJECTIVES:

- To introduce students to the embedded systems, its hardware and software.
- To introduce devices and buses used for embedded networking.
- To explain programming concepts and embedded programming in C and C++.
- To explain real time operating systems, inter-task communication and an exemplary case of MUCOS – IIRTOS.

UNIT-I INTRODUCTION TO EMBEDDED SYSTEMS 9

Definition and Classification – Overview of Processors and hardware units in an embedded system – Software embedded into the system – Exemplary Embedded Systems – Embedded Systems on a Chip (SoC) and the use of VLSI designed circuits

UNIT-II DEVICES AND BUSES FOR DEVICES NETWORK 9

I/O Devices - Device I/O Types and Examples – Synchronous - Iso-synchronous and Asynchronous Communications from Serial Devices - Examples of Internal Serial-Communication Devices - UART and HDLC - Parallel Port Devices - Sophisticated interfacing features in Devices/Ports- Timer and Counting Devices - '12C', 'USB', 'CAN' and advanced I/O Serial high speed buses- ISA, PCI, PCI-X, cPCI and advanced buses.

UNIT-III EMBEDDED PROGRAMMING 9

Programming in assembly language (ALP) vs. High Level Language - C Program Elements, Macros and functions -Use of Pointers - NULL Pointers - Use of Function Calls – Multiple function calls in a Cyclic Order in the Main Function Pointers – Function Queues and Interrupt Service Routines Queues Pointers – Concepts of EMBEDDED PROGRAMMING in C++ - Objected Oriented Programming – Embedded Programming in C++, 'C' Program compilers – Cross compiler – Optimization of memory codes.

UNIT-IV REAL TIME OPERATING SYSTEMS – PART - 1 9

OS Services – Interrupt Routines Handling, Task scheduling models - Handling of task scheduling and latency and deadlines as performance metrics - Inter Process Communication And Synchronisation – Shared data problem – Use of Semaphore(s) – Priority Inversion Problem and Deadlock Situations – Inter Process Communications using Signals – Semaphore Flag or mutex as Resource key – Message Queues – Mailboxes – Pipes – Virtual (Logical) Sockets – RPCs.

UNIT-V REAL TIME OPERATING SYSTEMS – PART - 2 9

Study of RTOS, VxWorks - Basic Features - Task Management Library at the System - Library Header File - VxWorks System Functions and System Tasks - Inter Process (Task) Communication Functions - Case Study of Coding for Sending Application Layer Byte Streams on a TCP/IP Network Using RTOS Vxworks

Total : 45hrs

REFERENCE:

1. Rajkamal, Embedded Systems Architecture, Programming and Design, TATA McGraw Hill, First reprint 2003
2. David E.Simon, An Embedded Software Primer, Pearson Education Asia, First Indian Reprint 2000.

SEMESTER - V - ELECTIVE - IV

22250E51AP - CLOUD COMPUTING LTPC4004

AIM

To acquire basic knowledge on cloud computing and its applications.

OBJECTIVES:

- Identify cloud computing models, characteristics, and technologies.
- Get knowledge about the different architectures in cloud.
- Identify the information about service management and cloud securities.

UNIT-I **9**

Overview of Computing Paradigm- Recent trends in Computing - Evolution of cloud computing - Introduction to Cloud Computing -Cloud Computing (NIST Model)- Properties, Characteristics & Disadvantages - Cloud computing vs. Cluster computing vs. Grid computing - Role of Open Standards

UNIT-II **9**

Cloud Computing Architecture - Cloud computing stack - Service Models (XaaS) - Infrastructure as a Service(IaaS) - Platform as a Service(PaaS) - Software as a Service(SaaS)- Deployment Models

UNIT-III **9**

Infrastructure as a Service(IaaS) - Introduction to IaaS - Resource Virtualization – Examples. Platform as a Service(PaaS) - Introduction to PaaS - Cloud Platform and Management – Examples - Software as a Service(SaaS) - Introduction to SaaS

UNIT-IV **9**

Service Management in Cloud Computing - Service Level Agreements(SLAs)- Identity & Access Management - Access Control - Trust, Reputation, Risk - Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations - Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations.

UNIT-V **9**

Cloud Security - Infrastructure Security - Network level security - Host level security - Application level security - Data security and Storage - Data privacy and security Issues, Jurisdictional issues raised by Data location -Case Study on Open Source & Commercial Clouds – Eucalyptus - Microsoft Azure - Amazon EC2.

Total:45hrs

REFERENCE BOOKS:

1. Cloud Computing Bible, BarrieSosinsky, Wiley-India, 2010
2. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011
3. Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012
4. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010

22250E51BP- SPEECH PROCESSING AND SYNTHESIS LTPC4004

AIM

To study about the Speech Processing and Synthesis

OBJECTIVES

To understand the mathematical foundations needed for speech processing
To understand the basic concepts and algorithms of speech processing and synthesis
To familiarize the students with the various speech signal representation, coding and recognition techniques
To appreciate the use of speech processing in current technologies and to expose the students to real– world applications of speech processing

UNITI FUNDAMENTALSOFSPEECHPROCESSING 9

Introduction – Spoken Language Structure – Phonetics and Phonology – Syllables andWords–SyntaxandSemantics–Probability,StatisticsandInformationTheory–ProbabilityTheory–EstimationTheory–SignificanceTesting–InformationTheory.

UNITII SPEECHSIGNALREPRESENTATIONSANDCODING 9

Overview of Digital Signal Processing – Speech Signal Representations – Short time FourierAnalysis – Acoustic Model of Speech Production – Linear Predictive Coding – CepstralProcessing–FormantFrequencies–TheRoleofPitch–SpeechCoding–LPCCoder.

UNITIII SPEECHRECOGNITION 9

Hidden Markov Models – Definition – Continuous and Discontinuous HMMs – PracticalIssues – Limitations. Acoustic Modeling – Variability in the Speech Signal – ExtractingFeatures – Phonetic Modeling – Adaptive Techniques – Confidence Measures – OtherTechniques.

UNITIV TEXTANALYSIS 9

Lexicon – Document Structure Detection – Text Normalization – Linguistic Analysis –HomographDisambiguation–Morphological Analysis–Letter-to-soundConversion–Prosody–Generationschematic–SpeakingStyle–SymbolicProsody–Duration Assignment–PitchGeneration

UNITV SPEECHSYNTHESIS 9

Attributes–FormantSpeechSynthesis–ConcatenativeSpeechSynthesis–Prosodic ModificationofSpeech–Source-filterModelsforProsodyModification–EvaluationofTTSSystems.

TOTAL: 45 PERIODS

REFERENCES:

1. JosephMariani,―LanguageandSpeechProcessing‖,Wiley,2009.
2. LawrenceRabinerandBiing-HwangJuang,―FundamentalsofSpeechRecognition‖,PrenticeHallSignal ProcessingSeries,1993.
3. SadaokiFurui,―DigitalSpeechProcessing:Synthesis,andRecognition,SecondEdition,(Signal ProcessingandCommunications)‖, Marcel Dekker,2000.
4. ThomasF.Quatieri,―Discrete-TimeSpeechSignalProcessing‖,PearsonEducation,2002.
5. XuedongHuang,AlexAcero,Hsiao-Wuen Hon,―SpokenLanguageProcessing–A guidetoTheory,AlgorithmandSystemDevelopment‖,Prentice HallPTR,2001.

22250E51CP- SOFT COMPUTING LTPC 4004

AIM:

To understand the concepts of Artificial Intelligence , ANN , Genetic Algorithms and Fuzzy systems and its applications.

OBJECTIVES:

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- To introduce the ideas of Neural networks, fuzzy logic and use of heuristics base on human experience.
- To have a general understanding of soft computing methodologies, including artificial neural networks, fuzzy sets, fuzzy logic, fuzzy clustering techniques and genetic algorithms;
- To Design and development of certain scientific and commercial application using computational neural network models, fuzzy models, fuzzy clustering applications and genetic algorithms in specified applications.

UNIT-I FUZZY SET THEORY 10

Introduction to Neuro – Fuzzy and Soft Computing – Fuzzy Sets – Basic Definition and Terminology – Set–Theoretic Operations – Member Function Formulation and Parameterization – Fuzzy Rules and Fuzzy Reasoning – Extension Principle and Fuzzy Relations – Fuzzy If Then Rules – Fuzzy Reasoning – Fuzzy Inference Systems – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models – Input Space Partitioning and Fuzzy Modeling.

UNIT-II OPTIMIZATION 8

Derivative based Optimization – Descent Methods – The Method of Steepest Descent – Classical Newton's Method – Step Size Determination – Derivative Free Optimization – Genetic Algorithms – Simulated Annealing – Random Search – Downhill Simplex Search.

UNIT-III NEURAL NETWORKS 10

Supervised Learning Neural Networks – Perceptrons – Adaline – Backpropagation Multilayer perceptrons – Radial Basis Function Networks – Unsupervised Learning and Other Neural Networks – Competitive Learning Networks – Kohonen Self – Organizing Networks – Learning Vector Quantization – Hebbian Learning.

UNIT-IV NEURO FUZZY MODELING 9

Adaptive Neuro – Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm – Learning Methods that Cross fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling – Framework – Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum.

UNIT-V APPLICATION OF COMPUTATIONAL INTELLIGENCE 8

Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency Prediction – Soft Computing for Color Recipe Prediction.

Total: 45 hrs

TEXTBOOK:

1. J. S. R. Jang, C. T. Sun and E. Mizutani, "Neuro Fuzzy and Soft Computing", PHI, Pearson Education, 2004.

REFERENCES:

1. Timothy J. Ross,"Fuzzy Logic with Engineering Application ", McGraw Hill, 1977.
2. Davis E. Goldberg,"Genetic Algorithms Search, Optimization and Machine Learning", Addison Wesley, 1989.
3. S. Rajasekaran and G. A. V. Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003.
4. R. Eberhart, P. Simpson and R. Dobbins, "Computational Intelligence PC Tools", AP Professional, Boston, 1996.

SEMESTER - V - ELECTIVE - V

22250E52AP-ADVANCED DATABASE TECHNOLOGY

L T P C
40 0 4

AIM:

To prepare the student to understand, develop, and manage more advanced database applications.

OBJECTIVES:

Be able to

- Know the operations of parallel and distributed databases.
- Understand the structure s and standards of object relational databases.
- Get familiar with the concepts of XML, Mobile and Multimedia Databases.

UNIT-I PARALLEL AND DISTRIBUTED DATABASES 9

Database System Architectures: Centralized and Client-Server Architectures – ServerSystem Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/OParallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism –Distributed Database Concepts - Distributed Data Storage – Distributed Transactions –Commit Protocols – Concurrency Control – Distributed Query Processing – Three TierClient Server Architecture-Case Studies.

UNIT-II OBJECT AND OBJECT RELATIONAL DATABASES 9

Concepts for Object Databases: Object Identity – Object structure – TypeConstructors – Encapsulation of Operations – Methods – Persistence – Type and ClassHierarchies – Inheritance – Complex Objects – Object Database Standards, Languagesand Design: ODMG Model – ODL – OQL – Object Relational and Extended – RelationalSystems : Object Relational featuresinSQL/Oracle – Case Studies.

UNIT-III XML DATABASES 9

XML Databases: XML Data Model – DTD - XML Schema - XML Querying – WebDatabases – JDBC – Information Retrieval – Data Warehousing – Data Mining

UNIT-IV MOBILE DATABASES 9

Mobile Databases: Location and Handoff Management - Effect of Mobility on DataManagement - Location Dependent Data Distribution - Mobile Transaction Models -Concurrency Control - Transaction Commit Protocols- Mobile Database RecoverySchemes.

UNIT-V MULTIMEDIA DATABASES 9

Multidimensional Data Structures – Image Databases – Text/Document Databases-Video Databases – Audio Databases – Multimedia Database Design.

Total = 45 hrs

REFERENCES:

1. R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, Fifth Edition,Pearson Education/Addison Wesley, 2007.

2. Thomas Cannolly and Carolyn Begg, “ Database Systems, A Practical Approachto Design, Implementation and Management”, Third Edition, Pearson Education,2007.

3. Henry F Korth, Abraham Silberschatz, S. Sudharshan, “Database SystemConcepts”, Fifth Edition, McGraw Hill, 2006.

4. C.J.Date, A.Kannan and S.Swamynathan,”An Introduction to DatabaseSystems”, Eighth Edition, Pearson Education, 2006.

22250E52BP - RECONFIGURABLE COMPUTING

L T P C
4 0 0 4

AIM:

To understand about the ReconfigurableComputing.

OBJECTIVES:

- Tounderstandtheneedforreconfigurable computing
- Toexposethestudents tovariousdevicearchitectures
- Toexamine thevarious reconfigurablecomputing systems
- Tounderstandthedifferenttypes ofcomputemodelsforprogramming reconfigurable
- architectures
- Toexpose thestudentstoHDL programmingandfamiliarizewith thedevelopment
- environment
- Toexposethestudents tothevariousplacementandroutingprotocols
- Todevelopapplications with FPGAs

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UNITI DEVICEARCHITECTURE 9

GeneralPurposeComputingVsReconfigurableComputing–SimpleProgrammableLogicDevices–ComplexProgrammableLogicDevices–FPGAs–DeviceArchitecture-CaseStudies.

UNITII RECONFIGURABLECOMPUTINGARCHITECTURESANDSYSTEMS 9

ReconfigurableProcessingFabricArchitectures– RPFIntegrationintoTraditionalComputingSystems–ReconfigurableComputingSystems– CaseStudies–ReconfigurationManagement.

UNITIII PROGRAMMINGRECONFIGURABLESYSTEMS 9

ComputeModels-ProgrammingFPGAApplicationsinHDL–CompilingCforSpatialComputing –OperatingSystemSupportforReconfigurableComputing.

UNITIV MAPPINGDESIGNS TORECONFIGURABLEPLATFORMS 9

TheDesignFlow -Technology Mapping–FPGAPlacementandRouting–ConfigurationBitstreamGeneration–CaseStudieswithAppropriateTools.

UNITV APPLICATIONDEVELOPMENTWITH FPGAS 9

CaseStudiesofFPGAApplications–SystemonaProgrammableChip(SoPC)Designs.

TOTAL:45PERIODS

REFERENCES:

1. ChristopheBobda,―IntroductiontoReconfigurableComputing–Architectures,AlgorithmsandApplications‖,Springer,2010.
2. MayaB.GokhaleandPaulS.Graham,―ReconfigurableComputing:AcceleratingComputationwithField-Programmable

GateArrays‖,Springer,2005.
3. FPGAFrontiers:NewApplicationsinReconfigurableComputing,2017,NicoleHemsoth,TimothyPrickettMorgan,NextPlatform.
4. ReconfigurableComputing:FromFPGAs toHardware/SoftwareCodesign 2011Editionby JoaoCardoso(Editor),MichaelHübne,Springer
5. ScottHauckandAndreDehon(Eds.), ―ReconfigurableComputing–TheTheory andPracticeofFPGA-BasedComputation‖,Elsevier/MorganKaufmann,2008.

22250E52CP - GREEN COMPUTING LTPC4004

AIM:

To Understand Green Technology and to implement Green computing practices to efficiently use the computers and its resources.

OBJECTIVES:

- Understanding scientific and social environment.
- Minimizing energy consumption from the IT estate.
- Purchasing green energy and using green suppliers.
- Reducing the paper and other consumables used.
- Minimizing equipment disposal requirements.

UNIT-I **9**

Origins, Regulations and industry initiatives- Government, Industry.

UNIT-II **9**

Approaches to green computing- Product longevity, Algorithmic efficiency.

UNIT-III **9**

Resource allocation, Virtualization.

UNIT-IV **9**

Terminal servers, Power management, Operating system support, Power supply, Storage, Video card, Display.

UNIT-V **9**

Web, Temporal and Spatial Data Mining Materials recycling, Telecommuting, Middleware support for green computing, Tools for monitoring, HPC computing, Green Mobile, embedded computing and networking, Management Frameworks Standards and metrics for computing green

Total: 45hrs

REFERENCES:

1. Green Computing and Green IT Best Practices on Regulations and Industry Initiatives, Virtualization, Power Management, Materials Recycling and Telecommuting by Jason Harris.

2. Green IT: Reduce Your Information System's Environmental Impact While Adding to the Bottom Line. By Toby Velte (Author), Anthony Velte (Author), Robert Elsenpeter (Author), MC-Grow Hill

3. The Greening of IT-How Companies Can Make a Difference for the Environment by John Lamb.

SEMESTER - V - ELECTIVE - VI

22250E53AP - SOFTWARE QUALITY ASSURANCE

L T P C
4 0 0 4

AIM:

To develop the ability to analyze and estimate the quality of the software.

OBJECTIVES:

- To introduce an integrated approach to software development incorporating quality management methodologies.
- To study about the quality improvements in software
- To understand the Software Quality software standards

UNIT I 9

Introduction to software quality - challenges – objectives – quality factors – components of SQA– contract review – development and quality plans – SQA components in project life cycle –SQA defect removal policies – Reviews

UNIT II 9

Basics of software testing – test generation from requirements – finite state models – combinatorial designs - test selection, minimization and prioritization for regression testing – testadequacy, assessment and enhancement

UNIT III 9

Testing strategies – white box and black box approach – integration testing – system and acceptance testing – performance testing – regression testing - internationalization testing – adhoctesting – website testing – usability testing – accessibility testingTest plan – management – execution and reporting – software test automation –automated testing tools

UNIT IV 9

Hierarchical models of software quality – software quality metrics –function points – Softwareproduct quality – software maintenance quality – effect of case tools – software qualityinfrastructure – procedures – certifications – configuration management – documentationcontrol.

UNIT V 9

Project progress control – costs – quality management standards – project process standards – management and its role in SQA – SQA unit

Total = 45hrs

REFERENCES

1. 1.Daniel Galin, Software quality assurance – from theory to implementation, Pearsoneducation, 2009.
2. Aditya Mathur, Foundations of software testing, Pearson Education, 2008.
3. Srinivasan Desikan and Gopalaswamy Ramesh, Software testing – principles andpractices , Pearson education, 2006.
4. Ron Patton, Software Testing , second edition, Pearson education, 2007.

22250E53BP - BIO-INFORMATICS LTPC4004

AIM:

To impart knowledge, on basic techniques of Bioinformatics.

OBJECTIVES:

- Build a solid foundation and acquire the vocabulary you need to supervise or to communicate with others who use these tools.
- To have ability to design drugs.
- To understand Evolutionary Trees and Phylogeny.
- Learn the key methods and tools used in bioinformatics.

UNIT I FUNDAMENTALS 7

The Central Dogma – Killer Application – Parallel Universes – Watson's Definition – Top Down Vs Bottom Up Approach – Information Flow – Conversance – Communications.

UNIT II DATABASE AND NETWORKS 9

Definition – Data Management – Data Life Cycle – Database Technology – Interfaces – Implementation – Networks Communication Models – Transmission Technology – Protocols – Bandwidth – Topology – Contents – Security – Ownership – Implementation.

UNIT III SEARCH ENGINES AND DATA VISUALIZATION 10

Search Process – Technologies – Searching and Information Theory – Computational Methods – Knowledge Management – Sequence Visualizations – Structure Visualizations – User Interfaces – Animation Vs Simulation.

UNIT IV STATISTICS– DATA MINING AND PATTERN MATCHING 11

Statistical Concepts – Micro Arrays – Imperfect Data – Basics – Quantifying – Randomness – Data Analysis – Tools Selection – Alignment – Clustering – Classification – Data Mining Methods – Technology – Infrastructure Pattern Recognition – Discovery – Machine Learning – Text Mining – Pattern Matching Fundamentals – Dot Matrix Analysis – Substitution Matrix – Dynamic Programming – Word Method – Bayesian Method – Multiple Sequence Alignment Tools.

UNIT V MODELING SIMULATION AND COLLABORATION 8

Drug Discovery Fundamentals – Protein Structure – System Biology Tools – Collaboration and Communication – Standards – Issues – Case Study.

Total: 45hrs

TEXT BOOK:

1. Bryan Bergeron, "Bio Informatics Computing", Prentice Hall, 2003.

REFERENCES:

1. T.K. Affward, D.J. Parry Smith, "Introduction to Bio Informatics", Pearson Education, 2001.
2. Pierre Baldi, Soren Brunak, "Bio Informatics The Machine Learning Approach", 2nd Edition, First East West Press, 2003.

22250E53CP - WIRELESS APPLICATION PROTOCOLS

L	T	P	C
4	0	0	4

AIM

To introduction the advanced element in the field of wireless communication.

OBJECTIVE:

- Be able to discuss current and emerging technology in Wireless technology.
- Understand fundamental trends of technological evolution of Wireless technology.
- Have hands-on knowledge in developing simple and comprehensive WAP contents.
- Be able to create simple Wireless applicaitions.

UNIT-I: 9

Wireless Concepts - Technologies - An Overview of WAP - WAP Application Environment -WAP Gateways - WAP Gateway Services and Security.

UNIT-II: 9

WAP Components - Specification - Standard Execution Environment - Agent Characters - Main Protocols - WTP/WSP/WDP(UDPYWEMP Transportation and WTLS Protocol.

UNIT- III: 9

WAP Design and Development - The Development Tools - WML Language - WML Script Language.

UNIT-IV: 9

Implementing an Enterprise WAP Strategy, Wireless transmission- Spread spectrum - MAC -SDMA - FDMA - TDMA - CDMA - Cellular Wireless Networks.

UNIT-V: 9

Application Area of WAP: Wireless Operator's Interrelated Services -Mailbox Management - Searching the Phone Directory - Managing Personal Information.

Total:45hrs

TEXT BOOKS :

1. Steve Mann & Scott Sbihli, - Wireless Application Protocols - Wiley Computer Publishing -2000
2. S.Ruseyev - WAP Technology & Applications - Easwar Press - 2003 .

REFERENCE BOOKS :

1. Sandeep singhal , Jari Alwinen., -The Wireless Application Protocol: Writing Applications forthe Mobile Internet - Addison Wesley Publications - 2000 .

PONNAIYAH RAMAJAYAM INSTITUTE OF SCIENCE & TECHNOLOGY (PRIST)

Declared as DEEMED-TO-BE-UNIVERSITY
U/s 3 of UGC Act, 1956

DEPARTMENT OF
ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

PROGRAM HANDBOOK

B.Tech – FULL TIME

[Regulation 2022]

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

B.TECH (FULL TIME) –AIDS – R-2022
I - VIII SEMESTERS CURRICULUM
SEMESTER I

Sl. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	22147IP	Induction Programme	-	-	-	0
2.	22147S11	Professional English - I	3	0	0	3
3.	22148S12	Matrices and Calculus	3	1	0	4
4.	22149S13	Engineering Physics	3	0	0	3
5.	22149S14	Engineering Chemistry	3	0	0	3
6.	22150S15	Problem Solving and Python Programming	3	0	0	3
PRACTICALS						
7.	22150L16	Problem Solving and Python Programming Laboratory	0	0	4	2
8.	22149L17	Physics and Chemistry Laboratory	0	0	4	2
9.	22147L18	Communication Laboratory – I	0	0	2	1
		TOTAL	15	1	10	**21**

SEMESTER II

Sl. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	22147S21	Professional English – II	3	0	0	3
2.	22148S22	Statistics and Numerical Methods	3	1	0	4
3.	22149S23A	Physics for Information Science	3	0	0	3
4.	22154S24	Engineering Graphics	2	0	4	4
5.	22153S25A	Basic Electrical and Electronics Engineering	3	0	0	3
6.	221AIDS26	Data Structures Design	3	0	0	3
PRACTICALS						
7.	22154L27	Engineering Practices Laboratory	0	0	4	2
8.	221AIDL28	Data Structures Design Laboratory	0	0	4	2
9.	22147L29	Communication Laboratory – II	0	0	4	2
		TOTAL	17	2	16	**27**

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

SEMESTER III

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	22148S31A	Discrete Mathematics	3	1	0	4
2.	221AIDS32	Digital Principles and Computer Organization	3	0	0	3
3.	221AIDC33	Database Design and Management	3	0	0	3
4.	221AIDC34	Design and Analysis of Algorithm	3	0	2	4
5.	221AIDC35	Data Exploration and Visualization	3	0	0	3
6.	221AIDC36	Artificial Intelligence	3	0	0	3
PRACTICALS						
7.	221AIDL37	Database Design and Management Laboratory	0	0	4 4	2
8.	221AIDL38	Artificial Intelligence Laboratory	0	0	4	2
9.	221AIDL39	Professional Development	0	0	2	1
		TOTAL	18	1	12	25

SEMESTER IV

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	22148S41A	Probability and Statistics	3	1	0	4
2.	221AIDC42	Operating Systems	3	0	2	4
3.	221AIDC43	Machine Learning	3	0	0	3
4.	221AIDC44	Fundamentals of Data Science and Analysis	3	0	0	3
5.	221AIDC45	Computer Networks	3	0	2	4
6.	22149S46	Environmental Sciences and Sustainability	2	0	0	2
PRACTICALS						
7.	221AIDL47	Data Science and Analysis Laboratory	0	0	4	2
8.	221AIDL48	Machine Learning Laboratory	0	0	4	2
		TOTAL	17	0	12	24

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

SEMESTER V

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
		THEORY				
1.	221AIDC51	Deep Learning	3	0	0	3
2.	221AIDC52	Data and Information Security	3	0	0	3
3.	221AIDC53	Distributed Computing	3	0	0	3
4.	221AIDC54	Big Data Analytics	3	0	0	3
5.	221AIDC55_	Professional Elective I				
6.	221AIDC56_	Professional Elective II				
7.	22147MC57_	Mandatory Course - I	3	0	0	0
		TOTAL	21	0	4	**21**

SEMESTER VI

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
		THEORY				
1.	22152S61	Embedded Systems and IOT Design	3	0	2	4
2.	221_ _OE62_	Open Elective - I	3	0	0	3
3.	221AIDC63_	Professional Elective – III	3	0	0	3
4.	221AIDC64_	Professional Elective – IV	3	0	0	3
5.	221AIDC65_	Professional Elective – V				
6.	221AIDC66_	Professional Elective – VI	3	0	0	3
7.	**22147MC67_**	Mandatory Course - II	3	0	0	0
		TOTAL	21	0	4	**16**

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

SEMESTER VII

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	22147S71	Human Values and Ethics	2	0	0	2
2.	221_ _OE73_	Open Elective – II	3	0	0	3
3.	221_ _OE74_	Open Elective – III	3	0	0	3
4.	221_ _OE75_	Open Elective – IV	3	0	0	3
5.	22160E75_	Elective Management	3	0	0	3
		TOTAL	14	0	0	14

SEMESTER VIII

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
PRACTICALS						
1.	221AIDC81	Project Work/ Internship	0	0	20	10
		TOTAL	0	0	20	**10**
		TOTAL NO. OF CREDITS:				**162**

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

LIST OF ELECTIVES

ELECTIVE - I (SEMESTER V)

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	221AIDC55A	Knowledge Engineering	2	0	2	3
2.	221AIDC55B	RecommenderSystems	2	0	2	3
3.	221AIDC55C	Soft Computing	2	0	2	3
4.	221AIDC55D	Text and SpeechAnalysis	2	0	2	3
5.	221AIDC55E	Business Analytics	2	0	2	3
6.	221AIDC55F	Image and videoanalytics	2	0	2	3
7.	221AIDC55G	Computer Vision	2	0	2	3
8.	221AIDC55H	Big Data Analytics	2	0	2	3

ELECTIVE – II (SEMESTER V)

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	221AIDC56A	Cloud Computing	2	0	2	3
2.	221AIDC56B	App Development	2	0	2	3
3.	221AIDC56C	Cloud Services Management	2	0	2	3
4.	221AIDC56D	UI and UX Design	2	0	2	3
5.	221AIDC56E	Software Testing and Automation	2	0	2	3
6.	221AIDC56F	Web Application Security	2	0	2	3
7.	221AIDC56G	Dev-ops	2	0	2	3
8.	221AIDC56H	Principles of ProgrammingLanguages	2	0	2	3

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

ELECTIVE – III (SEMESTER VI)

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	221AIDC63A	Cloud Computing	2	0	2	3
2.	221AIDC63B	Virtualization	2	0	2	3
3.	221AIDC63C	Cloud Services Management	2	0	2	3
4.	221AIDC63D	Data Warehousing	2	0	2	3
5.	221AIDC63E	Storage Technologies	2	0	2	3
6.	221AIDC63F	Software Defined Networks	2	0	2	3
7.	221AIDC63G	Stream Processing	2	0	2	3
8.	221AIDC63H	Security and Privacy in Cloud	2	0	2	3

ELECTIVE – IV (SEMESTER VI)

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	22AIDC64A	Ethical Hacking	2	0	2	3
2.	22AIDC64B	Digital and MobileForensics works	2	0	2	3
3.	22AIDC64C	Social Network Security	2	0	2	3
4.	22AIDC64D	Modern Cryptography	2	0	2	3
5.	22AIDC64E	Engineering Secure Software Systems	2	0	2	3
6.	22AIDC64F	Cryptocurrency and Blockchain Technologies	2	0	2	3
7.	22AIDC64G	Network Security	2	0	2	3
8.	22AIDC64H	Security and Privacy in Cloud	2	0	2	3

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

ELECTIVE - V (SEMESTER VI)

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	221AIDC65A	Augmented Reality/Virtual Reality	2	0	2	3
2.	221AIDC65B	Multimedia and Animation	2	0	2	3
3.	221AIDC65C	Video Creation and Editing	2	0	2	3
4.	221AIDC65D	UI and UX Design	2	0	2	3
5.	221AIDC65E	Digital marketing	2	0	2	3
6.	221AIDC65F	Multimedia Data Compression and Storage	2	0	2	3
7.	221AIDC65G	Game Development	2	0	2	3
8.	221AIDC65H	Visual Effects	2	0	2	3

ELECTIVE - VI (SEMESTER VI)

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	221AIDC66A	Augmented Reality/Virtual Reality	2	0	2	3
2.	221AIDC66B	Robotic Process Automation	2	0	2	3
3.	221AIDC66C	Neural Networks and Deep Learning	2	0	2	3
4.	221AIDC66D	Cyber security	2	0	2	3
5.	221AIDC66E	Quantum Computing	2	0	2	3
6.	221AIDC66F	Cryptocurrency and Blockchain Technologies	2	0	2	3
7.	221AIDC66G	Game Development	2	0	2	3
8.	221AIDC66H	3D Printing and Design	2	0	2	3

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

ELECTIVE - VII (SEMESTER VII)

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	22160E75A	Principles of Management	3	0	0	3
2.	22160E75B	Total Quality Management	3	0	0	3
3.	22160E75C	Industrial Management	3	0	0	3

LIST OF OPEN ELECTIVES

SEMESTER VI
OPEN ELECTIVE-I

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
1	22150FE67A	IoT Concepts and Applications (CSE)	2	0	2	3
2	22150FE67B	Augmented and Virtual Reality (CSE)	2	0	2	3

SEMESTER VII
OPEN ELECTIVE-II

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
1	22150FE75A	Data Science Fundamentals (CSE)	2	0	2	3
2	22150FE75B	Artificial Intelligence and Machine Learning Fundamentals	2	0	2	3

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

OPEN ELECTIVE-III

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
1	22147FE76A	English for Competitive Examinations	3	0	0	3
2	22153FE76A	Renewable Energy Technologies(EEE)	3	0	0	3
3	22153FE76B	Electric and Hybrid Vehicle(EEE)	3	0	0	3
4	22154FE76A	Introduction to non-destructive testing (MECHANICAL)	3	0	0	3
5	22154FE76B	Industrial Management	3	0	0	3
6	22152FE76A	Biomedical Instrumentation (ECE)	3	0	0	3
7	22152FE76B	Fundamentals of Electronic Devices and Circuits(ECE)	3	0	0	3

OPEN ELECTIVE-IV

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
1	22154FE77A	Additive Manufacturing (MECHANICAL)	3	0	0	3
2	22154FE77B	InIndustrial safety (MECHANICAL)	3	0	0	3
3	22153FE77A	Sensors (EEE)	3	0	0	3
4	22153FE77B	ElElectrical, Electronic and Magnetic materials (EEE)	3	0	0	3
5	22152FE77A	Wearable devices (ECE)	3	0	0	3
6	22152FE77B	Medical Informatics (ECE)	3	0	0	3

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

LIST OF MANDATORY COURSES

MANDATORY COURSE – I (SEMESTER V)

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	22147MC57A	Introduction to Women and Gender Studies	3	0	0	3
2.	22147MC57B	Elements of Literature	3	0	0	3
3.	22147MC57C	Film Appreciation	3	0	0	3
4.	22147MC57D	Disaster Management	3	0	0	3

MANDATORY COURSE – II (SEMESTER VI)

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	22147MC67A	Well Being with Traditional Practices (Yoga, Ayurveda and Siddha)	3	0	0	3
2.	22147MC67B	History of Science and Technology in India	3	0	0	3
3.	22147MC67C	Political and Economic Thought for a Humane Society	3	0	0	3
4.	22147MC67D	State, Nation Building and Politics in India	3	0	0	3

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22147IP INDUCTION PROGRAMME

This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

"Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have a broad understanding of society and relationships. Character needs to be nurturedas an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed."

"One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character. "

Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, peoplearound them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

(i) Physical Activity

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

(ii) Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and
also enhance creativity which would, hopefully, grow into engineering design later.

(iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, make decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's anddon'ts, but get students to explore and think by engaging them in a dialogue. It is best taught through group

discussions and real life activities rather than lecturing.
Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

(iv) Literary Activity

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

(v) Proficiency Modules

This would address some lacunas that students might have, for example, English, computer familiarity etc.

(vi) Lectures by Eminent People

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

(vii) Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the underprivileged.

(viii) Familiarization to Dept./Branch & Innovations

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

(ix) Department Specific Activities

About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering / Technology / Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits asan extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.

References:
Guide to Induction program from AICTE

22147S11 PROFESSIONAL ENGLISH - I

L T P C3 1 0 4

COURSE OBJECTIVES:

- To improve the communicative competence of learners
- To help learners use language effectively in academic /work contexts
- To build on students' English language skills by engaging them in listening, speaking andgrammar learning activities that are relevant to authentic contexts.
- To develop learners' ability to read and write complex texts, summaries, articles, blogs,definitions, essays and user manuals.
- To use language efficiently in expressing their opinions via various media.

INTRODUCTION TO EFFECTIVE COMMUNICATION 1

- What is effective communication? (There are many interesting activities for this.)
- Why is communication critical for excellence during study, research and work?
- What are the seven C's of effective communication?
- What are key language skills?
- What is effective listening? What does it involve?
- What is effective speaking?
- What does it mean to be an excellent reader? What should you be able to do?
- What is effective writing?
- How does one develop language and communication skills?
- What does the course focus on? How are communication and language skills going to be enhanced during this course? What do you as a learner need to do to enhance yourEnglish language and communication skills to get the best out of this course?

UNIT I INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 11

Listening –for general information-specific details- conversation: Introduction to classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form

Speaking - Self Introduction; Introducing a friend; Conversation - politeness strategies; Telephone conversation; Leave a voicemail; Leave a message with another person; asking for information to fill details in a form.

Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails.

Writing - Writing emails / letters introducing oneself

Grammar - Present Tense (simple and progressive); Question types: Wh / Yes or No/ and Tags

Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technicalcontexts).

UNIT II NARRATION AND SUMMATION 12

Listening - Listening to podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities.

Speaking - Narrating personal experiences / events; Interviewing a celebrity; Reporting / and summarizing documentaries / podcasts/ interviews.

Reading - Reading biographies, travelogues, newspaper reports, Excerpts from

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

literature, an
dtravel & technical blogs.
Writing - Guided writing-- Paragraph writing Short Report on an event (field trip etc.)Grammar –Past tense (simple); Subject-Verb Agreement; and Prepositions
Vocabulary - Word forms (prefixes & suffixes); Synonyms and Antonyms. Phrasal verbs.

UNIT III DESCRIPTION OF A PROCESS / PRODUCT 12

Listening - Listen to a product and process descriptions; a classroom lecture; and advertisements about products.
Speaking – Picture description; giving instruction to use the product; Presenting a product; and Summarizing a lecture.
Reading – Reading advertisements, gadget reviews; user manuals. Writing - Writing definitions; instructions; and Product /Process description.
Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses. Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words)

UNIT IV CLASSIFICATION AND RECOMMENDATIONS 12

Listening – Listening to TED Talks; Scientific lectures; and educational videos.Speaking – Small Talk; Mini presentations and making recommendations.
Reading – Newspaper articles; Journal reports –and Non Verbal Communication (tables, pie charts etc,)
Writing – Note-making / Note-taking (*Study skills to be taught, not tested; Writingrecommendations; Transferring information from non verbal (chart , graph etc, to verbal mode) Grammar – Articles; Pronouns - Possessive & Relative pronouns.
Vocabulary - Collocations; Fixed / Semi fixed expressions.

UNIT V EXPRESSION 12

Listening – Listening to debates/ discussions; different viewpoints on an issue; and panel discussions.
Speaking –group discussions, Debates, and Expressing opinions through Simulations & Role play.
Reading – Reading editorials; and Opinion Blogs;
Writing – Essay Writing (Descriptive or narrative).
Grammar – Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences.
Vocabulary - Cause & Effect Expressions – Content vs Function words.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

- To listen and comprehend complex academic texts
- To read and infer the denotative and connotative meanings of technical texts
- To write definitions, descriptions, narrations and essays on various topics
- To speak fluently and accurately in formal and informal communicative contexts

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

- To express their opinions effectively in both oral and written medium of communication

TEXT BOOKS:

1. English for Engineers & Technologists Orient Blackswan Private Ltd. Department ofEnglish, Anna University, (2020 edition)
2. English for Science & Technology Cambridge University Press, 2021.
3. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN.Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCES:

1. Technical Communication – Principles And Practices By Meenakshi Raman & SangeetaSharma, Oxford Univ. Press, 2016, New Delhi.
2. A Course Book on Technical English By Lakshmi Narayanan, Scitech Publications (India)Pvt. Ltd.
3. English For Technical Communication (With CD) By Aysha Viswamohan, Mcgraw HillEducation, ISBN : 0070264244.
4. Effective Communication Skill, Kulbhusan Kumar, R S Salaria, Khanna Publishing House.
5. Learning to Communicate – Dr. V. Chellammal, Allied Publishing House, New Delhi,2003.

22148S M12 MATRICES AND CALCULUS L T P C
3 1 0 4

COURSE OBJECTIVES:

- To develop the use of matrix algebra techniques that are needed by engineers for practicalapplications.
- To familiarize the students with differential calculus.
- To familiarize the student with functions of several variables. This is needed in manybranches of engineering.
- To make the students understand various techniques of integration.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals andtheir applications.

UNIT I MATRICES 9 + 3

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley - Hamilton theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms – Applications : Stretching of an elastic membrane.

UNIT II DIFFERENTIAL CALCULUS 9 + 3

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (sum, product, quotient, chain rules) - Implicit differentiation - Logarithmic differentiation - Applications : Maxima and Minima of functions of one variable.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

UNIT III FUNCTIONS OF SEVERAL VARIABLES 9 + 3

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Applications : Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers.

UNIT IV INTEGRAL CALCULUS 9 + 3

Definite and Indefinite integrals - Substitution rule - Techniques of Integration : Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals - Applications : Hydrostatic force and pressure, moments and centres of mass.

UNIT V MULTIPLE INTEGRALS 9 + 3

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals – Applications : Moments and centres of mass, moment of inertia.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able to

- Use the matrix algebra methods for solving practical problems.
- Apply differential calculus tools in solving various application problems.
- Able to use differential calculus ideas on several variable functions.
- Apply different methods of integration in solving practical problems.
- Apply multiple integral ideas in solving areas, volumes and other practical problems.

TEXT BOOKS:

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition , 2018.
3. James Stewart, " Calculus : Early Transcendentals ", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net changetheorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCES:

1. Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10th Edition, 2016
2. Bali. N., Goyal. M. and Watkins. C., " Advanced Engineering Mathematics ", FirewallMedia (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3. Jain . R.K. and Iyengar. S.R.K., " Advanced Engineering Mathematics ", NarosaPublications, New Delhi, 5th Edition, 2016.
4. Narayanan. S. and Manicavachagom Pillai. T. K., "Calculus" Volume I and II,

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd,New Delhi, 2016.
6. Srimantha Pal and Bhunia. S.C, "Engineering Mathematics" Oxford University Press,2015.
7. Thomas. G. B., Hass. J, and Weir. M.D, " Thomas Calculus ", 14th Edition, Pearson India,2018.

22149S13 ENGINEERING PHYSICS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To make the students effectively achieve an understanding of mechanics.
- To enable the students to gain knowledge of electromagnetic waves and its applications.
- To introduce the basics of oscillations, optics and lasers.
- Equipping the students to successfully understand the importance of quantum physics.
- To motivate the students towards the applications of quantum mechanics.

UNIT I MECHANICS 9

Multi-particle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of the system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy and moment of inertia - theorems of M .I –moment of inertia of continuous bodies – of a diatomic molecule - torque – rotational dynamics of rigid bodies – conservation of angular momentum – rotational energy state of a rigid diatomic molecule - gyroscope - torsional pendulum – double pendulum –Introduction to nonlinear oscillations.

UNIT II ELECTROMAGNETIC WAVES 9

The Maxwell's equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium- vacuum interface for normal incidence.

UNIT III OSCILLATIONS, OPTICS AND LASERS 9

Simple harmonic motion - resonance –analogy between electrical and mechanical oscillatingsystems - waves on a string - standing waves - traveling waves - Energy transfer of a wave - soundwaves - Doppler effect. Reflection and refraction of light waves - total internal reflection - interference – Michelson interferometer –Theory of air wedge and experiment. Theory of laser - characteristics - Spontaneous and stimulated emission - Einstein's coefficients - population inversion - Nd-YAG laser, CO2 laser, semiconductor laser –Basic applications of lasers in industry.

UNIT IV BASIC QUANTUM MECHANICS 9

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENUEURSHIP

Photons and light waves - Electrons and matter waves –Compton effect - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization –Free particle - particle in a infinite potential well: 1D,2D and 3D Boxes- Normalization, probabilities and the correspondence principle.

UNIT V APPLIED QUANTUM MECHANICS 9

The harmonic oscillator(qualitative)- Barrier penetration and quantum tunneling(qualitative)- Tunneling microscope - Resonant diode - Finite potential wells (qualitative)- Bloch's theorem for particles in a periodic potential –Basics of Kronig-Penney model and origin of energy bands.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completion of this course, the students should be able to

- Understand the importance of mechanics.
- Express their knowledge in electromagnetic waves.
- Demonstrate a strong foundational knowledge in oscillations, optics and lasers.
- Understand the importance of quantum physics.
- Comprehend and apply quantum mechanical principles towards the formation of energybands.

TEXT BOOKS:

1. D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education (IndianEdition), 2017.
2. E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press, 2013.
3. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGraw-Hill (Indian Edition), 2017.

REFERENCES:

1. R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education (Indian Edition),2009.
2. Paul A. Tipler, Physic – Volume 1 & 2, CBS, (Indian Edition), 2004.
3. K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications, Laxmi Publications,(Indian Edition), 2019.
4. D.Halliday, R.Resnick and J.Walker. Principles of Physics, Wiley (Indian Edition), 2015.
5. N.Garcia, A.Damask and S.Schwarz. Physics for Computer Science Students. Springer-Verlag, 2012.

22149S14 ENGINEERING CHEMISTRY L T P C

3 0 0 3

COURSE OBJECTIVES:

- To inculcate sound understanding of water quality parameters and water treatmenttechniques.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.

- To introduce the basic concepts and applications of phase rule and composites.
- To facilitate the understanding of different types of fuels, their preparation, properties andcombustion characteristics.
- To familiarize the students with the operating principles, working processes andapplications of energy conversion and storage devices.

UNIT I WATER AND ITS TREATMENT 9

Water: Sources and impurities, Water quality parameters: Definition and significance of-color, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD, fluoride and arsenic. Municipal water treatment: primary treatment and disinfection (UV, Ozonation, break-point chlorination). Desalination of brackish water: Reverse Osmosis. Boiler troubles: Scale and sludge, Boiler corrosion, Caustic embrittlement, Priming & foaming. Treatment of boiler feed water: Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) and External treatment
– Ion exchange demineralization and zeolite process.

UNIT II NANOCHEMISTRY 9

Basics: Distinction between molecules, nanomaterials and bulk materials; Size-dependent properties (optical, electrical, mechanical and magnetic); Types of nanomaterials: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemicaldeposition and electro spinning. Applications of nanomaterials in medicine, agriculture, energy, electronics and catalysis.

UNIT III PHASE RULE AND COMPOSITES 9

Phase rule: Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process.

Composites: Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). Properties and applications of: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples.

UNIT IV FUELS AND COMBUSTION 9

Fuels: Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil - cetane number; Power alcohol and biodiesel.

Combustion of fuels: Introduction: Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis - ORSAT Method. CO2 emission and carbon footprint.

UNIT V ENERGY SOURCES AND STORAGE DEVICES
9

Stability of nucleus: mass defect (problems), binding energy; Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of solar cells; Recent developments in solar cell materials. Wind energy; Geothermal energy; Batteries: Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion- battery; Electric vehicles - working principles; Fuel cells: H2-O2 fuel cell, microbial fuel cell; Supercapacitors: Storage principle, types and examples.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able:

- To infer the quality of water from quality parameter data and propose suitable treatmentmethodologies to treat water.
- To identify and apply basic concepts of nanoscience and nanotechnology in designingthe synthesis of nanomaterials for engineering and technology applications.
- To apply the knowledge of phase rule and composites for material selectionrequirements.
- To recommend suitable fuels for engineering processes and applications.
- To recognize different forms of energy resources and apply them for suitableapplications in energy sectors.

TEXT BOOKS:

1. P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, Dhanpat Rai PublishingCompany (P) Ltd, New Delhi, 2018.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, NewDelhi, 2008.
3. S.S. Dara, "A Text book of Engineering Chemistry", S. Chand Publishing, 12th Edition,2018

REFERENCES:

1. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, "Text book of nanoscience and nanotechnology", Universities Press-IIM Series in Metallurgy and Materials Science, 2018.
2. O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.
3. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
4. ShikhaAgarwal, "Engineering Chemistry-Fundamentals and Applications", CambridgeUniversity Press, Delhi, Second Edition, 2019.
5. O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers andTechnologists, Springer Science Business Media, New York, 2nd Edition, 2013.

22150S15	Problem Solving and Python Programming	L T P C
		3 0 0 3

COURSE OBJECTIVES:

- To understand the basics of algorithmic problem solving.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

- To learn to solve problems using Python conditionals and loops.
- To define Python functions and use function calls to solve problems.
- To use Python data structures - lists, tuples, dictionaries to represent complex data.
- To do input/output with files in Python.

UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING 9

Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode,debugging; values and types: int, float, boolean, string , and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS, STRINGS 9

Conditionals:Boolean values and operators, conditional (if), alternative (if-else),chained conditional (if-elif-else);Iteration: state, while, for, break, continue, pass; Fruitful functions: return values,parameters, local and global scope, function composition, recursion; Strings:string slices,immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

UNIT V FILES, MODULES, PACKAGES 9

Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).

TOTAL : 45 PERIODSCOURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Develop algorithmic solutions to simple computational problems.

CO2: Develop and execute simple Python programs.

CO3: Write simple Python programs using conditionals and loops for solving problems.CO4: Decompose a Python program into functions.

CO5: Represent compound data using Python lists, tuples, dictionaries etc.CO6: Read and write data from/to files in Python programs.

TEXT BOOKS:

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition,O'Reilly Publishers, 2016.

2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving andProgramming", 1st Edition, BCS Learning & Development Limited, 2017.

REFERENCES:

1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition,2021.
2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmersand Data Scientists", 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: WithApplications to Computational Modeling and Understanding Data‘‘, Third Edition, MIT Press , 2021
4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction toProgramming", 2nd Edition, No Starch Press, 2019.
5. https://www.python.org/
6. Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.

22150L16 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY

L T P C
0 0 4 2

COURSE OBJECTIVES:

- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To practice various computing strategies for Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

EXPERIMENTS:

Note: The examples suggested in each experiment are only indicative. The lab instructor is expected to design other problems on similar lines. The Examination shall not be restricted to the sample experiments listed here.

1.Identification and solving of simple real life or scientific or technical problems, and developingflow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel

bar, compute Electrical Current in Three Phase AC Circuit,

1. etc.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number

Patterns,pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacingcharacters)
8. Implementing programs using written modules and Python Standard Libraries (pandas,numpy. Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling. (copy from one file toanother, word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (divide by zero error,voter's age validity, student mark range validation)
11. Exploring Pygame tool.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: Develop algorithmic solutions to simple computational problems

CO2: Develop and execute simple Python programs.

CO3: Implement programs in Python using conditionals and loops for solving problems..

CO4: Deploy functions to decompose a Python program.

CO5: Process compound data using Python data structures.

CO6: Utilize Python packages in developing software applications.

TEXT BOOKS:

1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

REFERENCES:

1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press, 2021
4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5. https://www.python.org/
6. Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22149L17 PHYSICS AND CHEMISTRY LABORATORY L T P C

0 0 4 2

PHYSICS LABORATORY : (Any Seven Experiments)

COURSE OBJECTIVES:

- To learn the proper use of various kinds of physics laboratory equipment.
- To learn how data can be collected, presented and interpreted in a clear and concisemanner.
- To learn problem solving skills related to physics principles and interpretation ofexperimental data.
- To determine error in experimental measurements and techniques used to minimize sucherror.
- To make the student an active participant in each part of all lab exercises.

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertiaof regular and irregular objects.
2. Simple harmonic oscillations of cantilever.
3. Non-uniform bending - Determination of Young's modulus
4. Uniform bending – Determination of Young's modulus
5. Laser- Determination of the wavelength of the laser using grating
6. Air wedge - Determination of thickness of a thin sheet/wire
7. a) Optical fibre -Determination of Numerical Aperture and acceptance angle b) Compact disc- Determination of width of the groove using laser.
8. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
9. Ultrasonic interferometer – determination of the velocity of sound and compressibilityof liquids
10. Post office box -Determination of Band gap of a semiconductor.
11. Photoelectric effect
12. Michelson Interferometer.
13. Melde's string experiment
14. Experiment with lattice dynamics kit.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students should be able to

- Understand the functioning of various physics laboratory equipment.
- Use graphical models to analyze laboratory data.
- Use mathematical models as a medium for quantitative reasoning and describing physicalreality.
- Access, process and analyze scientific information.
- Solve problems individually and collaboratively.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)COURSE OBJECTIVES:

- To inculcate experimental skills to test basic understanding of water quality parameters,such as, acidity, alkalinity, hardness, DO, chloride and copper.
- To induce the students to familiarize with electroanalytical techniques such as, pH metry,potentiometry and conductometry in the determination of impurities in aqueous solutions.
- To demonstrate the analysis of metals and alloys.
- To demonstrate the synthesis of nanoparticles

1. Preparation of Na_2CO_3 as a primary standard and estimation of acidity of a watersample using the primary standard
2. Determination of types and amount of alkalinity in a water sample.
- Split the first experiment into two
3. Determination of total, temporary & permanent hardness of water by EDTA method.
4. Determination of DO content of water sample by Winkler's method.
5. Determination of chloride content of water sample by Argentometric method.
6. Estimation of copper content of the given solution by Iodometry.
7. Estimation of TDS of a water sample by gravimetry.
8. Determination of strength of given hydrochloric acid using pH meter.
9. Determination of strength of acids in a mixture of acids using conductivity meter.
10. Conductometric titration of barium chloride against sodium sulphate (precipitationtitration)
11. Estimation of iron content of the given solution using potentiometer.
12. Estimation of sodium /potassium present in water using a flame photometer.
13. Preparation of nanoparticles (TiO_2/ZnO/CuO) by Sol-Gel method.
14. Estimation of Nickel in steel
15. Proximate analysis of Coal

TOTAL : 30 PERIODS

COURSE OUTCOMES :

- To analyse the quality of water samples with respect to their acidity, alkalinity, hardnessand DO.
- To determine the amount of metal ions through volumetric and spectroscopic techniques
- To analyse and determine the composition of alloys.
- To learn simple method of synthesis of nanoparticles
- To quantitatively analyse the impurities in solution by electroanalytical techniques

TEXT BOOKS :

1. J. Mendham, R. C. Denney, J.D. Barnes, M. Thomas and B. Sivasankar, Vogel's Textbookof Quantitative Chemical Analysis (2009

22147S21 PROFESSIONAL ENGLISH - II

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

L T P C
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4

COURSE OBJECTIVES:

- To engage learners in meaningful language activities to improve their LSRW skills
- To enhance learners' awareness of general rules of writing for specific audiences
- To help learners understand the purpose, audience, contexts of different types of writing
- To develop analytical thinking skills for problem solving in communicative contexts
- To demonstrate an understanding of job applications and interviews for internship andplacements

UNIT I MAKING COMPARISONS 12

Listening – Evaluative Listening: Advertisements, Product Descriptions, -Audio / video; Listeningand filling a Graphic Organiser (Choosing a product or service by comparison)
Speaking – Marketing a product, Persuasive Speech Techniques.
Reading - Reading advertisements, user manuals, brochures;
Writing – Professional emails, Email etiquette - Compare and Contrast Essay; Grammar – Mixed Tenses, Prepositional phrases
Vocabulary – Contextual meaning of words

UNIT II EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING 12

Listening - Listening to longer technical talks and completing– gap filling exercises. Listening technical information from podcasts – Listening to process/event descriptions to identify cause & effects - Speaking – Describing and discussing the reasons of accidents or disasters based on news reports.
Reading - Reading longer technical texts– Cause and Effect Essays, and Letters / emails of complaint, Writing - Writing responses to complaints.
Grammar - Active Passive Voice transformations, Infinitive and Gerunds Vocabulary – Word Formation (Noun-Verb-Adj-Adv), Adverbs.

UNIT III PROBLEM SOLVING 12

Listening – Listening to / Watching movie scenes/ documentaries depicting a technical problem and suggesting solutions.
Speaking – Group Discussion(based on case studies), - techniques and Strategies,
Reading - Case Studies, excerpts from literary texts, news reports etc.,
Writing – Letter to the Editor, Checklists, Problem solution essay / Argumentative EssayGrammar – Error correction; If conditional sentences
Vocabulary - Compound Words, Sentence Completion.

UNIT IV REPORTING OF EVENTS AND RESEARCH 12

Listening – Listening Comprehension based on news reports – and documentaries – Precis writing, Summarising, Speaking –Interviewing, Presenting an oral report, Mini presentations on select topics; Reading –Newspaper articles; Writing – Recommendations, Transcoding, Accident Report, Survey Report Grammar – Reported Speech, Modals Vocabulary – Conjunctions- use of prepositions

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

UNIT V THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY 12

Listening – Listening to TED Talks, Presentations, Formal job interviews, (analysis of the interview performance);

Speaking – Participating in a Role play, (interview/telephone interview), virtual interviews, Making presentations with visual aids;

Reading – Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; Writing – Job / Internship application – Cover letter & Resume; Grammar – Numerical adjectives, Relative Clauses Vocabulary – Idioms.

TOTAL : 60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

- To compare and contrast products and ideas in technical texts.
- To identify cause and effects in events, industrial processes through technical texts
- To analyze problems in order to arrive at feasible solutions and communicate them orallyand in the written format.
- To report events and the processes of technical and industrial nature.
- To present their opinions in a planned and logical manner, and draft effective resumes incontext of job search.

TEXT BOOKS:

1. English for Engineers & Technologists (2020 edition) Orient Blackswan Private Ltd. Department of English, Anna University.
2. English for Science & Technology Cambridge University Press 2021.Dr. Veena Selvam, Dr.Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCES:

1. Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford universitypress. New Delhi.
2. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, NewDelhi.
3. Learning to Communicate – Dr. V. Chellammal. Allied Publishers, New Delhi, 2003
4. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan,Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
5. Krishna Mohan, Meera Banerji, “Developing Communication Skills”, Trinity Press, 2017.

22148S22 STATISTICS AND NUMERICAL METHODS L T P C 3 1 0 4

COURSE OBJECTIVES:

- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENEUERSHIP

- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I TESTING OF HYPOTHESIS 9 + 3

Sampling distributions - Tests for single mean, proportion and difference of means (Large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes.

UNIT II DESIGN OF EXPERIMENTS 9 + 3

One way and two way classifications - Completely randomized design – Randomized block design – Latin square design - 2^2 factorial design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9 + 3

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 9 +3

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivates using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9 +3

Single step methods: Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order differential equations - Multi step methods: Milne's and Adams - Bash forth predictor corrector methods for solving first order differential equations.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to:

- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field ofagriculture.
- Appreciate the numerical techniques of interpolation in various intervals and apply thenumerical techniques of differentiation and integration for engineering problems.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

- Understandthe knowledge of various techniques and methods for solving first and secondorder ordinary differential equations.
- Solve the partial and ordinary differential equations with initial and boundary conditions byusing certain techniques with engineering applications.

TEXT BOOKS:

1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", KhannaPublishers, 10th Edition, New Delhi, 2015.
2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics forEngineers", Pearson Education, Asia, 8th Edition, 2015.

REFERENCES:

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", CengageLearning, New Delhi, 8th Edition, 2014.
3. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia,New Delhi, 7th Edition, 2007.
4. Gupta S.C. and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand &Sons, New Delhi, 12th Edition, 2020.
5. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability andStatistics ", Tata McGraw Hill Edition, 4th Edition, 2012.
6. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineersand Scientists", 9th Edition, Pearson Education, Asia, 2010.

analysis of RLC circuits (Simple problems only)

UNIT II ELECTRICAL MACHINES 9

Construction and Working principle- DC Separately and Self excited Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, Working principle and Applications of Transformer, Three phase Alternator, Synchronous motor and Three Phase Induction Motor.

UNIT III ANALOG ELECTRONICS 9

Resistor, Inductor and Capacitor in Electronic Circuits- Semiconductor Materials: Silicon &Germanium – PN Junction Diodes, Zener Diode –Characteristics Applications – Bipolar Junction Transistor-Biasing, JFET, SCR, MOSFET,IGBT – Types, I-V Characteristics and Applications, Rectifier and Inverters

UNIT IV DIGITAL ELECTRONICS 9

Review of number systems, binary codes, error detection and correction codes, Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimizationusing K maps (Simple Problems only).

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

UNIT V MEASUREMENTS AND INSTRUMENTATION 9

Functional elements of an instrument, Standards and calibration, Operating Principle, types - Moving Coil and Moving Iron meters, Measurement of three phase power, Energy Meter, Instrument Transformers-CT and PT, DSO- Block diagram- Data acquisition.

TOTAL: 45 PERIODS

COURSE OUTCOMES :

After completing this course, the students will be able to

- **CO1:** Compute the electric circuit parameters for simple problems
- **CO2:** Explain the working principle and applications of electrical machines
- **CO3:** Analyze the characteristics of analog electronic devices
- **CO4:** Explain the basic concepts of digital electronics
- **CO5:** Explain the operating principles of measuring instruments

TEXT BOOKS:

1. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition,McGraw Hill Education, 2020
2. S.K.Bhattacharya "Basic Electrical and Electronics Engineering", Pearson Education,Second Edition, 2017.
3. Sedha R.S., "A textbook book of Applied Electronics", S. Chand & Co., 2008
4. James A .Svoboda, Richard C. Dorf, "Dorf's Introduction to Electric Circuits", Wiley, 2018.
5. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements &Instrumentation', Dhanpat Rai and Co, 2015.

REFERENCES:

1. Kothari DP and I.J Nagrath, "Basic Electrical Engineering", Fourth Edition, McGraw Hill
2. Education, 2019.
3. Thomas L. Floyd, 'Digital Fundamentals', 11th Edition, Pearson Education, 2017.
4. Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition,2017.
5. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, 2002.
6. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010

22154S24 ENGINEERING GRAPHICS

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COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Drawing engineering curves.
- Drawing a freehand sketch of simple objects.
- Drawing orthographic projection of solids and section of solids.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

- Drawing development of solids
- Drawing isometric and perspective projections of simple solids.

CONCEPTS AND CONVENTIONS (Not for Examination)

Importance of graphics in engineering applications — Use of drafting instruments — BIS conventions and specifications — Size, layout and folding of drawing sheets — Lettering and dimensioning.

UNIT I PLANE CURVES AND FREEHAND SKETCHIN 6+12

Basic Geometrical constructions, Curves used in engineering practices: Conics — Construction of ellipse, parabola and hyperbola by eccentricity method — Construction of cycloid — construction of involutes of square and circle — Drawing of tangents and normal to the above curves.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 6+12

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method. Visualization concepts and Free Hand sketching: Visualization principles —Representation of Three Dimensional objects — Layout of views- Freehand sketching of multiple views from pictorialviews of objects.

Practicing three dimensional modeling of simple objects by CAD Software (Not for examination)

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 6 +12

Sectioning of above solids in simple vertical position when the cutting plane is inclined to one of the principal planes and perpendicular to the other — obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders and cones.

Practicing three dimensional modeling of simple objects by CAD Software (Not for examination)

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+12

Principles of isometric projection — isometric scale — isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids - Prisms, pyramids and cylinders by visual ray method.

Practicing three dimensional modeling of isometric projection of simple objects by CAD Software (Not for examination)

TOTAL: (L=30+P=60) 90 PERIODS

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

- Use BIS conventions and specifications for engineering drawing.
- Construct the conic curves, involutes and cycloid.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

- Solve practical problems involving projection of lines.
- Draw the orthographic, isometric and perspective projections of simple solids.
- Draw the development of simple solids.

TEXT BOOKS:

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House,53rd Edition, 2019.
2. Natarajan K.V., "A Text Book of Engineering Graphics", Dhanalakshmi Publishers,Chennai, 2018.
3. Parthasarathy, N. S. and Vela Murali, "Engineering Drawing", Oxford University Press,2015

REFERENCES:

1. Basant Agarwal and Agarwal C.M., "Engineering Drawing", McGraw Hill, 2nd Edition, 2019.
2. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Publications, Bangalore, 27th Edition, 2017.
3. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
4. Parthasarathy N. S. and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
5. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson Education India, 2nd Edition, 2009.
6. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited,2008.

Publication of Bureau of Indian Standards:

1. IS 10711 — 2001: Technical products Documentation — Size and layout of drawing sheets.
2. IS 9609 (Parts 0 & 1) — 2001: Technical products Documentation — Lettering.
3. IS 10714 (Part 20) — 2001 & SP 46 — 2003: Lines for technical drawings.
4. IS 11669 — 1986 & SP 46 —2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) — 2001: Technical drawings — Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permittto use appropriate scale to fit a solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

5. 221AIDS26 DATA STRUCTURES DESIGN

L T P C

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SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

COURSE OBJECTIVES:

- To understand the concepts of ADTs
- To design linear data structures – lists, stacks, and queues
- To understand sorting, searching and hashing algorithms
- To apply Tree and Graph structures

UNIT I ABSTRACT DATA TYPES 9

Abstract Data Types (ADTs) – ADTs and classes – introduction to OOP – classes in Python – inheritance – namespaces – shallow and deep copying

Introduction to analysis of algorithms – asymptotic notations – recursion – analyzing recursive algorithms

UNIT II LINEAR STRUCTURES 9

List ADT – array-based implementations – linked list implementations – singly linked lists –circularly linked lists – doubly linked lists – applications of lists – Stack ADT – Queue ADT – double ended queues

UNIT III SORTING AND SEARCHING 9

Bubble sort – selection sort – insertion sort – merge sort – quick sort – linear search – binary search – hashing – hash functions – collision handling – load factors, rehashing, and efficiency

UNIT IV TREE STRUCTURES 9

Tree ADT – Binary Tree ADT – tree traversals – binary search trees – AVL trees – heaps – multi- way search trees

UNIT V GRAPH STRUCTURES 9

Graph ADT – representations of graph – graph traversals – DAG – topological ordering – shortest paths – minimum spanning trees

TOTAL: 45 HOURS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

- explain abstract data types
- design, implement, and analyse linear data structures, such as lists, queues, and stacks,according to the needs of different applications
- design, implement, and analyse efficient tree structures to meet requirements such assearching, indexing, and sorting
- model problems as graph problems and implement efficient graph algorithms to solve them

TEXT BOOKS:

1. Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, "Data Structures andAlgorithms in Python" (An Indian Adaptation), Wiley, 2021.
2. Lee, Kent D., Hubbard, Steve, "Data Structures and Algorithms with Python" SpringerEdition 2015.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

3. Narasimha Karumanchi, "Data Structures and Algorithmic Thinking with Python"Careermonk, 2015.

REFERENCES:

1. Rance D. Necaise, "Data Structures and Algorithms Using Python", John Wiley & Sons,2011.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein,"Introduction to Algorithms", Third Edition, PHI Learning, 2010.
3. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Fourth Edition,Pearson Education, 2014
4. Aho, Hopcroft, and Ullman, "Data Structures and Algorithms", Pearson Education India,2002.

22154L27 ENGINEERING PRACTICES LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES:

The main learning objective of this course is to provide hands on training to thestudents in:

1. Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in commonhousehold wood work.

2. Wiring various electrical joints in common household electrical wire work.

3. Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.

4. Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & ELECTRICAL)

PART I CIVIL ENGINEERING PRACTICES 15

PLUMBING WORK:

a) Connecting various basic pipe fittings like valves, taps, coupling, unions,reducers,elbows and other components which are commonly used in household.

b) Preparing plumbing line sketches.

c) Laying pipe connection to the suction side of a pump

d) Laying pipe connection to the delivery side of a pump.

e) Connecting pipes of different materials: Metal, plastic and flexible pipesused inhousehold appliances.

WOOD WORK:

a) Sawing,

b) Planing and

c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

Wood Work Study:

a) Studying joints in door panels and wooden furniture

b) Studying common industrial trusses using models.

PART II ELECTRICAL ENGINEERING PRACTICES 15

a) Introduction to switches, fuses, indicators and lamps - Basic switch boardwiring with lamp, fan and three pin socket
b) Staircase wiring
c) Fluorescent Lamp wiring with introduction to CFL and LED types.
d) Energy meter wiring and related calculations/ calibration
e) Study of Iron Box wiring and assembly
f) Study of Fan Regulator (Resistor type and Electronic type usingDiac/Triac/quadrac)
g) Study of emergency lamp wiring/Water heater

GROUP – B (MECHANICAL AND ELECTRONICS)

PART III MECHANICAL ENGINEERING PRACTICES 15

WELDING WORK:

a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.

b) Practicing gas welding.

BASIC MACHINING WORK:

a) (simple)Turning.

b) (simple)Drilling.

c) (simple)Tapping.

ASSEMBLY WORK:

a) Assembling a centrifugal pump.

b) Assembling a household mixer.

c) Assembling an airconditioner.

SHEET METAL WORK:

a) Making of a square tray

FOUNDRY WORK:

a) Demonstrating basic foundry operations.

PART IV ELECTRONIC ENGINEERING PRACTICES 15

SOLDERING WORK:

a) Soldering simple electronic circuits and checking continuity.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

ELECTRONIC ASSEMBLY AND TESTING WORK:

a) Assembling and testing electronic components on a small PCB

ELECTRONIC EQUIPMENT STUDY:

a) Study an elements of smart phone..

b) Assembly and dismantle of LED TV.

c) Assembly and dismantle of computer/ laptop

COURSE OUTCOMES:

TOTAL : 60 PERIODS

Upon completion of this course, the students will be able to:

- Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.
- Wire various electrical joints in common household electrical wire work.
- Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assemblyof common household equipments; Make a tray out of metal sheet using sheet metal work.
- Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

221AIDL28	**DATA STRUCTURES DESIGN LABORATORY**	**L T P C**
		0 0 4 2

COURSE OBJECTIVES:

- To implement ADTs in Python
- To design and implement linear data structures – lists, stacks, and queues
- To implement sorting, searching and hashing algorithms
- To solve problems using tree and graph structures

<u>LIST OF EXPERIMENTS:</u>

<u>Note:</u> The lab instructor is expected to design problems based on the topics listed. The Examination shall not be restricted to the sample experiments designed.

1. Implement simple ADTs as Python classes
2. Implement recursive algorithms in Python
3. Implement List ADT using Python arrays
4. Linked list implementations of List
5. Implementation of Stack and Queue ADTs

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENEUREURSHIP

6. Applications of List, Stack and Queue ADTs
7. Implementation of sorting and searching algorithms
8. Implementation of Hash tables
9. Tree representation and traversal algorithms
10. Implementation of Binary Search Trees

22148S31A DISCRETE MATHEMATICS L T P C

3 1 0 4

COURSE OBJECTIVES:

- To extend student's logical and mathematical maturity and ability to deal with abstraction.
- To introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.
- To understand the basic concepts of combinatorics and graph theory.
- To familiarize the applications of algebraic structures.
- To understand the concepts and significance of lattices and boolean algebra which are widely used in computer science and engineering.

UNIT I LOGIC AND PROOFS 9 + 3

Propositional logic – Propositional equivalences - Predicates and quantifiers – Nested quantifiers – Rules of inference - Introduction to proofs – Proof methods and strategy.

UNIT II COMBINATORICS 9 + 3

Mathematical induction – Strong induction and well ordering – The basics of counting – Thepigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications.

UNIT III GRAPHS 9 + 3

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.

UNIT IV ALGEBRAIC STRUCTURES 9 + 3

Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphism's – Normal subgroup and cosets – Lagrange's theorem – Definitions and examples of Rings and Fields.

UNIT V LATTICES AND BOOLEAN ALGEBRA 9 + 3

Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra – Sub Boolean Algebra – Boolean Homomorphism.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, students would :

CO1:Have knowledge of the concepts needed to test the logic of a program.

CO2:Have an understanding in identifying structures on many levels.

CO3:Be aware of a class of functions which transform a finite set into another finite set which relatesto

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

input and output functions in computer science.
CO4:Be aware of the counting principles.
CO5:Be exposed to concepts and properties of algebraic structures such as groups, rings andfields.

TEXT BOOKS:

1. Rosen. K.H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGrawHill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2017.
2. Tremblay. J.P. and Manohar. R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011.

REFERENCES:

1. Grimaldi. R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 5thEdition, Pearson Education Asia, Delhi, 2013.
2. Koshy. T. "Discrete Mathematics with Applications", Elsevier Publications, 2006.
3. Lipschutz. S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.

221AIDS32 DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION L T P C

3 0 2 4

COURSE OBJECTIVES:

- To analyze and design combinational circuits.
- To analyze and design sequential circuits
- To understand the basic structure and operation of a digital computer.
- To study the design of data path unit, control unit for processor and to familiarize with the hazards.
- To understand the concept of various memories and I/O interfacing.

UNIT I COMBINATIONAL LOGIC 9

Combinational Circuits – Karnaugh Map - Analysis and Design Procedures – Binary Adder –Subtractor – Decimal Adder - Magnitude Comparator – Decoder – Encoder – Multiplexers - Demultiplexers

UNIT II SYNCHRONOUS SEQUENTIAL LOGIC 9

Introduction to Sequential Circuits – Flip-Flops – operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design – Moore/Mealy models, state minimization, state assignment, circuit implementation - Registers – Counters.

UNIT III COMPUTER FUNDAMENTALS 9

Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction – Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes, Encoding of Machine Instruction – Interaction between Assembly and High Level Language.

UNIT IV PROCESSOR 9

Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Microprogrammed Control – Pipelining – Data Hazard – Control Hazards.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

UNIT V MEMORY AND I/O 9

Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O – Interconnection Standards: USB, SATA

45 PERIODS

PRACTICAL EXERCISES: 30 PERIODS

1. Verification of Boolean theorems using logic gates.
2. Design and implementation of combinational circuits using gates for arbitrary functions.
3. Implementation of 4-bit binary adder/subtractor circuits.
4. Implementation of code converters.
5. Implementation of BCD adder, encoder and decoder circuits
6. Implementation of functions using Multiplexers.
7. Implementation of the synchronous counters
8. Implementation of a Universal Shift register.
9. Simulator based study of Computer Architecture

COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO1 : Design various combinational digital circuits using logic gates
CO2 : Design sequential circuits and analyze the design procedures
CO3 : State the fundamentals of computer systems and analyze the execution of an instruction
CO4 : Analyze different types of control design and identify hazards
CO5 : Identify the characteristics of various memory systems and I/O communication

TOTAL:75 PERIODS

TEXT BOOKS

1. M. Morris Mano, Michael D. Ciletti, "Digital Design : With an Introduction to the Verilog HDL,VHDL, and System Verilog", Sixth Edition, Pearson Education, 2018.
2. David A. Patterson, John L. Hennessy, "Computer Organization and Design, The Hardware/Software Interface", Sixth Edition, Morgan Kaufmann/Elsevier, 2020.

REFERENCES

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization andEmbedded Systems", Sixth Edition, Tata McGraw-Hill, 2012.
2. William Stallings, "Computer Organization and Architecture – Designing for Performance", TenthEdition, Pearson Education, 2016.
3. M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, 2016.

221AIDC33	DATABASE DESIGN AND MANAGEMENT	L T P C
		3 0 0 3

COURSE OBJECTIVES:

- To introduce database development life cycle and conceptual modeling
- To learn SQL for data definition, manipulation and querying a database
- To learn relational database design using conceptual mapping and normalization

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

- To learn transaction concepts and serializability of schedules
- To learn data model and querying in object-relational and No-SQL databases

UNIT I CONCEPTUAL DATA MODELING 8

Database environment – Database system development lifecycle – Requirements collection –Database design -- Entity-Relationship model – Enhanced-ER model – UML class diagrams.

UNIT II RELATIONAL MODEL AND SQL 10

Relational model concepts -- Integrity constraints -- SQL Data manipulation – SQL Data definition – Views -- SQL programming.

UNIT III RELATIONAL DATABASE DESIGN AND NORMALIZATION 10

ER and EER-to-Relational mapping – Update anomalies – Functional dependencies – Inferencerules – Minimal cover – Properties of relational decomposition – Normalization (upto BCNF).

UNIT IV TRANSACTION MANAGEMENT 8

Transaction concepts – properties – Schedules – Serializability – Concurrency Control – Two-phaselocking techniques.

UNIT V OBJECT RELATIONAL AND NO-SQL DATABASES 9

Mapping EER to ODB schema – Object identifier – reference types – rowtypes – UDTs – Subtypes and supertypes – user-defined routines – Collection types – Object Query Language; No-SQL: CAP theorem – Document-based: MongoDB data model and CRUD operations; Column-based: Hbase data model and CRUD operations.

TOTAL : 45 PERIODS

COURSE OUTCOMES

After the completion of this course, students will be able to:

- Understand the database development life cycle and apply conceptual modeling
- Apply SQL and programming in SQL to create, manipulate and query the database
- Apply the conceptual-to-relational mapping and normalization to design relational database
- Determine the serializability of any non-serial schedule using concurrency techniques
- Apply the data model and querying in Object-relational and No-SQL databases.

TEXT BOOKS:

1. Thomas M. Connolly, Carolyn E. Begg, Database Systems – A Practical Approach to Design, Implementation, and Management, Sixth Edition, Global Edition, Pearson Education, 2015.
2. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, 7th Edition, Pearson, 2017.

REFERENCES:

1. Toby Teorey, Sam Lightstone, Tom Nadeau, H. V. Jagadish, “DATABASE MODELING ANDDESIGN - Logical Design”, Fifth Edition, Morgan Kaufmann Publishers, 2011.
2. Carlos Coronel, Steven Morris, and Peter Rob, Database Systems: Design, Implementation, and Management, Ninth Edition, Cengage learning, 2012
3. Abraham Silberschatz, Henry F Korth, S Sudharshan, “Database System Concepts", 6th

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENEUERSHIP

Edition, Tata Mc Graw Hill, 2011.
4. Hector Garcia-Molina, Jeffrey D Ullman, Jennifer Widom, "Database Systems:The Complete Book", 2nd edition, Pearson.
5. Raghu Ramakrishnan, "Database Management Systems", 4th Edition, Tata Mc Graw Hill, 2010.

221AIDC34 DESIGN AND ANALYSIS OF ALGORITHMS L T P C

3 0 2 4

COURSE OBJECTIVES:

- To critically analyze the efficiency of alternative algorithmic solutions for the same problem
- To illustrate brute force and divide and conquer design techniques.
- To explain dynamic programming and greedy techniques for solving various problems.
- To apply iterative improvement technique to solve optimization problems
- To examine the limitations of algorithmic power and handling it in different problems.

UNIT I INTRODUCTION 8

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types –Fundamentals of the Analysis of Algorithm Efficiency – Analysis Framework - Asymptotic Notations and their properties – Empirical analysis - Mathematical analysis of Recursive and Non-recursive algorithms – Visualization.

UNIT II BRUTE FORCE AND DIVIDE AND CONQUER 10

Brute Force – String Matching - Exhaustive Search - Traveling Salesman Problem - Knapsack Problem - Assignment problem. Divide and Conquer Methodology – Multiplication of Large Integers and Strassen's Matrix Multiplication – Closest-Pair and Convex - Hull Problems. Decrease and Conquer: - Topological Sorting – Transform and Conquer: Presorting – Heaps and Heap Sort.

UNIT III DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE 10

Dynamic programming – Principle of optimality - Coin changing problem – Warshall's and Floyd's algorithms – Optimal Binary Search Trees - Multi stage graph - Knapsack Problem and Memory functions. Greedy Technique – Dijkstra's algorithm - Huffman Trees and codes - 0/1 Knapsack problem.

UNIT IV ITERATIVE IMPROVEMENT 8

The Simplex Method-The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs- The Stable marriage Problem.

UNIT V LIMITATIONS OF ALGORITHM POWER 9

Lower - Bound Arguments - P, NP, NP- Complete and NP Hard Problems. Backtracking – N-Queen problem - Hamiltonian Circuit Problem – Subset Sum Problem. Branch and Bound – LIFO Search and FIFO search - Assignment problem – Knapsack Problem – Traveling Salesman Problem - Approximation Algorithms for NP-Hard Problems – Traveling Salesman problem – Knapsack problem.

TOTAL: 45 PERIODS

PRACTICAL EXERCISES:

1. Implement recursive and non-recursive algorithms and study the order of growth from log2nto n!.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENEUERSHIP

2. Divide and Conquer - Strassen’s Matrix Multiplication
3. Decrease and Conquer - Topological Sorting
4. Transform and Conquer - Heap Sort
5. Dynamic programming - Coin change Problem, Warshall’s and Floyd‘s algorithms, Knapsack Problem
6. Greedy Technique – Dijkstra’s algorithm, Huffman Trees and codes
7. Iterative improvement - Simplex Method
8. Backtracking – N-Queen problem, Subset Sum Problem
9. Branch and Bound - Assignment problem, Traveling Salesman Problem

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO1: Analyze the efficiency of recursive and non-recursive algorithms mathematically

CO2: Analyze the efficiency of brute force, divide and conquer, decrease and conquer, Transformand conquer algorithmic techniques

CO3: Implement and analyze the problems using dynamic programming and greedy algorithmic techniques.

CO4: Solve the problems using iterative improvement techniques for optimization.

CO5: Compute the limitations of algorithmic power and solve the problems using backtracking and branch and bound techniques.

TOTAL: 75 PERIODS

TEXT BOOKS:

1. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2012.

REFERENCES:

1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2019.
2. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, Third Edition, PHI Learning Private Limited, 2012.
3. S. Sridhar, Design and Analysis of Algorithms, Oxford university press, 2014.
4. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, Data Structures and Algorithms,Pearson Education, Reprint 2006.

221AIDC35	DATA EXPLORATION AND VISUALIZATION	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To outline an overview of exploratory data analysis.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

- To implement data visualization using Matplotlib.
- To perform univariate data exploration and analysis.
- To apply bivariate data exploration and analysis.
- To use Data exploration and visualization techniques for multivariate and time series data.

UNIT I EXPLORATORY DATA ANALYSIS 9

EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA - Visual Aids for EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques - Grouping Datasets - data aggregation – Pivot tables and cross-tabulations.

UNIT II VISUALIZING USING MATPLOTLIB 9

Importing Matplotlib – Simple line plots – Simple scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

UNIT III UNIVARIATE ANALYSIS 9

Introduction to Single variable: Distributions and Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality - Smoothing Time Series.

UNIT IV BIVARIATE ANALYSIS 9

Relationships between Two Variables - Percentage Tables - Analyzing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines – Transformations.

UNIT V MULTIVARIATE AND TIME SERIES ANALYSIS 9

Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond - Longitudinal Data – Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Time-based indexing – Visualizing – Grouping – Resampling.

45 PERIODS

PRACTICAL EXERCISES: 30 PERIODS

1. Install the data Analysis and Visualization tool: R/ Python /Tableau Public/ Power BI.
2. Perform exploratory data analysis (EDA) on with datasets like email data set. Export all your emails as a dataset, import them inside a pandas data frame, visualize them and get differentinsights from the data.
3. Working with Numpy arrays, Pandas data frames , Basic plots using Matplotlib.
4. Explore various variable and row filters in R for cleaning data. Apply various plot features in Ron sample data sets and visualize.
5. Perform Time Series Analysis and apply the various visualization techniques.
6. Perform Data Analysis and representation on a Map using various Map data sets with Mouse Rollover effect, user interaction, etc..
7. Build cartographic visualization for multiple datasets involving various countries of the world;states and districts in India etc.
8. Perform EDA on Wine Quality Data Set.
9. Use a case study on a data set and apply the various EDA and visualization techniques and

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

present an analysis report.

COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO1: Understand the fundamentals of exploratory data analysis.

CO2: Implement the data visualization using Matplotlib.

CO3: Perform univariate data exploration and analysis.

CO4: Apply bivariate data exploration and analysis.

CO5: Use Data exploration and visualization techniques for multivariate and time series data.

TOTAL: 75 PERIODS

TEXT BOOKS:

1. Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python",Packt Publishing, 2020. (Unit 1)

2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", Oreilly, 1st Edition, 2016. (Unit 2)

3. Catherine Marsh, Jane Elliott, "Exploring Data: An Introduction to Data Analysis for SocialScientists", Wiley Publications, 2nd Edition, 2008. (Unit 3,4,5)

REFERENCES:

1. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017.

2. Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly publications, 2019.

3. Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", 2nd Edition, CRC press, 2015.

221AIDC36	**ARTIFICIAL INTELLIGENCE**	**L T P C**
		3 0 0 3

COURSE OBJECTIVES:

The main objectives of this course are to:

- Learn the basic AI approaches
- Develop problem solving agents
- Perform logical and probabilistic reasoning

UNIT I INTELLIGENT AGENTS 9

Introduction to AI – Agents and Environments – concept of rationality – nature of environments – structure of agents. Problem solving agents – search algorithms – uninformed search strategies.

UNIT II PROBLEM SOLVING 9

Heuristic search strategies – heuristic functions. Local search and optimization problems – local search in continuous space – search with non-deterministic actions – search in partially observable environments – online search agents and unknown environments

UNIT III GAME PLAYING AND CSP 9

Game theory – optimal decisions in games – alpha-beta search – monte-carlo tree search – stochastic games – partially observable games. Constraint satisfaction problems – constraint propagation – backtracking search for CSP – local search for CSP – structure of CSP.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

UNIT IV LOGICAL REASONING 9

Knowledge-based agents – propositional logic – propositional theorem proving – propositionalmodel checking – agents based on propositional logic. First-order logic – syntax and semantics – knowledge representation and engineering – inferences in first-order logic – forward chaining – backward chaining – resolution.

UNIT V PROBABILISTIC REASONING 9

Acting under uncertainty – Bayesian inference – naïve Bayes models. Probabilistic reasoning – Bayesian networks – exact inference in BN – approximate inference in BN – causal networks.

COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO1: Explain intelligent agent frameworks

CO2: Apply problem solving techniques

CO3: Apply game playing and CSP techniquesCO4: Perform logical reasoning

CO5: Perform probabilistic reasoning under uncertainty

TEXT BOOKS:

TOTAL:45 PERIODS

1. Stuart Russell and Peter Norvig, “Artificial Intelligence – A Modern Approach”, FourthEdition, Pearson Education, 2021.

REFERENCES

1. Dan W. Patterson, “Introduction to AI and ES”, Pearson Education,2007
2. Kevin Night, Elaine Rich, and Nair B., “Artificial Intelligence”, McGraw Hill, 2008
3. Patrick H. Winston, "Artificial Intelligence", Third Edition, Pearson Education, 2006
4. Deepak Khemani, “Artificial Intelligence”, Tata McGraw Hill Education, 2013.
5. http://nptel.ac.in/

221AIDL37 DATABASE DESIGN AND MANAGEMENT LABORATORY **L T PC**
0 0 3 1.5

COURSE OBJECTIVES:

- To understand the database development life cycle
- To learn database design using conceptual modeling, Normalization
- To implement database using Data definition, Querying using SQL manipulation and SQL programming
- To implement database applications using IDE/RAD tools
- To learn querying Object-relational databases

SUGGESTIVE EXPERIMENTS

1. Database Development Life cycle:

Problem definition and Requirement analysisScope and

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

Constraints
2. Database design using Conceptual modeling (ER-EER) – top-down approach
Mapping conceptual to relational database and validate using Normalization
3. Implement the database using SQL Data definition with constraints, Views
4. Query the database using SQL Manipulation
5. Querying/Managing the database using SQL Programming
- Stored Procedures/Functions
- Constraints and security using Triggers
6. Database design using Normalization – bottom-up approach
7. Develop database applications using IDE/RAD tools (Eg., NetBeans,VisualStudio)
8. Database design using EER-to-ODB mapping / UML class diagrams
9. Object features of SQL-UDTs and sub-types, Tables using UDTs, Inheritance, Method definition
10. Querying the Object-relational database using Objet Query language

COURSE OUTCOMES

After the completion of this course, students will be able to:

- Understand the database development life cycle
- Design relational database using conceptual-to-relational mapping, Normalization
- Apply SQL for creation, manipulation and retrieval of data
- Develop a database applications for real-time problems
- Design and query object-relational databases

TOTAL : 45 PERIODS

HARDWARE:

- Standalone Desktops

SOFTWARE:

- PostgreSQL

221AIDL38	**ARTIFICIAL INTELLIGENCE LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

OBJECTIVES:

- To design and implement search strategies
- To implement game playing techniques
- To implement CSP techniques
- To develop systems with logical reasoning
- To develop systems with probabilistic reasoning

LIST OF EXPERIMENTS:

1. Implement basic search strategies – 8-Puzzle, 8 - Queens problem, Cryptarithmetic.
2. Implement A* and memory bounded A* algorithms
3. Implement Minimax algorithm for game playing (Alpha-Beta pruning)
4. Solve constraint satisfaction problems
5. Implement propositional model checking algorithms
6. Implement forward chaining, backward chaining, and resolution strategies
7. Build naïve Bayes models
8. Implement Bayesian networks and perform inferences

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

9. Mini-Project

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Design and implement search strategies
CO2: Implement game playing and CSP techniquesCO3:
Develop logical reasoning systems
CO4: Develop probabilistic reasoning systems

22148S41A PROBABILITY AND STATISTICS **L T P C**
3 1 0 4

COURSE OBJECTIVES

- This course aims at providing the required skill to apply the statistical tools in engineering problems.
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two dimensional random variables.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.

UNIT I PROBABILITY AND RANDOM VARIABLES 9 + 3

Axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions – Functions of a random variable.

UNIT II TWO- DIMENSIONAL RANDOM VARIABLES 9 + 3

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III ESTIMATION THEORY 9 + 3

Unbiased estimators - Efficiency - Consistency - Sufficiency - Robustness - Method of moments - Method of maximum Likelihood - Interval estimation of Means - Differences between means,variations and ratio of two variances

UNIT IV NON- PARAMETRIC TESTS 9 + 3

Introduction - The Sign test - The Signed - Rank test - Rank - sum tests - The U test - The H test -Tests based on Runs - Test of randomness - The Kolmogorov Tests .

UNIT V STATISTICAL QUALITY CONTROL 9 + 3

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENEUERSHIP

Control charts for measurements ($\overline{X}$ and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to:

- Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agricultureand statistical quality control.
- Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

TEXT BOOKS

1. Johnson. R.A., Miller. I.R and Freund . J.E, " Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2016.
2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata Mc Graw Hill,4th Edition, 2007.
3. John E. Freund, "Mathematical Statistics", Prentice Hall, 5th Edition, 1992.

REFERENCES:

1. Gupta. S.C. and Kapoor. V. K., "Fundamentals of Mathematical Statistics", Sultan Chand &Sons, New Delhi, 12th Edition, 2020.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3. Ross. S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 5thEdition, Elsevier, 2014.
4. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 4th Edition, 2012.
5. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers andScientists", Pearson Education, Asia, 9th Edition, 2010.

221AIDC42	OPERATING SYSTEMS	L T P C
		3 0 2 4

COURSE OBJECTIVES:

- To understand the basics and functions of operating systems.
- To understand Processes and Threads
- To analyze Scheduling algorithms and process synchronization.
- To understand the concept of Deadlocks.
- To analyze various memory management schemes.
- To be familiar with I/O management and File systems.
- To be familiar with the basics of virtual machines and Mobile OS like iOS and Android.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

UNIT I INTRODUCTION 7

Computer System - Elements and organization; Operating System Overview - Objectives and Functions - Evolution of Operating System; Operating System Structures – Operating SystemServices - User Operating System Interface - System Calls – System Programs - Design and Implementation - Structuring methods.

UNIT II PROCESS MANAGEMENT 11

Processes - Process Concept - Process Scheduling - Operations on Processes - Inter-process Communication; CPU Scheduling - Scheduling criteria - Scheduling algorithms: Threads - Multithread Models – Threading issues; Process Synchronization - The critical-section problem - Synchronization hardware – Semaphores – Mutex - Classical problems of synchronization - Monitors; Deadlock - Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

UNIT III MEMORY MANAGEMENT 10

Main Memory - Swapping - Contiguous Memory Allocation – Paging - Structure of the Page Table - Segmentation, Segmentation with paging; Virtual Memory - Demand Paging – Copy on Write - Page Replacement - Allocation of Frames –Thrashing.

UNIT IV STORAGE MANAGEMENT 10

Mass Storage system – Disk Structure - Disk Scheduling and Management; File-System Interface - File concept - Access methods - Directory Structure - Directory organization - File system mounting - File Sharing and Protection; File System Implementation - File System Structure - Directory implementation - Allocation Methods - Free Space Management; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem.

UNIT V VIRTUAL MACHINES AND MOBILE OS 7

Virtual Machines – History, Benefits and Features, Building Blocks, Types of Virtual Machines and their Implementations, Virtualization and Operating-System Components; Mobile OS - iOS and Android.

45 PERIODS

PRACTICAL EXERCISES: 30 PERIODS

1. Installation of Operating system : Windows/ Linux
2. Illustrate UNIX commands and Shell Programming
3. Process Management using System Calls : Fork, Exec, Getpid, Exit, Wait, Close
4. Write C programs to implement the various CPU Scheduling Algorithms
5. Illustrate the inter process communication strategy
6. Implement mutual exclusion by Semaphores
7. Write a C program to avoid Deadlock using Banker's Algorithm
8. Write a C program to Implement Deadlock Detection Algorithm
9. Write C program to implement Threading
10. Implement the paging Technique using C program

1. Write C programs to implement the following Memory Allocation Methods

a. First Fit b. Worst Fit c. Best Fit

2. Write C programs to implement the various Page Replacement Algorithms

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

3. Write C programs to Implement the various File Organization Techniques
4. Implement the following File Allocation Strategies using C programs
a. Sequential b. Indexed c. Linked
5. Write C programs for the implementation of various disk scheduling algorithms

COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO1: Analyze various scheduling algorithms and process synchronization.CO2 : Explain deadlock, prevention and avoidance algorithms.

CO3 : Compare and contrast various memory management schemes.

CO4 : Explain the functionality of file systems I/O systems, and VirtualizationCO5 : Compare iOS and Android Operating Systems.

TEXTBOOKS

TOTAL:75 PERIODS

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley and Sons Inc., 2018.
2. Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 4th Edition, New Delhi, 2016.

REFERENCES

1. Ramaz Elmasri, A. Gil Carrick, David Levine, "Operating Systems – A Spiral Approach", TataMcGraw Hill Edition, 2010.
2. William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, PrenticeHall, 2018.
3. Achyut S.Godbole, Atul Kahate, "Operating Systems", McGraw Hill Education, 2016.

221AIDC43 MACHINE LEARNING L T P C3 0 0 3

COURSE OBJECTIVES:

- To understand the basic concepts of machine learning.
- To understand and build supervised learning models.
- To understand and build unsupervised learning models.
- To evaluate the algorithms based on corresponding metrics identified

UNIT I INTRODUCTION TO MACHINE LEARNING 8

Review of Linear Algebra for machine learning; Introduction and motivation for machine learning; Examples of machine learning applications, Vapnik-Chervonenkis (VC) dimension, Probably Approximately Correct (PAC) learning, Hypothesis spaces, Inductive bias, Generalization, Bias variance trade-off.

UNIT II SUPERVISED LEARNING 11

Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Perceptron algorithm, Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random Forests

UNIT III ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING 9

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENEUERSHIP

Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization.

UNIT IV NEURAL NETWORKS 9

Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks –Unit saturation (aka the vanishing gradient problem) – ReLU, hyperparameter tuning, batch normalization, regularization, dropout.

UNIT V DESIGN AND ANALYSIS OF MACHINE LEARNING EXPERIMENTS 8

Guidelines for machine learning experiments, Cross Validation (CV) and resampling – K-fold CV, bootstrapping, measuring classifier performance, assessing a single classification algorithm and comparing two classification algorithms – *t* test, McNemar's test, K-fold CV paired *t* test

COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO1**:** Explain the basic concepts of machine learning.

CO2 : Construct supervised learning models.

CO3 : Construct unsupervised learning algorithms.

CO4: Evaluate and compare different models

TOTAL:45 PERIODS

TEXTBOOKS:

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.
2. Stephen Marsland, "Machine Learning: An Algorithmic Perspective, "Second Edition", CRCPress, 2014.

REFERENCES:

1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
2. Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition, 1997.
3. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", Second Edition, MIT Press, ~~2012~~, 2018.
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016
5. Sebastain Raschka, Vahid Mirjalili , "Python Machine Learning", Packt publishing, 3rdEdition, 2019.

221AIDC44	FUNDAMENTALS OF DATA SCIENCE AND ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the techniques and processes of data science
- To apply descriptive data analytics
- To visualize data for various applications
- To understand inferential data analytics
- To analysis and build predictive models from data

UNIT I INTRODUCTION TO DATA SCIENCE 08

Need for data science – benefits and uses – facets of data – data science process – setting the research goal – retrieving data – cleansing, integrating, and transforming data – exploratory data analysis – build

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENEUERSHIP

the models – presenting and building applications.

UNIT II DESCRIPTIVE ANALYTICS 10

Frequency distributions – Outliers –interpreting distributions – graphs – averages - describingvariability – interquartile range – variability for qualitative and ranked data - Normal distributions – z scores – correlation – scatter plots – regression – regression line – least squares regression line – standard error of estimate – interpretation of r^2 – multiple regression equations – regression toward the mean.

UNIT III INFERENTIAL STATISTICS 09

Populations – samples – random sampling – Sampling distribution- standard error of the mean - Hypothesis testing – z-test – z-test procedure –decision rule – calculations – decisions – interpretations - one-tailed and two-tailed tests – Estimation – point estimate – confidence interval – level of confidence – effect of sample size.

UNIT IV ANALYSIS OF VARIANCE 09

t-test for one sample – sampling distribution of t – t-test procedure – t-test for two independent samples – p-value – statistical significance – t-test for two related samples. F-test – ANOVA – Two- factor experiments – three f-tests – two-factor ANOVA –Introduction to chi-square tests.

UNIT V PREDICTIVE ANALYTICS 09

Linear least squares – implementation – goodness of fit – testing a linear model – weighted resampling. Regression using StatsModels – multiple regression – nonlinear relationships – logistic regression – estimating parameters – Time series analysis – moving averages – missing values – serial correlation – autocorrelation. Introduction to survival analysis.

TOTAL : 45 PERIODS

OUTCOMES:

Upon successful completion of this course, the students will be able to:CO1:
Explain the data analytics pipeline

CO2: Describe and visualize data

CO3 : Perform statistical inferences from data

CO4 : Analyze the variance in the data

CO5 : Build models for predictive analytics

TEXT BOOKS

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016. (first two chapters for Unit I).
2. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017.
3. Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016.

REFERENCES

1. Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press,2014.
2. Sanjeev J. Wagh, Manisha S. Bhende, Anuradha D. Thakare, “Fundamentals of Data Science”, CRC Press, 2022.
3. Chirag Shah, “A Hands-On Introduction to Data Science”, Cambridge University Press, 2020.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

4. Vineet Raina, Srinath Krishnamurthy, "Building an Effective Data Science Practice: A Framework to Bootstrap and Manage a Successful Data Science Practice", Apress, 2021.

221AIDC45	COMPUTER NETWORKS	L T P C
		3 0 2 4

COURSE OBJECTIVES:

- To understand the concept of layering in networks.
- To know the functions of protocols of each layer of TCP/IP protocol suite.
- To visualize the end-to-end flow of information.
- To learn the functions of network layer and the various routing protocols
- To familiarize the functions and protocols of the Transport layer

UNIT I INTRODUCTION AND APPLICATION LAYER 10

Data Communication - Networks – Network Types – Protocol Layering – TCP/IP Protocol suite –OSI Model – Introduction to Sockets - Application Layer protocols: HTTP – FTP – Email protocols (SMTP - POP3 - IMAP - MIME) – DNS – SNMP

UNIT II TRANSPORT LAYER 9

Introduction - Transport-Layer Protocols: UDP – TCP: Connection Management – Flow control - Congestion Control - Congestion avoidance (DECbit, RED) – SCTP – Quality of Service

UNIT III NETWORK LAYER 7

Switching : Packet Switching - Internet protocol - IPV4 – IP Addressing – Subnetting - IPV6, ARP, RARP, ICMP, DHCP

UNIT IV ROUTING 7

Routing and protocols: Unicast routing - Distance Vector Routing - RIP - Link State Routing – OSPF – Path-vector routing - BGP - Multicast Routing: DVMRP – PIM.

UNIT V DATA LINK AND PHYSICAL LAYERS 12

Data Link Layer – Framing – Flow control – Error control – Data-Link Layer Protocols – HDLC – PPP - Media Access Control – Ethernet Basics – CSMA/CD – Virtual LAN – Wireless LAN (802.11) - Physical Layer: Data and Signals - Performance – Transmission media- Switching – Circuit Switching.

45 PERIODS

PRACTICAL EXERCISES: 30 PERIODS

1. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and trace route PDUs using a network protocol analyzer and examine.
2. Write a HTTP web client program to download a web page using TCP sockets.
3. Applications using TCP sockets like: a) Echo client and echo server b) Chat
4. Simulation of DNS using UDP sockets.
5. Use a tool like Wireshark to capture packets and examine the packets
6. Write a code simulating ARP /RARP protocols.
7. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.
8. Study of TCP/UDP performance using Simulation tool.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

9. Simulation of Distance Vector/ Link State Routing algorithm.
10. Simulation of an error correction code (like CRC)

COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO 1: Explain the basic layers and its functions in computer networks.

CO 2: Understand the basics of how data flows from one node to another.

CO 3: Analyze routing algorithms.

CO 4: Describe protocols for various functions in the network.

CO 5: Analyze the working of various application layer protocols.

TEXT BOOKS

TOTAL:75 PERIODS

1. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Eighth Edition, Pearson Education, 2021.
2. Behrouz A. Forouzan, Data Communications and Networking with TCP/IP Protocol Suite, Sixth Edition TMH, 2022

REFERENCES

1. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Fifth Edition,Morgan Kaufmann Publishers Inc., 2012.
2. William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2013.
3. Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014.
4. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, “Computer Networks: An Open Source Approach”, McGraw Hill, 2012.

	L	T	P	C
22149S46 ENVIRONMENTAL SCIENCES AND SUSTAINABILITY	**2**	**0**	**0**	**2**

UNIT I ENVIRONMENT AND BIODIVERSITY 6

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threatsto biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ.

UNIT II ENVIRONMENTAL POLLUTION 9

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts .

UNIT III RENEWABLE SOURCES OF ENERGY 6

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.

UNIT IV SUSTAINABILITY AND MANAGEMENT 6

Development , GDP ,Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols-Sustainable Development Goals-targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.

UNIT V SUSTAINABILITY PRACTICES 6

Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles- carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio- economical and technological change.

TOTAL: 30 PERIODS

TEXT BOOKS:

1. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi,2016.
3. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition,Pearson Education, 2004.
4. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.
6. Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
7. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.

REFERENCES :

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38 . edition 2010.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi,2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, ThirdEdition, 2015.
5. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

221AIDL47 DATA SCIENCE AND ANALYTICS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- To develop data analytic code in python
- To be able to use python libraries for handling data
- To develop analytical applications using python
- To perform data visualization using plots

LIST OF EXPERIMENTS

Tools: Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh

Working with Numpy arrays

1. Working with Pandas data frames
2. Basic plots using Matplotlib
3. Frequency distributions, Averages, Variability
4. Normal curves, Correlation and scatter plots, Correlation coefficient
5. Regression
6. Z-test
7. T-test
8. ANOVA
9. Building and validating linear models
10. Building and validating logistic models
11. Time series analysis

OUTCOMES:

PRACTICALS 60 PERIODS

Upon successful completion of this course, students will be able to:

CO1. Write python programs to handle data using Numpy and Pandas

CO2. Perform descriptive analytics

CO3. Perform data exploration using Matplotlib

CO4. Perform inferential data analytics

CO5. Build models of predictive analytics

REFERENCES

1. Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016.
2. Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press,2014.
3. Data Analysis and Visualization Using Python, Analyze Data to Create Visualizations forBI Systems — Dr. Ossama Embarak

221AIDL48 MACHINE LEARNING LABORATORY L T P C

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

0 0 4 2

OBJECTIVES:

- To understand the data sets and apply suitable algorithms for selecting the appropriate features for analysis.
- To learn to implement supervised machine learning algorithms on standard datasets and evaluate the performance.
- To experiment the unsupervised machine learning algorithms on standard datasets and evaluate the performance.
- To build the graph based learning models for standard data sets.
- To compare the performance of different ML algorithms and select the suitable one based on the application.

LIST OF EXPERIMENTS:

1. For a given set of training data examples stored in a .CSV file, implement and demonstrate the **Candidate-Elimination algorithm** to output a description of the set of all hypotheses consistent with the training examples.
2. Write a program to demonstrate the working of the decision tree based **ID3 algorithm**. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
3. Build an Artificial Neural Network by implementing the **Backpropagation algorithm** and test the same using appropriate data sets.
4. Write a program to implement the **naïve Bayesian classifier** for a sample training data set stored as a .CSV file and compute the accuracy with a few test data sets.
5. Implement **naïve Bayesian Classifier** model to classify a set of documents and measure the accuracy, precision, and recall.
6. Write a program to construct a **Bayesian network to** diagnose CORONA infection using standard WHO Data Set.
7. Apply **EM algorithm** to cluster a set of data stored in a .CSV file. Use the same data set for clustering using the k-Means **algorithm**. Compare the results of these two algorithms.
8. Write a program to implement ***k*-Nearest Neighbour algorithm** to classify the iris data set. Print both correct and wrong predictions.
9. Implement the non-parametric **Locally Weighted Regression algorithm** in order to fit data points. Select an appropriate data set for your experiment and draw graphs.

List of Equipments:(30 Students per Batch)

The programs can be implemented in either Python or R.

OUTCOMES:

At the end of this course, the students will be able to:

TOTAL:60 PERIODS

CO1:Apply suitable algorithms for selecting the appropriate features for analysis. CO2:Implement supervised machine learning algorithms on standard datasets and evaluate theperformance.

CO3:Apply unsupervised machine learning algorithms on standard datasets and evaluate the performance.

CO4:Build the graph based learning models for standard data sets.

CO5:Assess and compare the performance of different ML algorithms and select the suitable one

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

based on the application.

221AIDC51 DEEP LEARNING LTPC

3 0 0 3

COURSEOBJECTIVES:

- Tounderstandandneedandprinciplesof deepneuralnetworks
- TounderstandCNNandRNNarchitecturesofdeepneuralnetworks
- Tocomprehendadvanceddeeplearningmodels
- Tolearntheevaluationmetricsfordeeplearningmodels

UNITI DEEPNETWORKSBASICS 9

Linear Algebra: Scalars -- Vectors -- Matrices and tensors; Probability Distributions -- Gradient-based Optimization – Machine Learning Basics: Capacity -- Overfitting and underfitting -- Hyperparameters and validation sets -- Estimators -- Bias and variance -- Stochastic gradient descent -- Challenges motivating deep learning; Deep Networks: Deep feedforward networks; Regularization -- Optimization.

UNITII CONVOLUTIONALNEURALNETWORKS 9

Convolution Operation -- Sparse Interactions -- Parameter Sharing -- Equivariance -- Pooling -- Convolution Variants: Strided -- Tiled -- Transposed and dilated convolutions; CNN Learning: Nonlinearity Functions -- Loss Functions -- Regularization -- Optimizers --Gradient Computation.

UNITIII RECURRENTNEURALNETWORKS 10

Unfolding Graphs -- RNN Design Patterns: Acceptor -- Encoder --Transducer; Gradient Computation -- Sequence Modeling Conditioned on Contexts -- Bidirectional RNN -- Sequence to Sequence RNN – Deep Recurrent Networks -- Recursive Neural Networks -- Long Term Dependencies; Leaky Units: Skip connections and dropouts; Gated Architecture: LSTM.

UNITIV MODELEVALUATION 8

Performancemetrics--BaselineModels --Hyperparameters:ManualHyperparameter --Automatic Hyperparameter -- Grid search -- Random search -- Debugging strategies.

UNITV AUTOENCODERSANDGENERATIVEMODELS 9

Autoencoders: Undercomplete autoencoders -- Regularized autoencoders -- Stochastic encoders and decoders -- Learning with autoencoders; DeepGenerative Models: Variationalautoencoders – Generative adversarial networks.

TOTAL:45PERIODS

COURSEOUTCOMES

Afterthecompletionofthiscourse,studentswillbeableto:

CO1: Explainthebasicsindeepneuralnetworks

CO2: Apply Convolution Neural Network for image processing

CO3: ApplyRecurrentNeuralNetworkanditsvariantsfortextanalysis

CO4: Apply model evaluation for various applications

CO5: Applyautoencodersandgenerativemodelsforsuitableapplications

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

TEXTBOOK

1. IanGoodfellow,YoshuaBengio,AaronCourville,``DeepLearning",MITPress,2016.
2. AndrewGlassner,"DeepLearning:AVisualApproach",NoStarchPress,2021.

REFERENCES

1. Salman Khan, Hossein Rahmani, Syed Afaq Ali Shah, Mohammed Bennamoun, ``A Guide to Convolutional Neural Networks for Computer Vision", Synthesis Lectures on Computer Vision, Morgan & Claypool publishers, 2018.
2. Yoav Goldberg, ``Neural Network Methods for Natural Language Processing", Synthesis Lectures on Human Language Technologies, Morgan & Claypool publishers, 2017.
3. FrancoisChollet,``DeepLearningwithPython",ManningPublicationsCo,2018.
4. Charu C. Aggarwal, ``Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 2018.
5. Josh Patterson, Adam Gibson, ``Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017.

221AIDC52 DATAANDINFORMATIONSECURITY LTP C

3 0 0 3

COURSEOBJECTIVES:

- TounderstandthebasicsofInformationSecurity
- Toknowthelegal,ethicalandprofessionalissuesinInformationSecurity
- Toequipthestudents'knowledgeondigitalsignature,emailsecurityandwebsecurity

UNITI INTRODUCTION 9

History, What is Information Security?, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC

UNITII SECURITYINVESTIGATION 9

Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues - An Overview of Computer Security - Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies

UNITIII DIGITALSIGNATUREANDAUTHENTICATION 9

Digital Signature and Authentication Schemes: Digital signature-Digital Signature Schemes and their Variants- Digital Signature Standards-Authentication: Overview- Requirements Protocols - Applications - Kerberos -X.509 Directory Services

UNITIV E-MAILANDIPSECURITY 9

E-mail and IP Security: Electronic mail security: Email Architecture -PGP – Operational Descriptions- Key management- Trust Model- S/MIME.IP Security: Overview- Architecture - ESP, AH Protocols IPSec Modes – Security association - Key management.

UNITV WEBSECURITY 9

Web Security: Requirements- Secure Sockets Layer- Objectives-Layers -SSL secure

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

communication-Protocols - Transport Level Security. Secure Electronic Transaction- Entities DS Verification-SET processing.

TOTAL:45PERIODS

COURSEOUTCOMES:

Uponsuccessfulcompletionofthiscourse,studentswillbeableto: CO1: Understand the basics of data and information security

CO2: Understandthelegal,ethicalandprofessionalissuesininformationsecurity

CO3:Understandthevariousauthenticationschemestosimulatedifferentapplications.

CO4: Understand various security practices and system security standards

CO5:Understand the Web security protocols for E-Commerce applications

TEXTBOOKS:

1. MichaelEWhitmanandHerbertJMattord,"PrinciplesofInformationSecurity,Course Technology, 6th Edition, 2017.
2. StallingsWilliam.CryptographyandNetworkSecurity:PrinciplesandPractice,Seventh Edition, Pearson Education, 2017.

REFERENCES

1. HaroldF.Tipton,MickiKrauseNozaki,,"InformationSecurityManagementHandbook, Volume 6, 6th Edition, 2016.
2. Stuart McClure, Joel Scrambray, George Kurtz, "Hacking Exposed", McGraw-Hill, Seventh Edition, 2012.
3. MattBishop,"ComputerSecurityArtandScience,AddisonWesleyReprintEdition,2015.
4. BehrouzAForouzan,DebdeepMukhopadhyay,CryptographyAndnetworksecurity,3rd Edition, . McGraw-Hill Education, 2015.

221AIDC53 DISTRIBUTEDCOMPUTING LTPC

3003

COURSEOBJECTIVES:

- Tointroducethecomputationandcommunicationmodelsofdistributedsystems
- Toillustratetheissuesofsynchronizationandcollectionofinformationindistributed systems
- Todescribedistributedmutualexclusionanddistributeddeadlockdetectiontechniques
- Toelucidateagreementprotocolsandfaulttolerancemechanismsindistributedsystems
- Toexplainthecloudcomputingmodelsandtheunderlying concepts

UNITI INTRODUCTION 8

Introduction: Definition-Relation to Computer System Components – Motivation – Message - Passing Systems versus Shared Memory Systems – Primitives for Distributed Communication – Synchronous versus Asynchronous Executions – Design Issues and Challenges; A Model of Distributed Computations: A Distributed Program – A Model of Distributed Executions – Models of Communication Networks – Global State of a Distributed System

.UNITII LOGICALTIMEANDGLOBALSTATE 10

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

LogicalTime: Physical Clock Synchronization: NTP – A Framework for a System of Logical Clocks – Scalar Time – Vector Time; Message Ordering and Group Communication: Message Ordering Paradigms – Asynchronous Execution with Synchronous Communication – Synchronous Program Order on Asynchronous System – Group Communication – Causal Order – Total Order; Global State and Snapshot Recording Algorithms: Introduction – System Model and Definitions – Snapshot Algorithms for FIFO Channels.

UNITIII DISTRIBUTEDMUTEXANDDEADLOCK 10

Distributed Mutual exclusion Algorithms: Introduction – Preliminaries – Lamport's algorithm – Ricart- Agrawala's Algorithm –– Token-Based Algorithms – Suzuki-Kasami's Broadcast Algorithm; Deadlock Detection in Distributed Systems: Introduction – System Model – Preliminaries – Models of Deadlocks – Chandy-Misra-Haas Algorithm for the AND model and OR Model.

UNITIV CONSENSUSANDRECOVERY 10

ConsensusandAgreement Algorithms: ProblemDefinition –Overviewof Results –Agreement ina Failure-Free System(Synchronous and Asynchronous) – Agreement in Synchronous Systems with Failures; Checkpointing and Rollback Recovery: Introduction – Background and Definitions – IssuesinFailureRecovery–Checkpoint-basedRecovery–CoordinatedCheckpointing Algorithm - -AlgorithmforAsynchronousCheckpointingandRecovery

UNITV CLOUDCOMPUTING 7

Definition of Cloud Computing – Characteristics of Cloud – Cloud Deployment Models – Cloud Service Models – Driving Factors and Challenges of Cloud – Virtualization – Load Balancing – Scalability and Elasticity – Replication – Monitoring – Cloud Services and Platforms: Compute Services – Storage Services – Application Services

TOTAL:45PERIODS

COURSEOUTCOMES:

Upon the completion of this course, the student will be able to

CO1: Explain the foundations of distributed systems (K2)
CO2: Solvesynchronizationandstateconsistencyproblems(K3)
CO3 Useresourcesharingtechniquesindistributedsystems(K3)
CO4: Applyworkingmodelofconsensusandreliabilityofdistributedsystems(K3)
CO5: Explainthefundamentalsofcloudcomputing(K2)

TEXTBOOKS

1. KshemkalyaniAjayD,MukeshSinghal,“DistributedComputing:Principles,Algorithmsand Systems”, Cambridge Press, 2011.
2. Mukesh Singhal, Niranjan G Shivaratri, “Advanced Concepts in Operating systems”, Mc-Graw Hill Publishers, 1994.

REFERENCES

1. GeorgeCoulouris,JeanDollimore,TimeKindberg,“DistributedSystemsConceptsand Design”, Fifth Edition, Pearson Education, 2012.
2. PradeepLSinha,“DistributedOperatingSystems:ConceptsandDesign”,PrenticeHallof India, 2007.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

3. TanenbaumAS,VanSteenM,“DistributedSystems:PrinciplesandParadigms”,Pearson Education, 2007.
4. LiuML,“DistributedComputing:PrinciplesandApplications”,PearsonEducation,2004.
5. NancyALynch,“DistributedAlgorithms”,MorganKaufmanPublishers,2003.
6. ArshdeepBagga,VijayMadisetti,“CloudComputing:AHands-OnApproach”,Universities Press, 2014.

221AIDC54 BIGDATAANALYTICS LTPC
202 3

COURSEOBJECTIVES:

- Tounderstandbig data.
- TolearnanduseNoSQLbigdatamanagement.
- TolearnmapreduceanalyticsusingHadoopandrelatedtools.
- Toworkwithmapreduce applications
- TounderstandtheusageofHadooprelatedtoolsforBigDataAnalytics

UNITI UNDERSTANDINGBIGDATA 5

Introductiontobig data –convergenceofkeytrends –unstructureddata –industryexamplesof big data–webanalytics–bigdataapplications–bigdatatechnologies–introductiontoHadoop–

open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics.

UNITII NOSQLDATAMANAGEMENT 7

Introduction to NoSQL – aggregate data models – key-value and document data models – relationships – graph databases – schemaless databases – materialized views – distribution models – master-slave replication – consistency - Cassandra – Cassandra data model – Cassandra examples – Cassandra clients

UNITIV MAPREDUCE APPLICATIONS 6

MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats.

UNITIII BASICSOFHADOOP 6

Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures - Cassandra – Hadoop integration.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

UNIT V HADOOP RELATEDTOOLS 6

Hbase–datamodelandimplementations–Hbaseclients–Hbaseexamples–praxis. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive–datatypesandfileformats –HiveQLdatadefinition–HiveQLdatamanipulation –HiveQL queries.

COURSEOUTCOMES:

After the completion of this course, students will be able to:

CO1: Describebigdataandusecasesfromselectedbusinessdomains.

CO2: Explain NoSQL big data management.

CO3: Install,configure,andrunHadoopandHDFS.

CO4: Performmap-reduceanalyticsusingHadoop.

CO5: UseHadoop-relatedtoolssuchasHBase,Cassandra,Pig,andHiveforbigdataanalytics.

LISTOF EXPERIMENTS:

DownloadingandinstallingHadoop;UnderstandingdifferentHadoopmodes.Startupscripts, Configuration files.

1. HadoopImplementationoffilemanagementtasks,suchasAddingfilesanddirectories, retrieving files and Deleting files
2. ImplementofMatrixMultiplicationwithHadoopMapReduce
3. RunabasicWordCountMapReduceprogramtounderstandMapReduceParadigm.
4. InstallationofHivealongwithpracticeexamples.
5. InstallationofHBase,InstallingthriftalongwithPracticeexamples
6. Practiceimportingandexportingdatafromvariousdatabases.

a. SoftwareRequirements:

i.Cassandra,Hadoop,Java,Pig,HiveandHBase.

TOTAL:60PERIODS

TEXTBOOKS:

1. MichaelMinelli,MichelleChambers,andAmbigaDhiraj,"BigData,BigAnalytics:Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. EricSammer,"HadoopOperations",O'Reilley,2012.
3. Sadalage,PramodJ.“NoSQLdistilled”,2013

REFERENCES:

1. E.Capriolo,D.Wampler,andJ.Rutherglen,"ProgrammingHive",O'Reilley,2012.
2. LarsGeorge,"HBase:TheDefinitiveGuide",O'Reilley,2011.
3. EbenHewitt,"Cassandra:TheDefinitiveGuide",O'Reilley,2010.
4. AlanGates,"ProgrammingPig",O'Reilley,2011.

221AIDC51 DEEPLEARNINGLABORATORY LTP C

004 2

COURSEOBJECTIVES:

- Tounderstandthetoolsandtechniquestoimplementdeepneuralnetworks
- Toapplydifferentdeeplearningarchitecturesforsolvingproblems

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

- Toimplementgenerativemodelsforsuitableapplications
- Tolearntobuildandvalidatedifferentmodels

LISTOF EXPERIMENTS:

1. SolvingXORproblemusingDNN
2. CharacterrecognitionusingCNN
3. Facerecognitionusing CNN
4. LanguagemodelingusingRNN
5. SentimentanalysisusingLSTM
6. PartsofspeechtaggingusingSequencetoSequencearchitecture
7. MachineTranslationusingEncoder-Decodermodel
8. ImageaugmentationusingGANs
9. Mini-projectonrealworldapplications

TOTAL:60PERIODS

COURSEOUTCOMES:

After the completion of this course, students will be able to:

CO1: Apply deep neural network for simple problems (K3)

CO2: ApplyConvolutionalNeuralNetworkforimageprocessing(K3
)

CO3: ApplyRecurrentNeuralNetworkanditsvariantsfortextanalysis(K3)

CO4: Applygenerativemodelsfordataaugmentation(K3)

CO5: Developreal-worldsolutionsusingsuitabledeepneuralnetworks(K4)

CO's-PO's&PSO'sMAPPING

22152S61 EMBEDDED SYSTEMS AND IOT LTP C

302 4

COURSEOBJECTIVES:

- TolearntheinternalarchitectureandprogrammingofanembeddedprocessoR.
- TointroduceinterfacingI/Odevicestotheprocessor.
- TointroducetheevolutionoftheInternetofThings(IoT).
- Tobuildasmalllow-
costembeddedandIoTsystemusingArduino/RaspberryPi/open platform.
- ToapplytheconceptofInternetofThingsinrealworldscenario.

UNITI 8-BITEMBEDDEDPROCESSOR 9

8-Bit Microcontroller – Architecture – Instruction Set and Programming – Programming Parallel Ports – Timers and Serial Port – Interrupt Handling.

UNITII EMBEDDEDCPROGRAMMING 9

MemoryAndI/O Devices Interfacing – Programming EmbeddedSystems in C – Need For RTOS– Multiple Tasks and Processes – Context Switching – Priority Based Scheduling Policies.

UNITIII IOTANDARDUINOPROGRAMMING 9

IntroductiontotheConceptofIoTDevices–IoTDevicesVersus Computers – IoT Configurations – Basic Components – Introduction to Arduino – Types of Arduino –ArduinoToolchain–ArduinoProgrammingStructure–Sketches–Pins– Input/OutputFromPins Using Sketches – Introduction to Arduino Shields – Integration of Sensors and Actuators with Arduino.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

UNITIV IOTCOMMUNICATIONANDOPENPLATFORMS 9

IoT Communication Models and APIs – IoT Communication Protocols – Bluetooth –WiFi – ZigBee – GPS – GSM modules – Open Platform (like Raspberry Pi) – Architecture – Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.

UNITV APPLICATIONSDEVELOPMENT 9

Complete Design of Embedded Systems – Development of IoT Applications – Home Automation – Smart Agriculture – Smart Cities – Smart Healthcare.

22147S71 HUMANVALUESANDETHICS LTPC

2002

COURSEDESCRIPTION

This course aims to provide a broad understanding about the modern values and ethical principles that have evolved and are enshrined in the Constitution of India with regard to the democratic, secular and scientific aspects. The course is designed for undergraduate students so that they could study, understand and apply these values in their day to day life.

COURSEOBJECTIVES:

- Tocreateawarenessaboutvaluesandethicsenshrinedinthe ConstitutionofIndia
- Tosensitizestudentsaboutthedemocraticvaluestobeupheldinthemodernsociety.
- Toinculcaterespectforallpeopleirrespectiveoftheirreligionorotheraffiliations.
- Toinstillthescientifictemperinthestudents'mindsanddeveloptheircriticalthinking.
- Topromotesenseofresponsibilityandunderstandingofthedutiesofcitizen.

UNITI DEMOCRATICVALUES 6

Understanding Democratic values: Equality, Liberty, Fraternity, Freedom, Justice, Pluralism, Tolerance, Respect for All, Freedom of Expression, Citizen Participation in Governance – World Democracies: French Revolution, American Independence, Indian Freedom Movement.ReadingText:ExcerptsfromJohnStuartMills'*OnLiberty*

UNITII SECULARVALUES 6

Understanding Secular values – Interpretation of secularism in Indian context - Disassociation of state from religion – Acceptance of all faiths – Encouraging non-discriminatory practices. ReadingText:Excerptfrom*SecularisminIndia:ConceptandPractice*byRamPuniyani

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

UNITIII SCIENTIFICVALUES 6

Scientific thinking and method: Inductive and Deductive thinking, Proposing and testingHypothesis, Validating facts using evidence based approach – Skepticism and Empiricism – Rationalism and Scientific Temper.

ReadingText:Excerptfrom*TheScientificTemper*byAntonyMichaelisR

UNITIV SOCIALETHICS 6

Application of ethical reasoning to social problems – Gender bias and issues – Gender violence – Social discrimination – Constitutional protection and policies – Inclusive practices.

ReadingText:Excerptfrom*21Lessonsforthe21st Century*byYuvalNoahHarari

UNITV SCIENTIFICETHICS 6

TransparencyandFairnessinscientificpursuits–Scientificinventionsforthebettermentofsociety -Unfairapplicationofscientificinventions–RoleandResponsibilityofScientistinthemodern society.

ReadingText:Excerptfrom*AmericanPrometheus:TheTriumphandTragedyofJ.Robert Oppenheimer* by Kai Bird and Martin J. Sherwin.

TOTAL:30PERIODS

REFERENCES:

1. TheNonreligious:UnderstandingSecularPeopleandSocieties,LukeW.GalenOxford University Press, 2016.
2. Secularism:ADictionaryofAtheism,Bullivant,Stephen;Lee,Lois,OxfordUniversityPress , 2016.
3. TheOxfordHandbookofSecularism,JohnR.Shook,OxfordUniversityPress,2017.
4. The Civic Culture: Political Attitudes and Democracy in Five Nations by Gabriel A. Almond and Sidney Verba, Princeton University Press,
5. ResearchMethodologyforNaturalSciencesbySoumitroBanerjee,IIScPress,January2022

COURSEOUTCOMES

Studentswillbeableto

CO1: Identifytheimportanceofdemocratic,secularandscientificvaluesinharmonious functioning of social life

CO2:Practicedemocraticandscientificvaluesinboththeirpersonalandprofessionallife. CO3 :Find rational solutions to social problems.

CO4:Behaveinanethicalmannerinsociety

CO5:Practicecriticalthinkingandthepursuitoftruth.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

221AIDC81 PROJECTWORK/INTERNSHIP LTPC
2010

COURSEOBJECTIVES:

- Totrainthestudents
- For gaining domain knowledge, and technical skills to solve potential business / researchproblems
- GatherrequirementsandDesignsuitablesoftwaresolutionsandevaluate
- alternatives
- Toworkinsmallteamsandunderstandtheprocessesandpracticesinthe‘industry.
- Implement,Testanddeploysolutionsfortargetplatforms
- Preparingprojectreportsandpresentation

The students shall individually / or as group work on business/research domains and related problems approved by the Department / organization that offered the internship / project.

The student can selectanytopic which is relevant to his/her specialization of the programme.The student should continue the work on the selected topic as per theformulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work, resultsand discussion, conclusion and references should be prepared as per the format prescribed bythe Universityand submittedtotheHead of the department. Thestudentswill be evaluated based on the report and viva-voce examination by a panel of examiners as per the Regulations.

TOTAL:300PERIODS

COURSEOUTCOMES:

Attheendoftheproject,thestudentwillbeableto

CO1:GainDomainknowledgeandtechnicalskillsetrequiredforsolving industry/ research problems

CO2:Providesolutionarchitecture,moduleleveldesigns,algorithms

CO3: Implement, test and deploy the solution for the target platform

CO4:Preparedetailedtechnicalreport,demonstrateandpresentthework

221AIDC55A KNOWLEDGEENGINEERING LTP C
200 3

COURSEOBJECTIVES:

- TounderstandthebasicsofKnowledgeEngineering.
- TodiscussmethodologiesandmodelingforAgentDesignandDevelopment.
- Todesignanddevelopontologies.
- Toapplyreasoningwithontologiesandrules.
- Tounderstandlearningandrulelearning.

UNITI REASONINGUNDERUNCERTAINTY 6

Introduction – Abductive reasoning – Probabilistic reasoning: Enumerative Probabilities – Subjective Bayesian view – Belief Functions – Baconian Probability – Fuzzy Probability – Uncertainty methods - Evidence-based reasoning – Intelligent Agent – Mixed-Initiative Reasoning– Knowledge Engineering.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENEUERSHIP

UNITII METHODOLOGYANDMODELING 6

Conventional Design and Development – Development tools and Reusable Ontologies – Agent Design and Development using Learning Technology – Problem Solving through Analysis and Synthesis – Inquiry-driven Analysis and Synthesis – Evidence-based Assessment – Believability Assessment – Drill-Down Analysis, Assumption-based Reasoning, and What-If Scenarios.

UNITIII ONTOLOGIES–DESIGNANDDEVELOPMENT 6

Concepts and Instances – Generalization Hierarchies – Object Features – Defining Features – Representation – Transitivity – Inheritance – Concepts as Feature Values – Ontology Matching. Design and Development Methodologies – Steps in Ontology Development – Domain Understanding and Concept Elicitation – Modelling-based Ontology Specification.

UNITIV REASONIINGWITHONTOLOGIESANDRULES 6

Production System Architecture – Complex Ontology-based Concepts – Reduction and Synthesis rules and the Inference Engine – Evidence-based hypothesis analysis – Rule and Ontology Matching – Partially Learned Knowledge – Reasoning with Partially Learned Knowledge.

UNITV LEARNINGANDRULELEARNING 6

Machine Learning – Concepts – Generalization and Specialization Rules – Types – Formal definition of Generalization. Modelling, Learning and Problem Solving – Rule learning and Refinement – Overview – Rule Generation and Analysis – Hypothesis Learning.

PRACTICALEXERCISES:30PERIODS

1. PerformoperationswithEvidenceBasedReasoning.
2. PerformEvidencebasedAnalysis.
3. PerformoperationsonProbabilityBasedReasoning.
4. PerformBelievabilityAnalysis.
5. ImplementRuleLearningandrefinement.
6. Performanalysisbasedonlearnedpatterns.
7. ConstructionofOntologyforagivendomain.

COURSEOUTCOMES:

Attheendofthiscourse,thestudentswillbeableto:

CO1: Understand the basics of Knowledge Engineering.

CO2:ApplymethodologiesandmodellingforAgentDesignandDevelopment.

CO3:Designanddevelopontologies.

CO4: Applyreasoningwithontologiesandrules.

CO5:Understandlearningandrulelearning.

TOTAL:60PERIODS

TEXTBOOKS:

1.Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning, Cambridge University Press, First Edition, 2016. (Unit 1 – Chapter 1 / Unit 2 – Chapter 3,4/ Unit 3 – Chapter 5, 6 / Unit 4-7,Unit5–Chapter8, 9)

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

REFERENCES:

1. RonaldJ.Brachman,HectorJ.Levesque:KnowledgeRepresentationandReasoning , Morgan Kaufmann, 2004.
2. ElaKumar,KnowledgeEngineering,IKInternationalPublisherHouse,2018.
3. JohnF.Sowa:KnowledgeRepresentation:Logical,Philosophical,andComputationalFoundations, Brooks/Cole, Thomson Learning, 2000.
4. King,KnowledgeManagementandOrganizationalLearning,Springer,2009.

JayLiebowitz,KnowledgeManagementLearningfromKnowledgeEngineering,1st Edition,2001

221AIDC55B	RECOMMENDERSYSTEMS	LTP C
		20 23

COURSEOBJECTIVES:

- Tounderstandthefoundationsoftherecommendersystem.
- Tolearnthesignificanceofmachinelearninganddataminingalgorithmsfor Recommender systems
- Tolearnaboutcollaborativefiltering
- Tomakestudentsdesignandimplementarecommendersystem.
- Tolearncollaborativefiltering.

UNIT INTRODUCTION 6

Introduction and basic taxonomy of recommender systems - Traditional and non-personalized Recommender Systems - Overview of data mining methods for recommender systems- similarity measures- Dimensionality reduction – Singular Value Decomposition (SVD)

Suggested Activities:

- Practicallearning–ImplementDatasimilaritymeasures.
- ExternalLearning–SingularValueDecomposition(SVD)applications

SuggestedEvaluationMethods:

- QuizonRecommendersystems.
- QuizofpythontoolsavailableforimplementingRecommendersystems

UNITII CONTENT-BASEDRECOMMENDATIONSYSTEMS 6

High-level architecture of content-based systems - Item profiles, Representing item profiles, Methods for learning user profiles, Similarity-based retrieval, and Classification algorithms.

Suggested Activities:

- Assignmentoncontent-basedrecommendationsystems
- Assignmentoflearninguserprofiles

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENEUERSHIP

SuggestedEvaluationMethods:

- Quizonsimilarity-basedretrieval.
- Quizofcontent-basedfiltering

UNITIII COLLABORATIVEFILTERING 6

A systematic approach, Nearest-neighbor collaborative filtering (CF), user-based and item-based CF, components of neighborhood methods (rating normalization, similarity weight computation,and neighborhood selection

Suggested Activities:

- Practicallearning–Implementcollaborativefilteringconcepts
- Assignmentofsecurityaspectsofrecommendersystems

SuggestedEvaluationMethods:

- Quizoncollaborativefiltering
- Seminaronsecuritymeasuresofrecommendersystems

UNITIV ATTACK-RESISTANTRECOMMENDERSYSTEMS 6

Introduction–TypesofAttacks–Detectingattacksonrecommendersystems –Individualattack – Group attack – Strategies for robust recommender design - Robust recommendation algorithms.

Suggested Activities:

- GroupDiscussiononattacksandtheirmitigation
- Studyoftheimpactofgroupattacks
- ExternalLearning–Useof CAPTCHAs

SuggestedEvaluationMethods:

- Quizonattacksonrecommendersystems
- SeminaronpreventingattacksusingtheCAPTCHAs

UNITV EVALUATINGRECOMMENDERSYSTEMS 6

EvaluatingParadigms–UserStudies–OnlineandOfflineevaluation–Goalsof evaluationdesign – Design Issues – Accuracy metrics – Limitations of Evaluation measures

Suggested Activities:

- GroupDiscussionongoalsofevaluationdesign
- Studyofaccuracymetrics

SuggestedEvaluationMethods:

- Quizonevaluationdesign
- Problems on accuracy measures

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

30PERIODS PracticalExercises
30 PERIODS

1. ImplementDatasimilaritymeasuresusingPython
2. Implementdimensionreductiontechniquesforrecommendersystems
3. Implementuserprofilelearning
4. Implementcontent-basedrecommendationsystems
5. Implementcollaborativefiltertechniques
6. Createanattackfortamperingwithrecommendersystems
7. ImplementaccuracymetricslikeReceiverOperatedCharacteristiccurves

TOTAL:60PERIODS

COURSEOUTCOMES:

On completion of the course, the students will be able to:

CO1: Understandthebasicconceptsofrecommendersystems.
CO2: Implement machine-learning and data-mining algorithms in recommender systems data sets.
CO3: ImplementationofCollaborativeFilteringincarryingoutperformanceevaluationof recommender systems based on various metrics.
CO4: Designandimplementasimplerecommendersystem.
CO5: Learnaboutadvancedtopicsofrecommendersystems.
CO6: Learnaboutadvancedtopicsofrecommendersystemsapplications

TEXTBOOKS:

1. CharuC.Aggarwal,RecommenderSystems:TheTextbook,Springer,2016.
2. DietmarJannach,MarkusZanker,AlexanderFelfernig and GerhardFriedrich, Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.
3. FrancescoRicci, Lior Rokach, BrachaShapira,Recommender SytemsHandbook, 1st ed, Springer (2011),
4. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3rd edition, Cambridge University Press, 2020.

221AIDC55C	**SOFTCOMPUTING**	**LTPC**
		202 3

COURSEOBJECTIVES:

- Tointroducetheideasoffuzzysets,fuzzylogicanduseofheuristicsbasedonhuman experience.
- To provide the mathematical background for carrying out the optimization associated with neural network learning
- TolearnvariousevolutionaryAlgorithms.
- Tobecomefamiliarwithneuralnetworksthatcanlearnfromavailableexamplesandg eneralize to form appropriate rules for inference systems.
- TointroducecasestudiesutilizingtheaboveandillustratetheIntelligent behavior of programs based on soft computing

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

UNITI INTRODUCTIONTOSOFTCOMPUTINGANDFUZZYLOGIC 6

Introduction - Fuzzy Logic - Fuzzy Sets, Fuzzy Membership Functions, Operations on Fuzzy Sets, Fuzzy Relations, Operations on Fuzzy Relations, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems

UNITII NEURALNETWORKS 6

Supervised Learning Neural Networks – Perceptrons - Backpropagation -Multilayer Perceptrons – Unsupervised Learning Neural Networks –Kohonen Self-Organizing Networks

UNITIII GENETICALGORITHMS 6

Chromosome Encoding Schemes -Population initialization and selection methods - Evaluation function - Genetic operators- Cross over – Mutation - Fitness Function – Maximizing function

UNITIVNEUROFUZZY MODELING 6

ANFIS architecture – hybrid learning – ANFIS as universal approximator – Coactive Neuro fuzzy modeling – Framework – Neuron functions for adaptive networks – Neuro fuzzy spectrum - Analysis of Adaptive Learning Capability

UNITVAPPLICATIONS 6

Modeling a two input sine function - Printed Character Recognition – Fuzzy filtered neural networks – Plasma Spectrum Analysis – Hand written neural recognition - Soft Computing for Color Recipe Prediction.

30 PERIODS

OUTCOMES:

CO1:Understand the fundamentals of fuzzy logic operators and inference mechanisms

CO2:UnderstandneuralnetworkarchitectureforAIapplicationssuchasclassificationand clustering

CO3:LearnthefunctionalityofGeneticAlgorithmsinOptimizationproblems

CO4:Use hybrid techniques involving Neural networks and Fuzzy logic

CO5:Apply soft computing techniques in real world applications

PRACTICALEXERCISES

30PERIODS

1. Implementationoffuzzycontrol/inferencesystem
2. Programmingexerciseonclassificationwithadiscreteperceptron
3. ImplementationofXORwithbackpropagationalgorithm
4. Implementationofselforganizingmapsforaspecificapplication
5. ProgrammingexercisesonmaximizingafunctionusingGeneticalgorithm
6. Implementationoftwoinputsinefunction
7. Implementationofthreeinputnonlinearfunction

TOTAL:60PERIODS

TEXTBOOKS:

1. SaJANG, J.-S. R., SUN, C.-T., & MIZUTANI, E. (1997). Neuro-fuzzy and soft computing: A computational approach to learning and machine intelligence. Upper Saddle River, NJ, Prentice Hall,1997

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

2. HimanshuSingh,YunisAhmadLone,DeepNeuro-FuzzySystemswithPython
3. WithCaseStudiesandApplicationsfromtheIndustry,Apress,2020

REFERENCES

1. roj Kaushik andSunitaTiwari, Soft Computing-FundamentalsTechniquesand Applications, 1st Edition, McGraw Hill, 2018.
2. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003.
3. Samir Roy, Udit Chakraborthy, Introduction to Soft Computing, Neuro Fuzzy and GeneticAlgorithms, Pearson Education, 2013.
4. S.N. Sivanandam, S.N. Deepa, Principles of Soft Computing, Third Edition, Wiley India Pvt Ltd, 2019.
5. R.Eberhart,P.SimpsonandR.Dobbins,"ComputationalIntelligence-PCTools",AP ofessional,Boston, 1996

221AIDC55D TEXTANDSPEECH ANALYSIS LTPC

2023

COURSEOBJECTIVES:

- Understandnaturallanguageprocessingbasics
- Applyclassificationalgorithmstotextdocuments
- Buildquestion-answeringanddialoguesystems
- Developaspeechrecognitionsystem
- Developaspeechsynthesizer

UNITI NATURALLANGUAGEBASICS 6

Foundations of natural language processing – Language Syntax and Structure- TextPreprocessing and Wrangling – Text tokenization – Stemming – Lemmatization – Removing stop- words – Feature Engineering for Text representation – Bag of Words model- Bag of N-Grams model – TF-IDF model

Suggested Activities

- FlippedclassroomonNLP
- ImplementationofTextPreprocessingusingNLTK
- ImplementationofTF-IDFmodels

SuggestedEvaluationMethods

- QuizonNLP Basics
- DemonstrationofPrograms

UNITII TEXTCLASSIFICATION 6

Vector Semantics and Embeddings -Word Embeddings - Word2Vec model – Glove model – FastText model – Overview of Deep Learning models – RNN – Transformers – Overview of Text summarization and Topic Models

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENEUERSHIP

Suggested Activities

- FlippedclassroomonFeatureextractionof documents
- ImplementationofSVMmodelsfortext classification
- Externallearning:TextsummarizationandTopicmodels

SuggestedEvaluationMethods

- Assignmentonabovetopics
- QuizonRNN,Transformers
- ImplementingNLPwithRNNandTransformers

UNITIII QUESTIONANSWERINGANDDIALOGUESYSTEMS 9

Information retrieval – IR-based question answering – knowledge-based question answering – language models for QA – classic QA models – chatbots – Design of dialogue systems -– evaluating dialogue systems

Suggested Activities:

- Flippedclassroomonlanguagemodelsfor QA
- Developingaknowledge-basedquestion-answeringsystem
- ClassicQAmodeldevelopment

SuggestedEvaluationMethods

- Assignmentontheabovetopics
- Quizonknowledge-basedquestionansweringsystem
- Developmentofsimplechatbots

UNITIV TEXT-TO-SPEECHSYNTHESIS 6

Overview. Text normalization. Letter-to-sound. Prosody, Evaluation. Signal processing - Concatenative and parametricapproaches, WaveNet and other deep learning-based TTS systems

Suggested Activities:

- FlippedclassroomonSpeechsignalprocessing
- ExploringTextnormalization
- Datacollection
- ImplementationofTTSsystems

SuggestedEvaluationMethods

- Assignmentontheabovetopics
- Quizonwavenet,deeplearning-basedTTSsystems
- FindingaccuracywithdifferentTTSsystems

UNIT V AUTOMATICSPEECHRECOGNITION 6

Speechrecognition:Acousticmodelling–FeatureExtraction-HMM,HMM-DNNsystems

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

Suggested Activities:
- FlippedclassroomonSpeechrecognition.
- ExploringFeatureextraction

SuggestedEvaluationMethods

- Assignmentontheabovetopics
- Quizonacousticmodelling

PRACTICALEXERCISES **30 PERIODS**

1. CreateRegularexpressionsinPythonfordetectingwordpatternsandtokenizingtext
2. GettingstartedwithPythonandNLTK-SearchingText,CountingVocabulary,Frequency Distribution, Collocations, Bigrams
3. AccessingTextCorporausingNLTKinPython
4. Writeafunctionthatfindsthe50mostfrequentlyoccurring wordsof atext that arenot stop words.
5. ImplementtheWord2Vecmodel
6. Useatransformerforimplementing classification
7. Designachatbotwithasimpledialogsystem
8. Converttexttospeechandfindaccuracy
9. Designaspeechrecognitionsystemandfindtheerror rate

TOTAL:60PERIODS

COURSEOUTCOMES:

Oncompletionofthecourse,thestudentswillbeableto

CO1: Explain existing and emerging deep learning architectures for text and speech processing

CO2: ApplydeeplearningtechniquesforNLPtasks,languagemodellingandmachinetranslation

CO3: Explain coreference and coherence for text processing

CO4: Buildquestion-answeringsystems,chatbotsanddialoguesystems

CO5: Applydeeplearningmodelsforbuildingspeechrecognitionandtext-to-speechsystems

TEXTBOOK

1. Daniel Jurafsky and James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and SpeechRecognition”, Third Edition, 2022.

REFERENCES:

1. Dipanjan Sarkar, “Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data”, APress,2018.
2. Tanveer Siddiqui, Tiwary U S, “Natural Language Processing and Information Retrieval”,Oxford University Press, 2008.
3. LawrenceRabiner,Biing-HwangJuang,B.Yegnanarayana,“FundamentalsofSpeech Recognition” 1st Edition, Pearson, 2009.
4. Steven Bird, Ewan Klein, and Edward Loper, “Natural language processing withPython”, O’REILLY.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

221AIDC55E BUSINESSANALYTICS L TP C

2023

COURSEOBJECTIVES:

- TounderstandtheAnalyticsLifeCycle.
- TocomprehendtheprocessofacquiringBusinessIntelligence
- TounderstandvarioustypesofanalyticsforBusinessForecasting
- TomodelthesupplychainmanagementforAnalytics.
- Toapplyanalyticsfordifferentfunctionsofabusiness

UNITI INTRODUCTIONTOBUSINESSANALYTICS 6

Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration

UNITII BUSINESSINTELLIGENCE 6

Data Warehouses and Data Mart - Knowledge Management –Types of Decisions - Decision Making Process - Decision Support Systems – Business Intelligence –OLAP – Analytic functions

UNITIII BUSINESSFORECASTING 6

Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models – Data Mining and Predictive Analysis Modelling –Machine Learning for Predictive analytics.

UNITIV HR&SUPPLYCHAINANALYTICS 6

Human Resources – Planning and Recruitment – Training and Development - Supply chain network - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain -Applying HR Analytics to make a prediction of the demand for hourly employeesfor a year.

UNITV MARKETING&SALESANALYTICS 6

Marketing Strategy, Marketing Mix, Customer Behaviour –selling Process – Sales Planning – Analytics applications in Marketing and Sales -predictive analytics for customers' behaviour in marketing and sales.

30PERIODS

LISTOF EXPERIMENTS:

UseMS-ExcelandPower-BItoperformthefollowing experimentsusingaBusinessdataset, and make presentations.

Studentsmaybeencouragedtobringtheirownreal-timesociallyrelevant dataset.

ICycle–MSExcel

1. ExplorethefeaturesofMs-Excel.
2. (i)Gettheinputfromuserandperformnumericaloperations(MAX,MIN,AVG,SUM, SQRT, ROUND)
ii)Performdataimport/exportoperationsfordifferentfileformats.
3. Performstatisticaloperations-Mean,Median,ModeandStandarddeviation,Variance, Skewness, Kurtosis
4. PerformZ-test,T-test&ANOVA

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

5. Performdatapre-processingoperationsi)HandlingMissingdataii)Normalization
6. PerformdimensionalityreductionoperationusingPCA,KPCA&SVD
7. Performbivariateandmultivariateanalysisonthedataset.
8. Applyandexplorevariousplottingfunctionsonthedata set.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

IICycle–PowerBIDesktop

9. Explorethefeaturesof PowerBIDesktop
10. Prepare&Loaddata
11. Developthedatamodel
12. PerformDAXcalculations
13. Designareport
14. Createadashboardandperformdataanalysis
15. Presentationofacase study

COURSEOUTCOMES:

CO1: Explaintherealworldbusinessproblemsandmodelwithanalyticalsolutions.

CO2: IdentifythebusinessprocessesforextractingBusinessIntelligence

CO3: Applypredictiveanalyticsforbusinessfore-casting

CO4: Applyanalyticsforsupplychainandlogisticsmanagement

CO5: Useanalyticsformarketingandsales.

TEXTBOOKS

R.EvansJames,BusinessAnalytics,2ndEdition,Pearson,

221AIDC55F IMAGE AND VIDEO ANALYTICS L TP C

2 0 2 3

COURSEOBJECTIVES:

- Tounderstandthebasicsofimageprocessingtechniquesforcomputervision.
- Tolearnthetechniquesusedforimagepre-processing.
- Todiscussthevariousobjectdetectiontechniques.
- TounderstandthevariousObjectrecognitionmechanisms.
- Toelaborateonthevideoanalytics techniques.

UNITI INTRODUCTION 6

Computer Vision – Image representation and image analysis tasks - Image representations – digitization – properties – color images – Data structures for Image Analysis - Levels of image data representation - Traditional and Hierarchical image data structures.

UNITII IMAGEPRE-PROCESSING 6

Local pre-processing - Image smoothing - Edge detectors - Zero-crossings of the second derivative - Scale in image processing - Canny edge detection - Parametric edge models - Edges in multi-speralct images - Local pre-processing in the frequency domain - Line detection by local pre-processing operators - Image restoration.

UNITIII OBJECTDETECTIONUSINGMACHINELEARNING 6

Object detection– Object detection methods – Deep Learning framework for Object detection–

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENEUERSHIP

bounding box approach-Intersection over Union (IoU) –Deep Learning Architectures-R-CNN-Faster R-CNN-You Only Look Once(YOLO)-Salient features-Loss Functions-YOLO architectures

UNITIV FACERECOGNITIONANDGESTURERECOGNITION 6

Face Recognition-Introduction-Applications of Face Recognition-Process of Face Recognition-DeepFace solution by Facebook-FaceNet for Face Recognition- Implementation using FaceNet-Gesture Recognition.

UNITV VIDEO ANALYTICS6

Video Processing – use cases of video analytics-Vanishing Gradient and exploding gradient problem-RestNet architecture-RestNet and skip connections-Inception Network-GoogleNet architecture-Improvement in Inception v2-Video analytics-RestNet and Inception v3.

30 PERIODS

LISTOF EXERCISES 30PERIODS

1. WriteaprogramthatcomputestheT-pyramidofanimage.
2. Writeaprogramthatderivesthequadtreerepresentationof animageusingthe homogeneity criterion of equal intensity
3. Developprogramsforthefollowinggeometrictransforms:(a)Rotation(b)Changeofscale (c)Skewing(d)Affinetransformcalculatedfromthreepairsofcorrespondingpoints(e) Bilinear transform calculated from four pairs of corresponding points.
4. DevelopaprogramtoimplementObjectDetectionandRecognition
5. Developaprogramformotionanalysisusingmovingedges,andapplyittoyouri mage sequences.
6. DevelopaprogramforFacialDetectionandRecognition
7. Writeaprogramforeventdetectioninvideosurveillancesystem

TOTAL:60PERIODS

COURSEOUTCOMES:

Attheendofthiscourse,thestudentswillbeableto:

CO1: Understandthebasicsofimageprocessingtechniquesforcomputervisionandvideoanalysis.

CO2:Explainthetechniquesusedforimagepre-processing.

CO3:Developvariousobjectdetectiontechniques.

CO4: Understandthevariousfacerecognitionmechanisms.

CO5:Elaborateondeeplearning-basedvideoanalytics.

TEXTBOOK:

1. MilanSonka,VaclavHlavac,RogerBoyle,“ImageProcessing,Analysis,and Machine Vision”, 4nd edition, Thomson Learning, 2013.
2. VaibhavVerdhan,(2021,ComputerVisionUsingDeepLearningNeura lNetwork Architectures with Python and Keras,Apress 2021(UNIT-III,IV and V)

REFERENCES

1. RichardSzeliski,“ComputerVision:AlgorithmsandApplications”,SpringerVerla gLondon

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

2. Limited,2011.
3. CaifengShan,FatihPorikli,TaoXiang,ShaogangGong,“VideoAnalyticsforBusiness Intelligence”, Springer, 2012.
4. D.A.Forsyth,J.Ponce,“ComputerVision:AModernApproach”,PearsonEducation, 2003.
5. E.R.Davies,(2012),“Computer&MachineVision”,FourthEdition,AcademicPress.

221AIDC55G COMPUTER VISION LTP C

20 23

COURSEOBJECTIVES:

- Tounderstandthefundamentalconceptsrelatedtoimageformationandprocessing.
- Tolearnfeaturedetection,matchinganddetection
- Tobecomefamiliarwithfeaturebasedalignmentandmotionestimation
- Todevelopskillson3Dreconstruction
- Tounderstandimagebasedrenderingandrecognition

UNITI INTRODUCTIONTOIMAGEFORMATIONANDPROCESSING 6

Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization.

UNITII FEATUREDETECTION,MATCHINGANDSEGMENTATION 6

Points andpatches-Edges-Lines-Segmentation -Active contours-Split andmerge-Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods.

UNIT III FEATURE-BASEDALIGNMENT&MOTIONESTIMATION 6

2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion.

UNITIV 3DRECONSTRUCTION 6

Shape from X - Active rangefinding - Surface representations - Point-based representations- Volumetric representations - Model-based reconstruction - Recovering texture maps and albedosos.

UNITV IMAGE-BASEDRENDERINGANDRECOGNITION 6

View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition - Category

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

recognition - Context and scene understanding- Recognition databases and test sets.

30 PERIODS

PRACTICALEXERCISES:

LABORATORYEXPERIMENTS:

Softwareneeded:

OpenCVcomputervisionLibraryforOpenCVinPython/PyCharmorC++/VisualStudioor equivalent

- OpenCVInstallationandworkingwithPython
- BasicImageProcessing-loadingimages,Cropping,Resizing,Thresholding,Contour analysis, Bolb detection
- ImageAnnotation–Drawinglines,textcircle,rectangle,ellipseonimages
- ImageEnhancement-UnderstandingColorspaces,colorspaceconversion,Histogram equialization, Convolution, Image smoothing, Gradients, Edge Detection
- ImageFeaturesandImageAlignment –Imagetransforms–Fourier,Hough,ExtractORB Image features, Feature matching, cloning,Feature matching based image alignment
- ImagesegmentationusingGraphcut/Grabcut
- CameraCalibrationwithcirculargrid
- PoseEstimation
- 3DReconstruction–CreatingDepthmapfromstereoimages
- ObjectDetectionandTrackingusingKalmanFilter,Camshift

CO1: To understand basic knowledge, theories and methods in image processing and computervision.

CO2: ToimplementbasicandsomeadvancedimageprocessingtechniquesinOpenCV.

CO3: Toapply2Dafeature-basedbasedimagealignment,segmentationandmotionestimations.

CO4: Toapply3Dimagereconstructiontechniques

CO5: Todesignanddevelopinnovativeimageprocessingandcomputervisionapplications.

TEXTBOOKS:

1. RichardSzeliski,"ComputerVision:AlgorithmsandApplications",Springer-Textsin Computer Science, Second Edition, 2022.

2. ComputerVision:AModernApproach, D.A.Forsyth,J.Ponce, Pearson Education, Second Edition, 2015.

REFERENCES:

1. RichardHartleyandAndrewZisserman,MultipleViewGeometryinComputerVision, Second Edition, Cambridge University Press, March 2004.

2. ChristopherM.Bishop;PatternRecognitionandMachineLearning,Springer,2006

3. E.R.Davies,ComputerandMachineVision,FourthEdition,AcademicPress,2012.

CO1: To understand basic knowledge, theories and methods in image processing and computervision.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

CO2: Toimplementbasicandsomeadvancedimageprocessingtechniquesin OpenCV.

CO3: Toapply2Dafeature-basedbasedimagealignment,segmentationandmotionestimations.

CO4: Toapply3Dimagereconstructiontechniques

CO5: Todesignanddevelopinnovativeimageprocessingandcomputervisionapplications.

TEXTBOOKS:

3. RichardSzeliski,"ComputerVision:AlgorithmsandApplications",Springer-Textsin Computer Science, Second Edition, 2022.

4. ComputerVision:AModernApproach,D.A.Forsyth,J.Ponce,PearsonEducation, Second Edition, 2015.

REFERENCES:

4. RichardHartleyandAndrewZisserman,MultipleViewGeometryinComputerVision, Second Edition, Cambridge University Press, March 2004.

5. ChristopherM.Bishop;PatternRecognitionandMachineLearning,Springer,2006

6. E.R.Davies,ComputerandMachineVision,FourthEdition,AcademicPress,2012.

221AIDC55H BIGDATAANALYTICS LTPC

202 3

OBJECTIVES:

- Tounderstandbig data.
- TolearnanduseNoSQLbigdata management.
- TolearnmapreduceanalyticsusingHadoopandrelatedtools.
- Toworkwithmapreduce applications
- TounderstandtheusageofHadooprelatedtoolsforBigDataAnalytics

UNITI UNDERSTANDINGBIGDATA 5

Introductiontobig data –convergenceofkeytrends –unstructureddata–industryexamplesof big data – web analytics – big data applications– big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics.

UNITII NOSQLDATAMANAGEMENT 7

Introduction to NoSQL – aggregate data models – key-value and document data models – relationships–graphdatabases–schemalessdatabases–materializedviews–distribution models – master-slave replication – consistency - Cassandra – Cassandra data model – Cassandra examples – Cassandra clients

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENEUERSHIP

UNITIII MAPREDUCE APPLICATIONS 6

MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats.

UNITIV BASICSOFHADOOP 6

Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures - Cassandra – Hadoop integration.

UNIT V HADOOPRELATEDTOOLS 6

Hbase–datamodelandimplementations–Hbaseclients–Hbaseexamples–praxis. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts.
Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.

30 PERIODS

COURSEOUTCOMES:

After the completion of this course, students will be able to:

CO1: Describebigdataandusecasesfromselectedbusinessdomains.
CO2: Explain NoSQL big data management.
CO3: Install,configure,andrunHadoopandHDFS.
CO4: Performmap-reduceanalyticsusingHadoop.
CO5: UseHadoop-relatedtoolssuchasHBase,Cassandra,Pig,andHiveforbigdataanalytics.

LISTOF EXPERIMENTS: 30 PERIODS

1. DownloadingandinstallingHadoop;UnderstandingdifferentHadoopmodes.Startups cripts, Configuration files.
2. HadoopImplementationoffilemanagementtasks,suchasAddingfilesanddirecto ries, retrieving files and Deleting files
3. ImplementofMatrixMultiplicationwithHadoopMapReduce
4. RunabasicWordCountMapReduceprogramtounderstandMapReduceParadigm.
5. InstallationofHivealongwithpracticeexamples.
7. InstallationofHBase,InstallingthriftalongwithPracticeexamples
8. Practiceimportingandexportingdatafromvariousdatabases.

SoftwareRequirements:
Cassandra,Hadoop,Java,Pig,HiveandHBase.

TEXTBOOKS:

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

TOTAL:60PERIODS

1. MichaelMinelli,MichelleChambers,andAmbigaDhiraj,"BigData,BigAnalytics
: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. EricSammer,"HadoopOperations",O'Reilley,2012.
3. Sadalage,PramodJ.“NoSQLdistilled”,2013

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

REFERENCES:

1. E.Capriolo,D.Wampler,andJ.Rutherglen,"ProgrammingHive",O'Reilley,2012.
2. LarsGeorge,"HBase:TheDefinitiveGuide",O'Reilley,2011.
3. EbenHewitt,"Cassandra:TheDefinitiveGuide",O'Reilley,2010.
4. AlanGates,"ProgrammingPig",O'Reilley,2011.

221AIDC56A CLOUD COMPUTING LTP C

20 23

COURSEOBJECTIVES:

- Tounderstandtheprinciplesofcloudarchitecture,modelsandinfrastructure.
- Tounderstandtheconceptsofvirtualizationandvirtualmachines.
- TogainknowledgeaboutvirtualizationInfrastructure.
- ToexploreandexperimentwithvariousClouddeploymentenvironments.
- Tolearnaboutthesecurityissuesinthecloudenvironment.

UNITI CLOUDARCHITECTUREMODELSANDINFRASTRUCTURE 6

Cloud Architecture: System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – Cloud deployment models – Cloud service models; Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Design Challenges

UNITII VIRTUALIZATIONBASICS 6

Virtual Machine Basics – Taxonomy of Virtual Machines – Hypervisor – Key Concepts – Virtualization structure – Implementation levels of virtualization – Virtualization Types: Full Virtualization – Para Virtualization – Hardware Virtualization – Virtualization of CPU, Memory and I/O devices.

UNITIII VIRTUALIZATIONINFRASTRUCTUREANDDOCKER 7

DesktopVirtualization –Network Virtualization –StorageVirtualization –System-levelof Operating Virtualization – Application Virtualization – Virtual clusters and Resource Management –Containers vs. Virtual Machines – Introduction to Docker – Docker Components – Docker Container – Docker Images and Repositories.

UNITIV CLOUDDEPLOYMENTENVIRONMENT 6

Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus – OpenStack.

UNITV CLOUDSECURITY 5

Virtualization System-Specific Attacks: Guest hopping – VM migration attack – hyperjacking. Data Securityand Storage; Identityand Access Management (IAM) - IAMChallenges - IAMArchitecture and Practice.

PRACTICALEXERCISES: 30PERIODS

1. InstallVirtualbox/VMware/EquivalentopensourcecloudWorkstationwithdifferentflavours of Linux or Windows OS on top of windows 8 and above.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

2. Install a C compiler in the virtual machine created using a virtual box and execute SimplePrograms
3. InstallGoogleAppEngine.Createahelloworldappandothersimplewebapplications using python/java.
4. UsetheGAElaunchertolaunchtheweb applications.
5. SimulateacloudscenariousingCloudSimandrunaschedulingalgorithmthatisnot present in CloudSim.
6. Findaproceduretotransferthefilesfromonevirtualmachinetoanothervirtualmachine.
7. InstallHadoopsinglenodeclusterandrunsimpleapplicationslikewordcount.
8. CreatingandExecutingYourFirstContainerUsingDocker.
9. RunaContainerfromDockerHub

COURSEOUTCOMES:
CO1: Understandthedesignchallengesinthecloud.
CO2: Applytheconceptofvirtualizationanditstypes.
CO3: ExperimentwithvirtualizationofhardwareresourcesandDocker.
CO4: Developanddeployservicesonthecloudandsetupacloud environment.
CO5: Explainsecuritychallengesinthecloudenvironment.
TOTAL:60PERIODS
TEXTBOOKS

1. KaiHwang,GeoffreyCFox,JackGDongarra,“DistributedandCloudComputing,From Parallel Processing to the Internet of Things”, Morgan Kaufmann Publishers, 2012.
2. JamesTurnbull,“TheDockerBook”,O’ReillyPublishers,2014.
3. Krutz,R.L.,Vines,R.D,“Cloudsecurity.AComprehensiveGuidetoSecureCloudComputing”, Wiley Publishing, 2010.

REFERENCES

1. JamesE.Smith,RaviNair,“VirtualMachines:VersatilePlatformsforSystemsand Processes”, Elsevier/Morgan Kaufmann, 2005.
2. TimMather,SubraKumaraswamy,andShahedLatif,“CloudSecurityandPrivacy:an enterprise perspective on risks and compliance”, O’Reilly Media, Inc., 2009.

221AIDC56B APPDEVELOPMENT LTP C
202 3
COURSEOBJECTIVES:

- Tolearndevelopmentofnativeapplicationswithbasic GUIComponents
- Todevelopcross-platformapplicationswitheventhandling
- Todevelopapplicationswithlocationanddatastoragecapabilities
- Todevelopwebapplicationswithdatabaseaccess

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

UNITI FUNDAMENTALSOFMOBILE&WEBAPPLICATIONDEVELOPMENT 6

Basics of Web and Mobile application development, Native App, Hybrid App, Cross-platform App, What is Progressive Web App, Responsive Web design,

UNITII NATIVEAPPDEVELOPMENTUSING JAVA 6

Native Web App, Benefits of Native App, Scenarios to create Native App, Tools for creating Native App, Consof NativeApp, PopularNativeAppDevelopmentFrameworks,Java&Kotlinfor Android, Swift & Objective-C for iOS, Basics of React Native, Native Components, JSX, State, Props

UNITIII 6

HybridWebApp, Benefitsof HybridApp,CriteriaforcreatingNativeApp,Toolsforcreating Hybrid App, Cons of Hybrid App, Popular Hybrid App Development Frameworks, Ionic, Apache Cordova,

UNITIV CROSS-PLATFORMAPPDEVELOPMENTUSINGREACT-NATIVE 6

What is Cross-platform App, Benefits of Cross-platform App, Criteria for creating Cross-platform App, Tools for creating Cross-platform App, Cons of Cross-platform App, Popular Cross- platform App Development Frameworks, Flutter, Xamarin, React-Native, Basics of React Native, Native Components, JSX, State, Props

UNITV NON-FUNCTIONALCHARACTERISTICSOFAPPFRAMEWORKS 6

Comparisonof differentApp frameworks, Build Performance, App Performance, Debugging capabilities, Time to Market, Maintainability, Ease of Development, UI/UX, Reusability

30PERIODS

COURSEOUTCOMES:

CO1: DevelopNativeapplicationswithGUIComponents.

CO2: Develophybridapplicationswithbasiceventhandling.

CO3 Implementcross-platformapplicationswithlocationanddatastoragecapabilities.

CO4: Implementcrossplatformapplicationswithbasic GUIandeventhandling.

CO5: Developwebapplicationswithclouddatabaseaccess.

PRACTICALEXERCISES: 30PERIODS

1. Usingreactnative,buildacrossplatformapplicationforaBMI calculator.
2. Buildacrossplatformapplicationforasimpleexpensemanagerwhichallowsentering expenses and income on each day and displays category wise weekly income and expense.
3. Develop a cross platform application toconvert unitsfrom imperial system tometric system(km to miles, kg to pounds etc.,)
4. Designanddevelopacrossplatformapplicationfordaytodaytask(to-do)management.
5. Design an android application using Cordova for a user login screen with username, password, reset button and a submit button. Also, include header image and a label. Use layout managers.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENEUERSHIP

6. Designanddevelopanandroidapplicationusing ApacheCordovatofindanddisplaythecurrent location of the user.
7. WriteprogramsusingJavatocreateAndroidapplicationhavingDatabases
- Forasimplelibraryapplication.
- Fordisplayingbooksavailable,bookslend,bookreservation.Assumethatstudent information is available in a database which has been stored in a database server.

TOTAL:60PERIODS

TEXTBOOKS

1. HeadFirstAndroidDevelopment,DawnGriffiths,O'Reilly,1st edition
2. ApacheCordovainAction,RaymondK.Camden,Manning.2015
3. Full Stack React Native: Create beautiful mobile apps with JavaScript and React Native, AnthonyAccomazzo,HousseinDjirdeh,SophiaShoemaker,DevinAbbott,FullStackpublishing

REFERENCES

1. AndroidProgrammingforBeginners,JohnHorton,PacktPublishing,2ndEdition
2. NativeMobileDevelopmentbyShaunLewis,Mike Dunn
3. BuildingCross-PlatformMobileandWebAppsforEngineersandScientists:AnActive Learning Approach, Pawan Lingras, Matt Triff, Rucha Lingras
4. ApacheCordova4Programming,JohnMWargo, 2015
5. ReactNativeCookbook,DanielWard,PacktPublishing,2ndEdition

221AIDC56C CLOUDSERVICESMANAGEMENT L TP C

2023

COURSEOBJECTIVES:

- IntroduceCloudServiceManagementterminology,definition&concepts
- CompareandcontrastcloudservicemanagementwithtraditionalITservicemanagement
- Identifystrategiestoreduceriskandeliminateissuesassociatedwithadoptionofcloud services

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

- Select appropriate structures for designing, deploying and running cloud-based services ina business environment
- Illustratethebenefitsanddrivetheadoptionofcloud-basedservicestosolverealworld problems

UNITI CLOUDSERVICEMANAGEMENTFUNDAMENTALS 6

Cloud Ecosystem, The Essential Characteristics, Basics of Information Technology Service ManagementandCloudServiceManagement,ServicePerspectives,CloudServiceModels,Cloud Service Deployment Models

UNITII CLOUDSERVICESSTRATEGY 6

Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driver for Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, Cloud Service Architecture

UNITIII CLOUDSERVICEMANAGEMENT 6

CloudServiceReferenceModel, CloudServiceLifeCycle, Basicsof CloudServiceDesign,Dealing with Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service Capacity Planning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service Operations Management

UNITIV CLOUDSERVICEECONOMICS 6

Pricing models for Cloud Services, Freemium, Pay Per Reservation, Pay per User, Subscription based Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models

UNITV CLOUDSERVICEGOVERNANCE&VALUE 6

IT Governance Definition, Cloud Governance Definition, Cloud Governance Framework, Cloud Governance Structure, Cloud Governance Considerations, Cloud Service Model Risk Matrix, Understanding Value of Cloud Services, Measuring the value of Cloud Services, Balanced Scorecard, Total Cost of Ownership

COURSEOUTCOMES:

CO1: Exhibit cloud-design skills tobuild and automatebusinesssolutionsusing cloud technologies.

CO2: Possess Strong theoretical foundation leading to excellence and excitement towards adoption of cloud-based services

CO3: Solvetherealworldproblemsusing Cloudservicesandtechnologies

PRACTICALEXERCISES: 30PERIODS

1. Create a Cloud Organization in AWS/Google Cloud/or any equivalent Open Source cloud softwares like Openstack, Eucalyptus, OpenNebula with Role-based access control
2. CreateaCost-modelforawebapplicationusingvariousservicesanddoCost-benefit analysis
3. CreatealertsforusageofCloudresources

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENEUERSHIP

4. CreateBillingalertsforyourCloudOrganization
5. CompareCloudcostforasimplewebapplicationacrossAWS,AzureandGCPand suggest the best one

TOTAL:60PERIODS

TEXTBOOKS

1. CloudServiceManagementandGovernance:SmartServiceManagementinCloud Eraby Enamul Haque, Enel Publications
2. CloudComputing:Concepts,Technology&ArchitecturebyThomasErl,Ricard oPuttini, Zaigham Mohammad 2013
3. CloudComputingDesignPatternsbyThomasErl,RobertCope,AminNaserpour

REFERENCES

1. EconomicsofCloudComputingbyPraveenAyyappa,LAPLambertAcademicPublishing
2. Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya, Christian Vechhiola, S. Thamarai Selvi

221AIDC56D UI AND UX DESIGN LTP C

202 3

COURSEOBJECTIVES:

- ToprovideasoundknowledgeinUI&UX
- TounderstandtheneedforUIandUX
- TounderstandthevariousResearchMethodsusedinDesign
- ToexplorethevariousToolsusedinUI& UX
- Creatingawireframeandprototype

UNITI FOUNDATIONSOFDESIGN 6

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy

UNITII FOUNDATIONSOFUIDESIGN 6

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides

UNITIII FOUNDATIONSOFUXDESIGN 6

Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals

UNITIV WIREFRAMING,PROTOTYPINGANDTESTING 6

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools- Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENEUERSHIP

UNITVRESEARCH,DESIGNING,IDEATING,&INFORMATION ARCHITECTURE6

Identifying andWriting Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture

LISTOF EXPERIMENTS 30PERIODS

1. DesigningaResponsivelayoutforansocietalapplication
2. ExploringvariousUIInteractionPatterns
3. DevelopinganinterfacewithproperUIStyleGuides
4. DevelopingWireflowdiagramforapplicationusingopensourcesoftware
5. ExploringvariousopensourcecollaborativeinterfacePlatform
6. HandsonDesignThinkingProcessforanewproduct
7. Brainstormingfeatureforproposedproduct
8. DefiningtheLookandFeelofthenewProject
9. CreateaSamplePatternLibraryforthatproduct(Moodboard,Fonts,ColorsbasedonUI principles)
10. Identifyacustomerproblemtosolve
11. Conduct end-to-end user research - User research, creating personas, Ideation process(User stories, Scenarios), Flow diagrams, Flow Mapping
12. Sketch,designwithpopulartoolandbuildaprototypeandperformusabilitytestingand identify improvements

TOTAL:60PERIODS

COURSEOUTCOMES:

Oncompletionofthecourse,thestudentswillbeableto:

CO1: BuildUIforuser Applications

CO2: EvaluateUXdesignofanyproductorapplication

CO3: Demonstrate UX Skills in product development

CO4: Implement Sketching principles

CO5: CreateWireframeandPrototype

TEXTBOOKS

1. JoelMarsh,“UXforBeginners”,O’Reilly,2022
2. Jon Yablonski, “Laws of UX using Psychology to Design Better Product & Services” O’Reilly 2021

REFERENCES

1. JeniferTidwell,CharlesBrewer,AynneValencia,“DesigningInterface”3 rdEdition ,O’Reilly 2020
2. SteveSchoger,AdamWathan“RefactoringUI”,2018
3. SteveKrug,“Don'tMakeMeThink,Revisited:ACommonsenseApproachtoWeb& Mobile”, Third Edition, 2015
4. https://www.nngroup.com/articles/
5. https://www.interaction-design.org/literature.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

221AIDC56E SOFTWARE TESTING AND AUTOMATION LTPC
20 23

COURSEOBJECTIVES:

- Tounderstandthebasicsofsoftwaretesting
- Tolearnhowtodothetestingandplanning effectively
- Tobuildtestcasesandexecutethem
- Tofocusonwideaspectsoftestingandunderstandingmultiplefacetsof testing
- Togetaninsightabouttestautomationandthetoolsusedfortestautomation

UNITI FOUNDATIONSOFSOFTWARETESTING 6

WhydowetestSoftware?,Black-BoxTestingandWhite-BoxTesting,SoftwareTestingLifeCycle, V-model of Software Testing, Program Correctness and Verification, Reliability versus Safety, Failures, Errors and Faults (Defects), Software Testing Principles, Program Inspections, Stages of Testing: Unit Testing, Integration Testing, System Testing

UNITII TESTPLANNING 6

TheGoalofTestPlanning,HighLevelExpectations,IntergroupResponsibilities,TestPhases,Test Strategy, Resource Requirements, Tester Assignments, Test Schedule, Test Cases, Bug Reporting, Metrics and Statistics.

UNITIII TESTDESIGNANDEXECUTION 6

Test Objective Identification, Test Design Factors, Requirement identification, Testable Requirements, Modeling a Test Design Process, Modeling Test Results, Boundary Value Testing, Equivalence Class Testing, Path Testing, Data Flow Testing, Test Design Preparedness Metrics, Test Case Design Effectiveness, Model-Driven Test Design, Test Procedures, Test Case Organization and Tracking, Bug Reporting, Bug Life Cycle.

UNITIV ADVANCEDTESTINGCONCEPTS 6

Performance Testing: Load Testing, Stress Testing, Volume Testing, Fail-Over Testing, Recovery Testing, Configuration Testing, Compatibility Testing, Usability Testing, Testing theDocumentation, Security testing, Testing in the Agile Environment, Testing Web and Mobile Applications.

UNITV TESTAUTOMATIONANDTOOLS 6

Automated Software Testing,Automate Testing of Web Applications, Selenium: Introducing Web DriverandWebElements,LocatingWebElements,ActionsonWebElements,DifferentWeb

Drivers, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test Reports.

PRACTICALEXERCISES:
30PERI
ODS

1. Developthetestplanfortestingane-commerceweb/mobileapplication(www.amazon.in).
2. Designthetestcasesfortestingthee-commerceapplication
3. Testthee-commerceapplicationandreportthedefectsinit.
4. Developthetestplananddesignthetestcasesforaninventorycontrolsystem.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

5. Executethetestcasesagainstaclientserverordesktopapplicationandidentifythedefects.
6. Testtheperformanceofthee-commerceapplication.
7. Automatethetestingofe-commerceapplicationsusingSelenium.
8. IntegrateTestNGwiththeabovetestautomation.
9. MiniProject:
a) Builddata-drivenframeworkusingSeleniumandTestNG
b) BuildPageobjectModelusingSeleniumandTestNG
c) BuildBDDframeworkwithSelenium,TestNGandCucumber

COURSEOUTCOMES:

CO1: Understandthebasicconceptsofsoftwaretestingandtheneedforsoftwaretesting
CO2:DesignTestplanninganddifferentactivitiesinvolvedintestplanning
CO3:Designeffectivetestcasesthatcanuncovercriticaldefectsintheapplication
CO4:Carryoutadvancedtypesoftesting
CO5: AutomatethesoftwaretestingusingSeleniumandTestNG

TOTAL:60PERIODS

TEXTBOOKS

1. YogeshSingh,“SoftwareTesting”,CambridgeUniversityPress,2012
2. Unmesh Gundecha,SatyaAvasarala,"Selenium WebDriver3Practical Guide"-Second Edition 2018

REFERENCES

1. GlenfordJ. Myers, CoreySandler,TomBadgett,TheArtof SoftwareTesting, 3rdEdition, 2012, John Wiley & Sons, Inc.
2. RonPatton,Softwaretesting,2ndEdition,2006,SamsPublishing
3. PaulC.Jorgensen,SoftwareTesting:ACraftsman’sApproach,FourthEdition,2014, Taylor & Francis Group.
4. CarlCocchiaro,SeleniumFrameworkDesigninData-DrivenTesting,2018,PacktPublishing.
5. ElfriedeDustin,ThomGarrett,BernieGaurf,ImplementingAutomatedSoftwareTesting, 2009, Pearson Education, Inc.
6. SatyaAvasarala,SeleniumWebDriverPracticalGuide,2014,PacktPublishing.
7. VarunMenon,TestNgBeginner'sGuide,2013,PacktPublishing.

221AIDC56F	**WEB APPLICATION SECURITY**	**LTP C**
		202 3

COURSEOBJECTIVES:

- Tounderstandthefundamentalsofwebapplicationsecurity
- Tofocusonwideaspectsofsecuredevelopmentanddeploymentofwebapplications
- TolearnhowtobuildsecureAPIs
- Tolearnthebasicsofvulnerabilityassessmentandpenetrationtesting
- TogetaninsightaboutHackingtechniquesandTools

UNITI FUNDAMENTALSOFWEBAPPLICATIONSECURITY 6

The history of Software Security-Recognizing Web Application Security Threats, Web Application Security, Authenticationand Authorization, Secure Socket layer,Transport layer

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

Security, Session Management-Input Validation

UNITII SECUREDEVELOPMENTANDDEPLOYMENT 5

Web Applications Security - Security Testing, Security Incident Response Planning,The Microsoft Security Development Lifecycle (SDL), OWASP Comprehensive Lightweight Application Security Process (CLASP), The Software Assurance Maturity Model (SAMM)

UNITIII SECUREAPIDEVELOPMENT 6

API Security- Session Cookies,Token Based Authentication, Securing Natter APIs: Addressing threats with Security Controls, Rate Limiting for Availability, Encryption, Audit logging, Securing service-to-service APIs: API Keys , OAuth2, Securing Microservice APIs: Service Mesh, Locking Down Network Connections, Securing Incoming Requests.

UNITIV VULNERABILITYASSESSMENTANDPENETRATIONTESTING 6

Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud-based vulnerability scanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Database-based vulnerability scanners, Types of Penetration Tests: External Testing, Web Application Testing, Internal Penetration Testing, SSID or Wireless Testing, Mobile Application Testing.

UNITV HACKINGTECHNIQUESANDTOOLS 7

Social Engineering, Injection, Cross-Site Scripting(XSS), Broken Authentication and Session Management, Cross-Site Request Forgery, Security Misconfiguration, Insecure Cryptographic Storage, Failure to Restrict URL Access, Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite, etc.

PRACTICALEXERCISES:

30PERIODS

1. Installwiresharkandexplorethevariousprotocols
a. AnalyzethedifferencebetweenHTTPvsHTTPS
b. Analyzethevarioussecuritymechanismsembeddedwithdifferentprotocols.
2. IdentifythevulnerabilitiesusingOWASPZAPtool
3. CreatesimpleRESTAPIusingpythonforfollowingoperation
. GET
a. PUSH
b. POST
c. DELETE
4. InstallBurpSuitetodofollowingvulnerabilities:
. SQLinjection
a. cross-sitescripting(XSS)
5. AttackthewebsiteusingSocialEngineeringmethod

COURSEOUTCOMES:

CO1: Understandingthebasicconceptsofwebapplicationsecurityandtheneedfor it

CO2: Beacquaintedwiththeprocessforsecuredevelopmentanddeploymentofwebapplications

CO3: AcquiretheskilltodesignanddevelopSecureWebApplicationsthatuseSecureAPIs

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENEUERSHIP

CO4:Beabletogettheimportanceofcarryingoutvulnerabilityassessmentandpenetration testing
CO5:Acquiretheskilltothinklikeahackerandtousehackerstoolsets

TOTAL:60PERIODS

TEXTBOOKS

1. AndrewHoffman, WebApplicationSecurity:ExploitationandCountermeasuresforModern Web Applications, First Edition, 2020, O'Reilly Media, Inc.
2. BryanSullivan,VincentLiu,WebApplicationSecurity:ABeginnersGuide,2012,The McGraw-Hill Companies.
3. NeilMadden,APISecurityinAction,2020,ManningPublicationsCo.,NY,USA.

REFERENCES

1. Michael Cross, Developer's GuidetoWebApplication Security, 2007, Syngress Publishing, Inc.
2. RaviDasandGregJohnson,TestingandSecuringWebApplications,2021,Taylor& Francis Group, LLC.
3. PrabathSiriwardena,AdvancedAPISecurity,2020,ApressMediaLLC,USA.
4. MalcomMcDonald,WebSecurityforDevelopers,2020,NoStarchPress, Inc.
5. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, and Terron Williams Grey Hat Hacking: The Ethical Hacker's Handbook, Third Edition, 2011, The McGraw-Hill Companies.

221AIDC56G	**DEVOPS**	**L T P C**
		2 0 2 3

COURSEOBJECTIVES:

- TointroduceDevOpsterminology,definition&concepts
- TounderstandthedifferentVersioncontroltoolslikeGit,Mercurial
- TounderstandtheconceptsofContinuousIntegration/ContinuousTesting/Continuous Deployment)
- TounderstandConfigurationmanagementusingAnsible
- Illustratethebenefitsanddrivetheadoptionofcloud-basedDevopstoolstosolvereal world problems

UNITI INTRODUCTIONTODEVOPS 6

DevopsEssentials-IntroductionToAWS,GCP,Azure-Versioncontrolsystems:GitandGithub.

UNITII COMPILEANDBUILDUSINGMAVEN&GRADLE 6

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, Understand buildusing Gradle

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENEUERSHIP

UNITIII CONTINUOUSINTEGRATIONUSINGJENKINS 6

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (GitPlugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

UNITIV CONFIGURATIONMANAGEMENTUSINGANSIBLE 6

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible

UNITV BUILDINGDEVOPSPIPELINESUSINGAZURE 6

Create Github Account, Create Repository, Create Azure Organization,Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file

30 PERIODS

COURSEOUTCOMES:

CO1: UnderstanddifferentactionsperformedthroughVersioncontroltoolslikeGit.

CO2: PerformContinuousIntegrationandContinuousTestingandContinuousDeployment using Jenkins by building and automating test cases using Maven & Gradle.

CO3:AbilitytoPerformAutomatedContinuousDeployment

CO4: AbilitytodoconfigurationmanagementusingAnsible

CO5: UnderstandtoleverageCloud-basedDevOpstoolsusingAzureDevOps

PRACTICALEXERCISES: 30PERIODS

1. CreateMavenBuildpipelineinAzure
2. RunregressiontestsusingMavenBuildpipelineinAzure
3. InstallJenkinsin Cloud
4. CreateCIpipelineusingJenkins
5. CreateaCDpipelineinJenkinsanddeployinCloud
6. CreateanAnsibleplaybookforasimplewebapplicationinfrastructure
7. BuildasimpleapplicationusingGradle
8. InstallAnsibleandconfigureansiblerolesandtowriteplaybooks

TEXTBOOKS

1. Roberto Vormittag, "A Practical Guide to Git and GitHub forWindows Users: From Beginner to Expert in Easy Step-By-Step Exercises", Second Edition, Kindle Edition, 2016.
2. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014

REFERENCES

1. Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for ... DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020
2. byMitesh Soni
3. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", First Edition, 2015.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

4. David Johnson, “Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps”, Second Edition, 2016.
5. Mariot Tsitoara, “Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer”, Second Edition, 2019.
6. https://www.jenkins.io/user-handbook.pdf
7. https://maven.apache.org/guides/getting-started/

221AIDC56H PRINCIPLES OF PROGRAMMING LANGUAGES LTP C

300 3

COURSEOBJECTIVES:

- Tounderstandanddescribesyntaxandsemanticsofprogramminglanguages
- Tounderstanddata,datatypes,andbasicstatements
- Tounderstandcall-returnarchitectureandwaysofimplementingthem
- Tounderstandobject-orientation,concurrency,andeventhandlinginprogramming languages
- Todevelopprogramsinnon-proceduralprogrammingparadigms

UNITI SYNTAXANDSEMANTICS 9

Evolution of programming languages – describing syntax – context-free grammars – attribute grammars – describing semantics – lexical analysis – parsing – recursive-descent – bottom up parsing

UNITII DATA,DATATYPES,ANDBASICSTATEMENTS 9

Names – variables – binding – type checking – scope – scope rules – lifetime and garbage collection–primitivedatatypes–strings–arraytypes–associativearrays–recordtypes– uniontypes–pointersandreferences–Arithmeticexpressions–overloadedoperators– type conversions– relational and boolean expressions– assignment statements– mixed mode assignments– control structures–selection– iterations– branching– guarded statements

UNITIII SUBPROGRAMSANDIMPLEMENTATIONS 9

Subprograms–designissues–localreferencing–parameterpassing–overloadedmethods– generic methods – design issues for functions– semantics of call and return – implementingsimplesubprograms–stackanddynamiclocalvariables–nested subprograms – blocks – dynamic scoping

UNITIV OBJECT-ORIENTATION,CONCURRENCY,ANDEVENTHANDLING 9

Object-orientation– design issues for OOP languages– implementation of object-oriented constructs–concurrency–semaphores–monitors–messagepassing–threads– statement level concurrency – exception handling – event handling

UNITV FUNCTIONALANDLOGICPROGRAMMINGLANGUAGES 9

Introduction to lambda calculus – fundamentals of functional programming languages –

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

ProgrammingwithScheme–ProgrammingwithML–Introductiontologicandlogic programming – Programming with Prolog – multi-paradigm languages

TOTAL:45 PERIODS

COURSEOUTCOMES:

CO1: Describesyntaxandsemanticsofprogramminglanguages

CO2: Explaindata,datatypes,andbasicstatementsofprogramminglanguages

CO3: Designandimplementsubprogramconstructs

CO4: Applyobject-oriented,concurrency,andeventhandlingprogrammingconstructs and Develop programs in Scheme, ML, and Prolog

CO5: Understandandadoptnewprogramminglanguages

TEXTBOOKS

1. RobertW.Sebesta,"ConceptsofProgrammingLanguages",TwelfthEdition(Global Edition), Pearson, 2022.

2. MichaelL.Scott,"ProgrammingLanguagePragmatics",FourthEdition,Elsevier,2018.

3. R.KentDybvig,"TheSchemeprogramminglanguage",FourthEdition,PrenticeHall,2011.

4. JeffreyD.Ullman,"ElementsofMLprogramming",SecondEdition,Pearson,1997.

5. W. F. Clocksin and C. S. Mellish, "Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2003.

221AIDC63A Cloud Computing 2 0 2 3

COURSEOBJECTIVES:

- Tounderstandtheprinciplesofcloudarchitecture,modelsandinfrastructure.
- Tounderstandtheconceptsofvirtualizationandvirtualmachines.
- TogainknowledgeaboutvirtualizationInfrastructure.
- ToexploreandexperimentwithvariousClouddeploymentenvironments.
- Tolearnaboutthesecurityissuesinthecloudenvironment.

UNITI CLOUDARCHITECTUREMODELSANDINFRASTRUCTURE 6

Cloud Architecture: System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – Cloud deployment models – Cloud service models; Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Design Challenges

UNITII VIRTUALIZATIONBASICS 6

Virtual Machine Basics – Taxonomy of Virtual Machines – Hypervisor – Key Concepts – Virtualization structure – Implementation levels of virtualization – Virtualization Types: Full Virtualization – Para Virtualization – Hardware Virtualization – Virtualization of CPU, Memory and I/O devices.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENEUERSHIP

UNITIII VIRTUALIZATIONINFRASTRUCTUREANDDOCKER 7

DesktopVirtualization –Network Virtualization –StorageVirtualization –System-levelof Operating Virtualization – Application Virtualization – Virtual clusters and Resource Management –Containers vs. Virtual Machines – Introduction to Docker – Docker Components – Docker Container – Docker Images and Repositories.

UNITIV CLOUDDEPLOYMENTENVIRONMENT 6

Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus – OpenStack.

UNITV CLOUDSECURITY 5

Virtualization System-Specific Attacks: Guest hopping – VM migration attack – hyperjacking. Data Securityand Storage; Identityand Access Management (IAM) - IAMChallenges - IAMArchitecture and Practice.

30 PERIODS

PRACTICALEXERCISES: 30PERIODS

1. InstallVirtualbox/VMware/EquivalentopensourcecloudWorkstationwithdifferentflavours of Linux or Windows OS on top of windows 8 and above.
2. Install a C compiler in the virtual machine created using a virtual box and execute SimplePrograms
3. InstallGoogleAppEngine.Createahelloworldappandothersimplewebapplications using python/java.
4. UsetheGAElaunchertolaunchtheweb applications.
5. SimulateacloudscenariousingCloudSimandrunaschedulingalgorithmthatisnot present in CloudSim.
6. Findaproceduretotransferthefilesfromonevirtualmachinetoanothervirtualmachine.
7. InstallHadoopsinglenodeclusterandrunsimpleapplicationslikewordcount.
8. CreatingandExecutingYourFirstContainerUsingDocker.
9. RunaContainerfromDockerHub

COURSEOUTCOMES:

CO1: Understandthedesignchallengesinthecloud.
CO2: Applytheconceptofvirtualizationanditstypes.
CO3: ExperimentwithvirtualizationofhardwareresourcesandDocker.
CO4: Developanddeployservicesonthecloudandsetupacloud environment.
CO5: Explainsecuritychallengesinthecloudenvironment.

TOTAL:60PERIODS

TEXTBOOKS

1. KaiHwang,GeoffreyCFox,JackGDongarra,"DistributedandCloudComputing,From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. JamesTurnbull,"TheDockerBook",O'ReillyPublishers,2014.
3. Krutz,R.L.,Vines,R.D,"Cloudsecurity.AComprehensiveGuidetoSecureCloudComputing", Wiley Publishing, 2010.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENEUERSHIP

REFERENCES

1. JamesE.Smith,RaviNair,“VirtualMachines:VersatilePlatformsforSystemsand Processes”, Elsevier/Morgan Kaufmann, 2005.
2. TimMather,SubraKumaraswamy,andShahedLatif,“CloudSecurityandPrivacy:a n enterprise perspective on risks and compliance”, O’Reilly Media, Inc., 2009.

221AIDC63B Virtualization 2 0 2 3

COURSEOBJECTIVES:

- ToLearnthebasicsandtypesofVirtualization
- TounderstandtheHypervisorsanditstypes
- ToExploretheVirtualizationSolutions
- ToExperimentthevirtualizationplatforms

UNITI INTRODUCTIONTOVIRTUALIZATION 7

Virtualization and cloud computing - Need of virtualization – cost, administration, fast deployment, reduce infrastructure cost – limitations- Types of hardware virtualization: Full virtualization - partial virtualization - Paravirtualization-Types of Hypervisors

UNITII SERVERANDDESKTOPVIRTUALIZATION 6

Virtual machine basics- Types of virtual machines- Understanding Server Virtualization- types of server virtualization- Business Cases for Server Virtualization – Uses of Virtual Server Consolidation – Selecting Server Virtualization Platform-Desktop Virtualization-Types of Desktop Virtualization

UNITIII NETWORKVIRTUALIZATION 6

Introduction to Network Virtualization-Advantages- Functions-Tools for Network Virtualization-VLAN-WAN Architecture-WAN Virtualization

UNITIV STORAGEVIRTUALIZATION 5

Memory Virtualization-Types of Storage Virtualization-Block, File-Addressspace Remapping-Risks of Storage Virtualization-SAN-NAS-RAID

UNITV VIRTUALIZATIONTOOLS 6

VMWare-Amazon AWS-Microsoft HyperV- Oracle VM Virtual Box- IBM PowerVM- Google Virtualization- Case study.

30 PERIODS

PACTICALEXERCISES:

1. Createtype2virtualizationinVMWAREoranyequivalent OpenSourceTool.Allocatememory and storage space as per requirement. Install Guest OS on that VMWARE.

2.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

a. Shrinkandextendvirtualdisk
b. Create,Manage,Configureandschedulesnapshots
c. CreateSpanned,MirroredandStripedvolume
d. CreateRAID5volume
3.
a. DesktopVirtualizationusingVNC
b. DesktopVirtualizationusingChromeRemoteDesktop

22AIDC64A **ETHICALHACKING** **LTP C**
20 23

COURSEOBJECTIVES:

- Tounderstandthebasicsofcomputerbasedvulnerabilities.
- Toexploredifferentfootprinting,reconnaissanceandscanningmethods.
- Toexposetheenumerationandvulnerabilityanalysismethods.
- TounderstandhackingoptionsavailableinWebandwirelessapplications.
- Toexploretheoptionsfornetworkprotection.
- Topracticetoolstoperformethicalhackingtoexpose thevulnerabilities.UNITI INTRODUCTION 6

Ethical Hacking Overview - Role of Security and Penetration Testers .- Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer -The Transport Layer- TheInternetLayer -IPAddressing .- Network andComputerAttacks- Malware- Protecting Against Malware Attacks.- Intruder Attacks - Addressing Physical Security

UNITII FOOTPRINTING,RECONNAISSANCEANDSCANNINGNETWORKS 6

Footprinting Concepts - Footprinting through Search Engines, Web Services, Social Networking Sites, Website, Email - Competitive Intelligence - Footprinting through Social Engineering - Footprinting Tools - Network Scanning Concepts - Port-Scanning Tools - Scanning Techniques - Scanning Beyond IDS and Firewall

UNITIII ENUMERATIONANDVULNERABILITYANALYSIS 6

Enumeration Concepts - NetBIOS Enumeration – SNMP,LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment Concepts - Desktop and Server OS Vulnerabilities - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities- Vulnerabilities of Embedded Oss

UNITIV SYSTEMHACKING 6

Hacking Web Servers - Web Application Components- Vulnerabilities - Tools for Web Attackers and Security Testers Hacking Wireless Networks - Components of a Wireless Network – Wardriving- Wireless Hacking - Tools of the Trade –

UNITV NETWORKPROTECTIONSYSTEMS 6

Access Control Lists. - Cisco Adaptive Security Appliance Firewall - Configuration and Risk Analysis Tools for Firewalls and Routers - Intrusion Detection and Prevention Systems- Network-Based and Host-Based IDSs and IPSs - Web Filtering - Security Incident Response Teams –

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENEUERSHIP

Honeypots.

30 PERIODS

PRACTICALEXERCISES:

1. InstallKaliorBacktrackLinux/Metasploitable/WindowsXP
2. Practicethebasicsof reconnaissance.
3. UsingFOCA/SearchDiggitytools extractmetadataandexpandingthetargetlist

4.Aggregatesinformationfrompublicdatabasesusingonlinefreetoolslike Paterva's Maltego.

5.InformationgatheringusingtoolslikeRobtex.

6. ScanthetargetusingtoolslikeNessus.
7. ViewandcapturenetworktrafficusingWireshark.
8. Automatedigforvulnerabilitiesandmatchexploitsusing Armitage

FOCA : http://www.informatica64.com/foca.aspx.

Nessus

:http://www.tenable.com/products/ness

us.Wireshark : http://www.wireshark.org.

TOTAL:60PERIODS

COURSEOUTCOMES:

Attheendofthiscourse,thestudentswillbeable:

CO1:Toexpressknowledgeonbasicsofcomputerbasedvulnerabilities

CO2:Togainunderstandingondifferentfootprinting,reconnaissanceandscanningmethods.

CO3 Todemonstratetheenumerationandvulnerabilityanalysismethods

CO4:TogainknowledgeonhackingoptionsavailableinWebandwirelessapplications.

CO5:Toacquireknowledgeontheoptionsfornetwork protection.

CO6:Tousetoolstoperformethicalhackingtoexposethevulnerabilities.

TEXTBOOKS

1. MichaelT.Simpson,KentBackman,andJamesE.Corley,Hands-OnEthicalHackingand Network Defense, Course Technology, Delmar Cengage Learning, 2010.

2. TheBasicsofHackingandPenetrationTesting-PatrickEngebretson,SYNGRESS, Elsevier, 2013.

3. TheWebApplicationHacker'sHandbook:FindingandExploitingSecurityFlaws,DafyddStuttard and Marcus Pinto, 2011.

REFERENCES

1. BlackHatPython:PythonProgrammingforHackersandPentesters,JustinSeitz, 2014.

22AIDC64B	**DIGITALANDMOBILEFORENSICS**	**L TPC**
		202 3

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

COURSEOBJECTIVES:

- Tounderstandbasicdigitalforensicsandtechniques.
- Tounderstanddigitalcrimeandinvestigation.
- Tounderstandhowtobepreparedfordigitalforensic readiness.
- TounderstandanduseforensicstoolsforiOSdevices.
- TounderstandanduseforensicstoolsforAndroiddevices.

UNITI INTRODUCTIONTODIGITALFORENSICS 6

Forensic Science – Digital Forensics – Digital Evidence – The Digital Forensics Process – Introduction – The Identification Phase – The Collection Phase – The Examination Phase – The Analysis Phase – The Presentation Phase

UNITII DIGITALCRIMEANDINVESTIGATION 6

DigitalCrime–Substantive CriminalLaw–GeneralConditions –Offenses–InvestigationMethods for Collecting Digital Evidence – International Cooperation to Collect Digital Evidence

UNITIII DIGITALFORENSICREADINESS 6

Introduction – Law Enforcement versus Enterprise Digital Forensic Readiness – Rationale for Digital Forensic Readiness – Frameworks, Standards and Methodologies – Enterprise Digital Forensic Readiness – Challenges in Digital Forensics

UNITIV iOSFORENSICS 6

Mobile Hardware and Operating Systems - iOS Fundamentals – Jailbreaking – File System – Hardware – iPhone Security – iOS Forensics – Procedures and Processes – Tools – Oxygen Forensics – MobilEdit – iCloud

UNITV ANDROIDFORENSICS 6

Android basics – Key Codes – ADB – Rooting Android – Boot Process – File Systems – Security – Tools – Android Forensics – Forensic Procedures – ADB – Android OnlyTools – Dual UseTools – Oxygen Forensics – MobilEdit – Android App Decompiling

30 PERIODS

COURSEOUTCOMES:

Oncompletionofthecourse,thestudentswillbeableto:

CO1:Haveknowledgeondigitalforensics.

CO2: Knowaboutdigitalcrimeandinvestigations.

CO3: Beforensicready.

CO4:Investigate,identifyandextractdigitalevidencefromiOSdevices.

CO5: Investigate,identifyandextractdigitalevidencefromAndroiddevices.

LABEXPERIMENTS:

30PERIODS

1. InstallationofSleuthKitonLinux.Listalldatablocks.Analyzeallocatedaswellasunallocated blocks of a disk image.
2. DataextractionfromcalllogsusingSleuth Kit.
3. DataextractionfromSMSandcontactsusingSleuth Kit.
4. InstallMobileVerificationToolkitorMVTanddecryptencryptediOSbackups.
5. ProcessandparserecordsfromtheiOSsystem.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

6. Extractinstalledapplicationsfrom Androiddevices.
7. Extractdiagnosticinformationfrom Androiddevicesthroughtheadbprotocol.
8. Generateaunifiedchronologicaltimelineofextractedrecords,

TOTAL:60PERIODS

TEXTBOOK:

1. AndreArnes,“DigitalForensics”,Wiley,2018.
2. ChuckEasttom,“AnIn-depthGuidetoMobileDeviceForensics”,FirstEdition,CRCPress, 2022.

REFERENCES

1. Vacca,J,ComputerForensics,ComputerCrimeSceneInvestigation,2ndEd,Charles River Media, 2005, ISBN: 1-58450-389.

22AIDC64C	SOCIALNETWORKSECURITY	LTP C
		202 3

COURSEOBJECTIVES:

- Todevelopsemanticwebrelatedsimpleapplications
- ToexplainPrivacyandSecurityissuesinSocialNetworking
- Toexplainthedataextractionandminingofsocialnetworks
- Todiscussthepredictionofhumanbehaviorinsocialcommunities
- TodescribetheAccessControl,PrivacyandSecuritymanagementofsocialnetworks

UNITI FUNDAMENTALSOFSOCIALNETWORKING 6

IntroductiontoSemanticWeb,Limitationsof currentWeb,Development ofSemanticWeb, Emergence of the Social Web, Social Network analysis, Development of Social Network Analysis,Keyconceptsandmeasuresinnetworkanalysis,Historicaloverviewofprivacyand security, Major paradigms, for understanding privacy and security

UNITII SECURITYISSUESINSOCIALNETWORKS 6

Theevolutionof privacyandsecurityconcernswith networked technologies, Contextual influences on privacy attitudes and behaviors, Anonymity in a networked world

UNITIII EXTRACTIONANDMININGINSOCIALNETWORKINGDATA 6

ExtractingevolutionofWebCommunityfromaSeriesofWebArchive,Detecting communities in social networks, Definition of community, Evaluating communities, Methods for community detection and mining, Applications of community mining algorithms, Tools for detecting communities social network infrastructures and communities, Big data and Privacy

UNITIV PREDICTINGHUMANBEHAVIORANDPRIVACYISSUES 6

Understandingandpredictinghumanbehaviorforsocialcommunities,Userdata Management, Inference and Distribution, Enabling new human experiences, Reality mining, Context, Awareness, Privacyin online social networks,Trust in online environment,What is Neo4j, Nodes, Relationships, Properties

SKILL DEVELOPMENT EMPLOYABILITY ENTREPRENEUERSHIP

UNITV ACCESSCONTROL,PRIVACYANDIDENTITYMANAGEMENT 6

Understand the access control requirements for Social Network, Enforcing Access Control Strategies, Authentication and Authorization, Roles-based Access Control, Host, storage and network access control options, Firewalls, Authentication, and Authorization in Social Network, Identity & Access Management, Single Sign-on, Identity Federation, Identity providers and service consumers, The role of Identity provisioning

COURSEOUTCOMES:

CO1: Developsemanticwebrelatedsimpleapplications

CO2:AddressPrivacyandSecurityissuesinSocialNetworking

CO3:Explainthedataextractionandminingofsocialnetworks

CO4:Discussthepredictionofhumanbehaviorinsocialcommunities

CO5:Describetheapplicationsofsocialnetworks

30PERIODS

PRACTICALEXERCISES: **30PERIODS**

1. Designownsocialmediaapplication
2. CreateaNetworkmodelusingNeo4j
3. ReadandwriteDatafromGraphDatabase
4. Find“FriendofFriends”usingNeo4j
5. Implementsecuresearchinsocialmedia
6. CreateasimpleSecurity&Privacydetector

TOTAL:60PERIODS

TEXTBOOKS

1. PeterMika,“SocialNetworksandtheSemanticWeb,FirstEdition,Springer2007.
2. BorkoFurht,“HandbookofSocialNetworkTechnologiesandApplication,FirstEdition, Springer, 2010.
3. LearningNeo4j3.x–SecondEditionByJérômeBaton,RikVanBruggen,Packtpublishing
4. David Easley, Jon Kleinberg, “Networks, Crowds, and Markets: Reasoning about aHighly ConnectedWorld‖,FirstEdition, CambridgeUniversityPress, 2010.

REFERENCES

1. Easley D. Kleinberg J., “Networks, Crowds, and Markets – Reasoning about a Highly ConnectedWorld‖, Cambridge University Press, 2010.
2. Jackson,MatthewO.,“SocialandEconomicNetworks”,PrincetonUniversityPress,2008.
3. GuandongXu ,Yanchun Zhang and Lin Li, “Web Mining and Social Networking – Techniques and applications”, First Edition, Springer, 2011.
4. Dion Goh and Schubert Foo, “Social information Retrieval Systems: EmergingTechnologies and Applications for Searching the Web Effectively”, IGI Global Snippet,2008.
5. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, “Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modeling”, IGI Global

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENEUERSHIP

Snippet, 2009.

6. John G. Breslin, Alexander Passant and Stefan Decker, “The Social Semantic Web”, Springer, 2009.

22AIDC64D MODERNCRYPTOGRAPHY LTPC
202 3

COURSEOBJECTIVES:

- TolearnaboutModernCryptography.
- Tofocusonhowcryptographicalgorithmsandprotocolsworkandhowtousethem.
- TobuildaPseudorandompermutation.
- ToconstructBasiccryptanalytictechniques.
- Toprovideinstructiononhowtousetheconceptsof block ciphersandmessage authentication codes.

UNITI INTRODUCTION 6

Basics of Symmetric Key Cryptography, Basics of Asymmetric Key Cryptography, Hardness of Functions. Notions of Semantic Security (SS) and Message Indistinguishability (MI): Proof of Equivalence of SS and MI, Hard Core Predicate, Trap-door permutation, Goldwasser-Micali Encryption. Goldreich-Levin Theorem: Relation between Hardcore Predicates and Trap-door permutations.

UNITII FORMALNOTIONSOFATTACKS 6

Attacks under Message Indistinguishability: Chosen Plaintext Attack (IND-CPA), ChosenCiphertext Attacks (IND-CCA1 and IND-CCA2), Attacks under MessageNon-malleability: NM-CPA and NM-CCA2, Inter-relations among the attack model

UNITIII RANDOMORACLES 6

Provable Security and asymmetric cryptography, hash functions. One-way functions: Weak and Strong one-way functions. Pseudo-random Generators (PRG): Blum-Micali-Yao Construction, Construction of more powerful PRG, Relation between One-way functions and PRG, Pseudo-random Functions (PRF)

UNITIV BUILDINGAPSEUDORANDOMPERMUTATION 6

The LubyRackoff Construction: Formal Definition, Application of the LubyRackoff Construction to the construction of Block Ciphers, The DES in the light of LubyRackoff Construction.

UNITV MESSAGEAUTHENTICATIONCODES 6

Left orRight Security(LOR).FormalDefinitionofWeak andStrong MACs, Using aPRFasaMAC, Variable length MAC. Public Key Signature Schemes: Formal Definitions, Signing and Verification, Formal Proofs of Security of Full Domain Hashing. Assumptions for Public Key SignatureSchemes: One-way functions Imply Secure One-time Signatures. Shamir's Secret Sharing Scheme. Formally Analyzing Cryptographic Protocols. Zero Knowledge Proofs and Protocols.

30 PERIODS

PRACTICALEXERCISES: 30PERIODS

1. ImplementFeige-Fiat-Shamiridentificationprotocol.
2. ImplementGQidentificationprotocol.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

3. ImplementSchnorridentificationprotocol.
4. ImplementRabinone-timesignaturescheme.
5. ImplementMerkleone-timesignaturescheme.
6. ImplementAuthenticationtreesandone-timesignatures.
7. ImplementGMRone-timesignaturescheme.

COURSEOUTCOMES:

CO1:Interpretthebasicprinciplesofcryptographyandgeneralcryptanalysis.
CO2:Determinetheconceptsofsymmetricencryptionandauthentication.
CO3 Identifytheuseofpublickeyencryption,digitalsignatures,andkeyestablishment.
CO4: Articulate the cryptographic algorithms to compose, build and analyze simple cryptographic solutions.
CO5:ExpresstheuseofMessageAuthenticationCodes.

TOTAL:60PERIODS

TEXTBOOKS:

1. HansDelfs and Helmut Knebl,Introduction to Cryptography:Principles andApplications, Springer Verlag.
2. Wenbo Mao, Modern Cryptography, Theory and Practice, Pearson Education (Low Priced Edition)

REFERENCES:

1. ShaffiGoldwasser andMihirBellare, LectureNotesonCryptography, Available at http://citeseerx.ist.psu.edu/.
2. OdedGoldreich, Foundations of Cryptography, CRC Press (Low Priced Edition Available), Part 1 and Part 23
3. WilliamStallings,“CryptographyandNetworkSecurity:Principlesand Practice”,PHI3rd Edition, 2006.

22AIDC64E ENGINEERING SECURES OF SOFTWARE SYSTEM LTP C
202 3

COURSEOBJECTIVES:

- Knowtheimportanceandneedforsoftwaresecurity.
- Knowaboutvariousattacks.
- Learnaboutsecuresoftwaredesign.
- Understandriskmanagementinsecuresoftwaredevelopment.
- Knowtheworkingoftoolsrelatedtosoftwaresecurity.

UNITI NEEDOFSOFTWARESECURITYANDLOW-LEVELATTACKS 6

Software Assurance and Software Security - Threats to software security - Sources of software insecurity - Benefits of Detecting Software Security - Properties of Secure Software – Memory-Based Attacks: Low-Level Attacks Against Heap and Stack - Defense Against Memory-Based Attacks

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UNITII SECURESOFTWAREDESIGN 7

Requirements Engineering for secure software - SQUARE process Model - Requirements elicitation and prioritization- Isolating The Effects of Untrusted Executable Content - Stack Inspection – Policy Specification Languages – Vulnerability Trends – Buffer Overflow – Code Injection - Session Hijacking. Secure Design - Threat Modeling and Security Design Principles

UINTIII SECURITYRISKMANAGEMENT 5

RiskManagementLifeCycle–Risk Profiling –Risk ExposureFactors–RiskEvaluationand Mitigation – Risk Assessment Techniques – Threat and Vulnerability Management

UNITIV SECURITYTESTING 8

Traditional Software Testing – Comparison - Secure Software Development Life Cycle - Risk Based Security Testing – Prioritizing Security TestingWith Threat Modeling – Penetration Testing –PlanningandScoping-Enumeration–RemoteExploitation–WebApplicationExploitation-ExploitsandClientSideAttacks–PostExploitation–BypassingFirewallsandAvoidingDetection -ToolsforPenetrationTesting

UNITV SECUREPROJECTMANAGEMENT 4

Governanceandsecurity-Adoptinganenterprisesoftwaresecurityframework -Securityand project management - Maturity of Practice

30 PERIODS

PRACTIA LEXERCISES

1. ImplementtheSQLinjectionattack.
2. ImplementtheBufferOverflowattack.
3. ImplementCrossSiteScriptingandPreventXSS.
4. PerformPenetrationtestingonawebapplicationtogatherinformationaboutthesystem, then initiate XSS and SQL injection attacks using tools like Kali Linux.
5. Developandtestthesecuretestcases
6. Penetrationtestusingkali Linux

30 PERIODS

COURSEOUTCOMES:

Upon completion of the course, the student will be able to

CO1: Identifyvariousvulnerabilitiesrelatedtomemoryattacks.

CO2: Apply security principles in software development.

CO3: Evaluatetheextentof risks.

CO4: Involveselectionoftestingtechniquesrelatedtosoftwaresecurityinthetestingphaseof software development.

CO5: Usetoolsforsecuringsoftware.

TOTAL:60PERIODS

TEXTBOOKS:

1. JuliaH.Allen,“SoftwareSecurityEngineering”,PearsonEducation,2008
2. EvanWheeler,“SecurityRisk Management:BuildinganInformationSecurityRisk Management Program from the Ground Up”, First edition, Syngress Publishing, 2011
3. ChrisWysopal, LucasNelson, Dino DaiZovi, and Elfriede Dustin, “TheArt of Software Security Testing: Identifying Software Security Flaws (Symantec Press)”, Addison-

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

Wesley Professional, 2006

REFERENCES:

1. Robert C. Seacord, "Secure Coding in C and C++ (SEI Series in Software Engineering)", Addison-Wesley Professional, 2005.
2. JonErickson,"Hacking:TheArtofExploitation",2ndEdition,NoStarchPress,2008.
3. Mike Shema, "Hacking Web Apps: Detecting and Preventing Web Application Security Problems", First edition, Syngress Publishing, 2012
4. Bryan Sullivan and Vincent Liu, "Web Application Security, A Beginner's Guide", Kindle Edition, McGraw Hill, 2012
5. Lee Allen, "Advanced Penetration Testing for Highly-Secured Environments: The Ultimate Security Guide (Open Source: Community Experience Distilled)", Kindle Edition, Packt Publishing,2012
6. JasonGrembi,"DevelopingSecureSoftware"

22AIDC64F CRYPTOCURRENCYANDBLOCKCHAINTECHNOLOGIES LTP C
202 3

COURSEOBJECTIVES:

- Tounderstandthebasicsof Blockchain
- TolearnDifferentprotocolsandconsensusalgorithmsinBlockchain
- TolearntheBlockchainimplementationframeworks
- TounderstandtheBlockchainApplications
- ToexperimenttheHyperledgerFabric,Ethereumnetworks

UNITI INTRODUCTIONTOBLOCKCHAIN 7

Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain, Transactions- The Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree

UNITII BITCOINANDCRYPTOCURRENCY 6

A basic crypto currency, Creation of coins, Payments and double spending, FORTH – theprecursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay

UNITIII BITCOINCONSENSUS 6

BitcoinConsensus,ProofofWork(PoW)-HashcashPoW,BitcoinPoW,AttacksonPoW ,monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases.

UNITIV HYPERLEDGERFABRIC&ETHEREUM 5

ArchitectureofHyperledgerfabricv1.1-chaincode-Ethereum:Ethereumnetwork,EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

UNITV BLOCKCHAINAPPLICATIONS 6

Smart contracts, Truffle Design and issue- DApps- NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance,etc- Case Study.

COURSEOUTCOMES:

CO1: UnderstandemergingabstractmodelsforBlockchainTechnology

CO2: Identifymajorresearchchallengesandtechnicalgapsexisting betweentheoryandpractice in the crypto currency domain.

CO3: ItprovidesconceptualunderstandingofthefunctionofBlockchainasamethodofsecuring distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.

CO4: ApplyhyperledgerFabricandEthereumplatformtoimplementtheBlockchainApplication.

30 PERIODS

PRACTICAL

30PERIODS

1. Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on cloud to run.
2. Create and deploy a blockchain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your blockchain network.
3. Interactwithablockchainnetwork.Executetransactionsandrequestsagainstablock chain network by creating an app to test the network and its rules.
4. Deploy an asset-transfer app using blockchain. Learn app development within a Hyperledger Fabric network.
5. Useblockchaintotrackfitnessclubrewards.Build a webappthatusesHyperledgerFabric to track and trace member rewards.
6. Car auction network: A Hello World example with Hyperledger Fabric Node SDK and IBM Blockchain Starter Plan. Use Hyperledger Fabricto invoke chain code while storing results and data in the starter plan

TOTAL:60PERIODS

TEXTBOOKS

1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.
2. 2.Andreas Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O’Reilly, 2014.

REFERENCES:

1. DanielDrescher,“BlockchainBasics”,FirstEdition,Apress,2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. PrincetonUniversity Press, 2016.
3. MelanieSwan,“Blockchain:BlueprintforaNewEconomy”,O’Reilly, 2015
4. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and Blockchain”, Packt Publishing

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

5. HandbookofResearchonBlockchainTechnology,publishedbyElsevierInc.ISBN: 9780128198162, 2020.

22AIDC64G NETWORKSECURITY LTP C
202 3

COURSEOBJECTIVES:

- Tolearnthefundamentalsof cryptography.
- Tolearnthekeymanagementtechniquesandauthenticationapproaches.
- Toexplorethenetworkandtransportlayersecuritytechniques.
- Tounderstandtheapplicationlayersecuritystandards.
- Tolearntherealtimesecuritypractices.

UNITI INTRODUCTION 8

Basicsofcryptography,conventionalandpublic-keycryptography,hashfunctions,authentication, and digital signatures.

UNITII KEYMANAGEMENTANDAUTHENTICATION 7

Key Management and Distribution: Symmetric Key Distribution, Distribution of Public Keys, X.509 Certificates,Public-KeyInfrastructure.UserAuthentication:RemoteUser-AuthenticationPrinciples, Remote User-Authentication Using Symmetric Encryption, Kerberos Systems, Remote User Authentication Using Asymmetric Encryption.

UNITIII ACCESSCONTROLANDSECURITY 4

Network Access Control: Network Access Control, Extensible Authentication Protocol, IEEE802.1X Port-Based Network Access Control - IP Security - Internet Key Exchange (IKE).Transport-Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security, HTTPS standard, Secure Shell (SSH) application.

UNITIV APPLICATIONLAYERSECURITY 5

Electronic Mail Security: Pretty Good Privacy, S/MIME, DomainKeys Identified Mail. Wireless Network Security: Mobile Device Security

UNITV SECURITYPRACTICES 6

Firewalls and Intrusion Detection Systems: Intrusion Detection Password Management, Firewall Characteristics Types of Firewalls, Firewall Basing, Firewall Location and Configurations. Blockchains, Cloud Security and IoT security

30PERIODS

PRACTICALEXERCISES:

30PERIODS

1. Implementsymmetrickeyalgorithms
2. Implementasymmetrickeyalgorithmsandkeyexchangealgorithms
3. Implementdigitalsignatureschemes
4. InstallationofWireshark,tcpdumpandobservedatatransferredinclient-server communication using UDP/TCP and identify the UDP/TCP datagram.
5. CheckmessageintegrityandconfidentialityusingSSL

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

6. ExperimentEavesdropping,Dictionaryattacks,MITMattacks
7. ExperimentwithSniffTrafficusingARPPoisoning
8. Demonstrateintrusiondetectionsystemusinganytool.
9. Explorenetworkmonitoringtools
10. StudytoconfigureFirewall,VPN

COURSEOUTCOMES:

Attheendofthiscourse,thestudentswillbeable:

CO1: Classifytheencryptiontechniques

CO2: Illustrate the key management technique and authentication.

CO3: Evaluatethesecuritytechniquesappliedtonetworkandtransportlayer

CO4: Discuss the application layer security standards.

CO5: Applysecuritypracticesforrealtimeapplications.

TOTAL:60PERIODS

TEXTBOOKS:

1. CryptographyandNetworkSecurity:PrinciplesandPractice,6thEdition,William Stallings, 2014, Pearson, ISBN 13:9780133354690.

REFERENCES:

1. NetworkSecurity:PrivateCommunicationsinaPublicWorld,M.Speciner,R.Perl man,C. Kaufman, Prentice Hall, 2002.
2. LinuxiptablesPocketReference,GregorN.Purdy,O'Reilly,2004,ISBN-13:978-0596005696.
3. LinuxFirewalls,byMichaelRash,NoStarchPress,October2007,ISBN:978-1-59327-141-1.
4. NetworkSecurity,FirewallsAndVPNs,J.MichaelStewart,Jones&BartlettLearnin g,2013, ISBN-10: 1284031675, ISBN-13: 978-1284031676.
5. TheNetworkSecurityTestLab:AStep-By-StepGuide,MichaelGregg,DreamtechPress, 2015, ISBN-10:8126558148, ISBN-13: 978-8126558148.

22AIDC64H AUGMENTEDREALITY/VIRTUALREALITY LTPC

2023

COURSEOBJECTIVES:

- ToimpartthefundamentalaspectsandprinciplesofAR/VRtechnologies.
- Toknowtheinternalsofthehardwareandsoftwarecomponentsinvolve dinthe development of AR/VR enabled applications.
- Tolearnaboutthegraphicalprocessingunitsandtheirarchitectures.
- TogainknowledgeaboutAR/VRapplicationdevelopment.
- Toknowthetechnologiesinvolvedinthedevelopmentof AR/VRbasedapplications.

UNITI INTRODUCTION 7

Introduction to Virtual Reality and Augmented Reality – Definition – Introduction to Trajectoriesand Hybrid Space-ThreeI'sof VirtualReality – Virtual RealityVs3D ComputerGraphics – Benefits of Virtual Reality – Components of VR System – Introduction to AR-AR Technologies-InputDevices – 3D Position Trackers – Types of Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces – Types of Gesture Input Devices – Output Devices

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENEUERSHIP

– Graphics Display – Human Visual System – Personal Graphics Displays – LargeVolume Displays – Sound Displays – Human Auditory System.

UNITII VRMODELING 6

Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – Kinematics Modeling – Transformation Matrices – Object Position – Transformation Invariants –Object Hierarchies – Viewing the 3D World – Physical Modeling – Collision Detection – Surface Deformation – Force Computation – Force Smoothing and Mapping – Behavior Modeling – Model Management.

UNITIII VRPROGRAMMING 6

VR Programming – Toolkits and Scene Graphs –World ToolKit – Java 3D – Comparison of World ToolKit and Java 3D

UNITIV APPLICATIONS 6

Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society-Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications – Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR inRobotics – Information Visualization – VR in Business – VR in Entertainment – VR in Education.

UNITV AUGMENTEDREALITY 5

Introduction to Augmented Reality-Computer vision for AR-Interaction-Modelling and Annotation- Navigation-Wearable devices

30 PERIODS

PRACTICALEXERCISES:

1. StudyoftoolslikeUnity,Maya,3DSMAX,ARtoolkit,VuforiaandBlender.
2. Usetheprimitiveobjectsandapplyvariousprojectiontypesbyhandlingcamera.
3. Downloadobjectsfromassetstoreandapplyvariouslightingandshadingeffects.
4. Modelthreedimensionalobjectsusingvariousmodellingtechniquesandapplytextures over them.
5. Create three dimensional realistic scenes and develop simple virtual reality enabled mobile applications which have limited interactivity.
6. Addaudioandtextspecialeffectstothedevelopedapplication.
7. DevelopVRenabledapplicationsusingmotiontrackersandsensorsincorporatingfull haptic interactivity.
8. DevelopARenabledapplicationswithinteractivitylikeElearningenvironment,Virtual walkthroughs and visualization of historic places.
9. DevelopARenabledsimpleapplicationslikehumananatomyvisualization,DNA/RNA structure visualization and surgery simulation.
10. DevelopsimpleMRenabledgamingapplications.

COURSEOUTCOMES:

Oncompletionofthecourse,thestudentswillbeableto:

CO1: Understand the basic concepts of AR and VR **CO2:**Understand the tools and technologies related to AR/VR **CO3:**KnowtheworkingprincipleofAR/VRrelatedSensordevices **CO4:**Design of various models

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENEUERSHIP

using modeling techniques **CO5:**Develop AR/VRapplications in different domains**30 PERIODS**

TOTAL:60PERIODS

TEXTBOOKS:

1. CharlesPalmer,JohnWilliamson,“VirtualRealityBlueprints:CreatecompellingVR experiences for mobile”, Packt Publisher, 2018
2. DieterSchmalstieg, Tobias Hollerer, “Augmented Reality:Principles & Practice”, Addison Wesley, 2016
3. JohnVince,“IntroductiontoVirtualReality”,Springer-Verlag,2004.
4. William R. Sherman, Alan B. Craig: Understanding Virtual Reality –Interface, Application, Design”, Morgan Kaufmann, 2003

4. reatetype2virtualizationonESXI6.5server
5. CreateaVLANinCISCOpackettracer
6. InstallKVMinLinux
7. CreateNestedVirtualMachine(VMunderanotherVM)COURSEOUTCOMES:

CO1: AnalysethevirtualizationconceptsandHypervisor **CO2:** Apply the Virtualization for real-world applications **CO3:** Install & Configure the different VM platforms **CO4:** Experiment with the VM with various software

TEXTBOOKS

Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010

1. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011

2. David Marshall, Wade A. Reynolds, Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach

3. Chris Wolf,ErickM.Halter,“Virtualization:FromtheDesktoptotheEnterprise”,APress, 2005.

4. JamesE.Smith,RaviNair,“VirtualMachines:VersatilePlatformsforSystemsand Processes”, Elsevier/Morgan Kaufmann, 2005.

DavidMarshall,WadeA.Reynolds,“AdvancedServerVirtualization:VMwareandMicrosoft Platform in the Virtual Data Center”, Auerbach Publications

221AIDC65B MULTIMEDIA AND ANIMATION LTP C

202 3

COURSEOBJECTIVES:

- TograspthefundamentalknowledgeofMultimediaelementsandsystems
- TogetfamiliarwithMultimediafileformatsandstandards
- TolearntheprocessofAuthoringmultimediapresentations
- Tolearnthetechniquesofanimationin2Dand3DforthemobileUI
- Toexploredifferentpopularapplicationsofmultimedia

UNITI INTRODUCTIONTOMULTIMEDIA 6

Definitions, Elements, Multimedia Hardware and Software, Distributed multimedia systems, challenges: security, sharing / distribution, storage, retrieval, processing, computing. Multimedia metadata, Multimedia databases, Hypermedia, Multimedia Learning.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

UNITII MULTIMEDIAFILEFORMATSANDSTANDARDS 6

File formats – Text, Image file formats, Graphic and animation file formats, Digital audio and Video file formats, Color in image and video, Color Models. Multimedia data and file formats for the web.

UNITIII MULTIMEDIAAUTHORING 6

Authoringmetaphors,ToolsFeaturesand Types:CardandPageBasedTools,IconandObject Based Tools, Time Based Tools, Cross Platform Authoring Tools, Editing Tools, PaintingandDrawingTools,3DModelingandAnimationTools,ImageEditingTools, audioEditingTools,DigitalMovieTools,Creatinginteractivepresentations,virtuallearning, simulations.

UNITIV ANIMATION 6

Principles of animation: staging, squash and stretch, timing, onion skinning, secondary action, 2D, 2 ½ D, and 3D animation, Animation techniques: Keyframe, Morphing, Inverse Kinematics, Hand Drawn, Character rigging, vector animation, stop motion, motion graphics, , Fluid Simulation, skeletal animation, skinning Virtual Reality, Augmented Reality.

UNITV MULTIMEDIAAPPLICATIONS 6

Multimedia Big data computing, social networks, smart phones, surveillance, Analytics, Multimedia Cloud Computing, Multimedia streaming cloud, media on demand, security and forensics, Online social networking, multimedia ontology, Content based retrieval from digital libraries.

30PERIODS

LISTOF EXPERIMENTS:

WorkingwithImageEditingtools:

InstalltoolslikeGIMP/InkScape/Krita/Pencilandperformeditingoperations: ØUse

different selection and transform tools to modify or improve an image

ØCreatelogosandbannersforhomepagesofwebsites.

WorkingwithAudioEditingtools:

ØInstall tools like, Audacity / Ardour for audio editing, sound mixing and special effects like fade- in or fade-out etc.,

ØPerformaudiocompressionbychoosingapropercodec.

WorkingwithVideoEditingandconversiontools:

InstalltoolslikeOpenShot/Cinelerra/HandBrakeforeditingvideocontent. ØEdit

and mix video content, remove noise, create special effects, add captions.

ØCompress and convert video file format to other popular formats.

Workingwithweb/mobileauthoringtools:

Adapt/KompoZer/BlueGriffon/BlueFish/AptanaStudio/NetBeans/WordPress/Expression Web:

ØDesignsimpleHomepagewithbanners,logos,tablesquicklinks etc

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

ØProvide a search interface and simple navigationfrom the homepage to the inside pages of the website.

ØDesignResponsivewebpagesforuseonbothwebandmobileinterfaces.

WorkingwithAnimationtools:

Installtoolslike,Krita,WickEditor,Blender:

ØPerform a simple 2D animation with sprites

ØPerformsimple3Danimationwithkeyframes,kinematics

- WorkingwithMobileUIanimationtools:Origamistudio/Lottie/Frameretc.,

WorkingwithE-Learningauthoringtools:

InstalltoolslikeEdApp/Moovly/CourseLab/IsEazyandCamStudio/Ampache,VideoLAN:

ØDemonstrate screen recording and further editing for e-learning content.

ØCreateasimpleE-Learningmoduleforatopicofyour choice.

CreatingVRandARapplications:

ØAnyaffordableVRviewerlikeGoogleCardboardandanydevelopmentplatformlikeOpenspace 3D / ARCore etc.

Note: all tools listed are open source. Usage of any proprietary tools in place of open source tools is not restricted.

WEBREFERENCES:

1. https://itsfoss.com/
2. https://www.ucl.ac.uk/slade/know/3396
3. https://handbrake.fr/
4. https://opensource.com/article/18/2/open-source-audio-visual-production-tools https://camstudio.org/
5. https://developer.android.com/training/animation/overview
6. https://developer.android.com/training/animation/overview(UNIT-IV)

COURSEOUTCOMES:

- GetthebiggerpictureofthecontextofMultimediaanditsapplications
- Usethedifferenttypesofmediaelementsofdifferentformatsoncontent pages
- Author2Dand3Dcreativeandinteractivepresentationsfordifferenttargetmultimedia applications.
- Usedifferentstandardanimationtechniquesfor2D,21/2D,3Dapplications
- Understandthecomplexityofmultimediaapplicationsinthecontextofcloud,security, bigdata streaming, social networking, CBIR etc.,

TEXTBOOKS:

1. Ze-NianLi,MarkS.Drew,JiangchuanLiu,FundamentalsofMultimedia",ThirdEdition, Springer Texts in Computer Science, 2021. (UNIT-I, II, III)

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENEUERSHIP

REFERENCES:

1. John M Blain, The Complete Guide to Blender Graphics: Computer Modeling & Animation, CRC press, 3rd Edition, 2016.
2. GeraldFriedland,RameshJain,"MultimediaComputing",CambridgeUniversityPress, 2018.
3. Prabhat K.Andleigh, Kiran Thakrar, "Multimedia System Design", Pearson Education, 1stEdition, 2015.
4. MohsenAminiSalehi,XiangboLi,"MultimediaCloudComputingSystems",Springer Nature, 1st Edition, 2021.
5. MarkGaimbruno,"3DGraphicsandAnimation",SecondEdition,NewRiders,2002.
6. Rogers David, "Animation: Master – A Complete Guide (Graphics Series)", Charles River Media, 2006.
7. Rick parent, "Computer Animation: Algorithms and Techniques", Morgan Kauffman, 3rd Edition, 2012.
8. Emilio Rodriguez Martinez, Mireia Alegre Ruiz, "UI Animations with Lottieand After Effects: Create, render, and ship stunning After Effects animations natively on mobile with React Native", Packt Publishing, 2022.

221AIDC65E	**DIGITALMARKETING**	**LTP C**
		2 0 2 3

COURSEOBJECTIVES:

- Theprimaryobjectiveof thismoduleistoexamineandexploretheroleandimportanceof digital marketing in today's rapidly changing business environment.
- Italsofocusesonhowdigitalmarketingcanbeutilizedbyorganizationsandhow itseffectiveness can be measured.

UNITI INTRODUCTIONTOONLINEMARKET 6

Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing.

UNITII SEARCHENGINEOPTIMISATION 6

Search Engine optimisation - Keyword Strategy- SEO Strategy - SEO success factors -On-Page Techniques - Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising -Display Advertisement

UNITIII E-MAILMARKETING 6

E- Mail Marketing - Types of E- Mail Marketing - Email Automation - Lead Generation - Integrating Email with Social Media and Mobile- Measuring and maximizing email campaign effectiveness. MobileMarketing-MobileInventory/channels-Locationbased;Contextbased;Couponsandoffers, Mobile Apps, Mobile Commerce, SMS Campaigns-Profiling and targeting

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENEURSHIP

UNITIV SOCIALMEDIAMARKETING 6

SocialMedia Marketing -SocialMediaChannels-LeveragingSocialmediaforbrandconversations and buzz. Successful /benchmark Social media campaigns. Engagement Marketing- Building Customer relationships - Creating Loyalty drivers - Influencer Marketing.

UNITV DIGITALTRANSFORMATION 6

Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, Social Media, Web Analytics - Changing your strategy based on analysis- Recent trends in Digital marketing.

30PERIODS

PRACTICALEXERCISES: 30PERIODS

1. Subscribe to a weekly/quarterly newsletter and analyze how its content and structure aidwith the branding of the company and how it aids its potential customer segments.

2. Performkeywordsearchforaskincarehospitalwebsitebasedonsearchvolumeand competition using Google keyword planner tool.

3. DemonstratehowtousetheGoogleWebMastersIndexingAPI

4. Discussaninterestingcasestudyregardinghowaninsurancecompanymanagesleads.

5. Discussnegativeandpositiveimpactsand ethicalimplicationsofusingsocialmedia for political advertising.

6. DiscusshowPredictiveanalyticsisimpactingmarketingautomation

COURSEOUTCOMES:

CO1: Toexamineandexploretheroleandimportanceofdigitalmarketingintoday'srapidly changing business environment..

CO2: Tofocusesonhowdigitalmarketingcanbeutilizedby organizationsandhow itseffectiveness can be measured.

CO3: Toknowthekeyelementsof adigitalmarketing strategy.

CO4: Tostudyhowtheeffectivenessofadigitalmarketingcampaigncanbemeasured

CO5: Todemonstrateadvancedpracticalskillsincommondigitalmarketingtoolssuchas SEO, SEM, Social media and Blogs.

TOTAL:60PERIODS

TEXTBOOKS

1. FundamentalsofDigitalMarketingbyPuneetSinghBhatia;Publisher:PearsonEducation;
2. Firstedition(July2017);ISBN-10:933258737X;ISBN-13:978-9332587373.
3. Digital Marketing by Vandana Ahuja ;Publisher: Oxford University Press (April 2015).ISBN-10: 0199455449
4. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler;Publisher: Wiley; 1stedition (April 2017); ISBN10: 9788126566938;ISBN 13: 9788126566938;ASIN: 8126566930.
5. Ryan, D. (2014). Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited..
6. Barker, Barker, BormannandNeher(2017), Social Media Marketing: AStrategic Approach, 2E South-Western ,Cengage Learning.
7. Pulizzi,JBeginner'sGuidetoDigitalMarketing,McgrawHillEducation

221AIDC65H VISUAL EFFECTS LTP C
2 02 3

COURSEOBJECTIVES

- Togetabasicideaonanimationprinciplesandtechniques
- TogetexposuretoCGI,colorandlightelementsofVFX
- Tohaveabetterunderstandingofbasicspecialeffectstechniques
- Tohaveaknowledgeofstateof theart vfxtechniques
- Tobecomefamiliarwithpopularcompositingtechniques

UNITI ANIMATIONBASICS 6

VFX production pipeline, Principles of animation, Techniques: Keyframe, kinematics, Full animation,limitedanimation,Rotoscoping,stopmotion,objectanimation,pixilation,rigging,shape keys, motion paths.

UNITII CGI,COLOR,LIGHT 6

CGI – virtual worlds, Photorealism, physical realism, function realism, 3D Modeling and Rendering:color-Color spaces,colordepth,Colorgrading,coloreffects,HDRI, Light –Areaand mesh lights, image based lights, PBR lights, photometric light, BRDF shading model

UNITIII SPECIALEFFECTS 6

Special Effects –props,scaled models, animatronics, pyrotechniques, Schüfftan process, Particle effects – wind, rain, fog, fire

UNITIV VISUALEFFECTSTECHNIQUES 6

Motion Capture, Matt Painting, Rigging, Front Projection.Rotoscoping, Match Moving – Tracking, camera reconstruction, planar tracking, Calibration, Point Cloud Projection, Ground plane determination, 3D Match Moving

UNITV COMPOSITING 6

Compositing – chroma key, blue screen/green screen, background projection, alpha compositing, deep image compositing, multiple exposure, matting, VFX tools -Blender, Natron, GIMP.

30 PERIODS

LaboratoryExperiments:

Using Natron:

- o UnderstandingNatronEnvironment:
- o Workingwithcolorandusingcolorgrading
- o usingChannels
- o Mergingimages
- o UsingRotopaint
- o performingTrackingandstabilizing
- o Transformingelements
- o Stereoscopiccompositing

Using Blender:

ØMotionTracking –cameraandobjecttracking

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

ØCamera fx, colorgrading, vignettes ØCompositingimagesandvideofiles ØMultilayer rendering

30 PERIODS
TOTAL:60PERIODS

COURSEOUTCOMES

Attheendofthecourse,thestudentwillbeableto:

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

CO1: Toimplementanimationin2D/3Dfollowingtheprinciplesandtechniques
CO2: To use CGI, color and light elements in VFX applications
CO3: To create special effects using any of the state of the art tools
CO4: Toapplypopularvisualeffectstechniquesusingadvancedtools
CO5: TousecompositingtoolsforcreatingVFXforavarietyof applications

TEXTBOOKS:

1. ChrisRoda,RealTimeVisualEffectsfortheTechnicalArtist,CRCPress,1st Edition, 2022.
2. SteveWright,DigitalCompositingforfilmandvideo,Routledge,4th Edition,2017.
3. JohnGress,DigitalVisualEffectsandCompositing,NewRidersPress,1st Edition,2014.

REFERENCES:

1. JonGress,"DigitalVisualEffectsandCompositing",NewRidersPress,1st Edition,2014.
2. Robin Brinkman, The Art and Science of Digital Compositing: Techniques for Visual Effects, Animation and Motion Graphics", Morgan Kauffman, 2008.
3. Luiz Velho, Bruno Madeira, "Introduction to Visual Effects A Computational Approach", Routledge, 2023.
4. JasmineKatatikarn,MichaelTanzillo,"LightingforAnimation:Theartofvisualstorytelling ,Routledge,1st Edition,2016.
5. EranDinur,"TheCompleteguidetoPhotorealism,forVisualEffects,Visualization
6. Jeffrey A. Okun, Susan Zwerman, Christopher McKittrick, " The VES Handbook of Visual Effects: Industry Standard VFX Practices and Procedures", Third Edition, 2020.and Games", Routledge, 1st Edition, 2022.
7. https://www.blender.org/features/vfx/
8. https://natrongithub.github.io/

221AIDC66B ROBOTICPROCESSAUTOMATION LTP C
202 3

COURSEOBJECTIVES:

- TounderstandthebasicconceptsofRoboticProcessAutomation.
- ToexposetothekeyRPAdesignanddevelopmentstrategiesandmethodologies.
- TolearnthefundamentalRPAlogicandstructure.
- ToexploretheExceptionHandling,DebuggingandLoggingoperationsinRPA.
- TolearntodeployandMaintainthesoftwarebot.

UNITI INTRODUCTIONTOROBOTICPROCESS AUTOMATION 6

Emergence of Robotic Process Automation (RPA), Evolution of RPA,Differentiating RPA from Automation - Benefits of RPA - Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools - Templates, User Interface, Domains in Activities, Workflow Files.

UNITII AUTOMATIONPROCESSACTIVITIES 6

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events

UNITIII APPINTEGRATION,RECORDINGANDSCRAPING 6

App Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse and keyboardactionstoperformoperation,ScrapingdatafromwebsiteandwritingtoCSV. ProcessMining.

UNITIV EXCEPTIONHANDLINGANDCODEMANAGEMENT 6

Exception handling, Common exceptions, Logging- Debugging techniques, Collecting crashdumps, Error reporting.Code management and maintenance: Project organization, Nesting workflows, Reusability, Templates, Commenting techniques, State Machine.

UNITV DEPLOYMENTANDMAINTENANCE 6

Publishing using publish utility, Orchestration Server, Control bots, Orchestration Server to deploy bots, License management, Publishing and managing updates.RPAVendors

- OpenSourceRPA,Future ofRPA

30 PERIODS

PRACTICALEXERCISES: 30PERIODS

SetupandConfigureaRPAtoolandunderstandtheuserinterfaceofthetool:

1. CreateaSequencetoobtainuserinputsdisplaythemusingamessage box;
2. CreateaFlowcharttonavigatetoadesiredpagebasedonacondition;
3. CreateaStateMachineworkflowtocompareuserinputwitharandomnumber.
4. BuildaprocessintheRPAplatformusingUIAutomationActivities.
5. CreateanautomationprocessusingkeySystemActivities,VariablesandArguments
6. AlsoimplementAutomationusingSystemTrigger
7. Automateloginto(web)Emailaccount
8. Recordingmouseandkeyboardactions.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENEUERSHIP

9. ScrapingdatafromwebsiteandwritingtoCSV
10. ImplementErrorHandlinginRPAplatform
11. Web Scraping
12. EmailQueryProcessing

TOTAL:60PERIODS

COURSEOUTCOMES:

Bytheendofthiscourse,thestudentswill beableto:

- EnunciatethekeydistinctionsbetweenRPAandexistingautomationtechniques and platforms.
- UseUiPathtodesigncontrolflowsandworkflowsforthetargetprocess
- Implementrecording,webscrapingandprocessminingbyautomation
- UseUIPathStudiotodetect,andhandleexceptionsinautomationprocesses
- ImplementanduseOrchestratorforcreation,monitoring,scheduling,a nd controlling of automated bots and processes.

TEXTBOOKS:

1. Learning Robotic Process Automation: Create Software robots and automate business processeswiththeleadingRPAtool-UiPathbyAlokManiTripathi,Packt Publishing,2018.
2. 2.Tom Taulli , “The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems”, Apress publications, 2020.

REFERENCES:

1. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author),IntroductiontoRobotic Process Automation: aPrimer,InstituteofRoboticProcess Automation, Amazon Asia-Pacific Holdings Private Limited, 2018
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018
3. AGerardusBlokdyk,“RoboticProcessAutomationRpaACompleteGuide“,2020

221AIDC66D CYBERSECURITY LTP C

202 3

COURSEOBJECTIVES:

- Tolearncybercrimeandcyberlaw.
- Tounderstandthecyberattacksandtoolsformitigatingthem.
- Tounderstandinformationgathering.
- Tolearnhowtodetect acyberattack.
- Tolearnhowtopreventacyberattack.

UNITI INTRODUCTION 6

Cyber Security – History of Internet – Impact of Internet – CIA Triad; Reason for Cyber Crime – Need for Cyber Security – History of Cyber Crime; Cybercriminals – Classification of Cybercrimes– A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act –

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

Cybercrime and Punishment.

UNITII ATTACKSANDCOUNTERMEASURES 6

OSWAP; Malicious AttackThreats andVulnerabilities: Scopeof Cyber-Attacks– SecurityBreach – Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineering Attack – Wireless Network Attack – Web Application Attack – Attack Tools – Countermeasures.

UNITIII RECONNAISSANCE 5

Harvester – Whois – Netcraft – Host – Extracting Information from DNS – Extracting Information from E-mail Servers – Social Engineering Reconnaissance; Scanning – Port Scanning – Network Scanning and Vulnerability Scanning – Scanning Methodology – Ping Sweer Techniques – Nmap CommandSwitches –SYN – Stealth–XMAS –NULL –IDLE –FIN Scans –BannerGrabbing and OS Finger printing Techniques.

UNITIV INTRUSIONDETECTION 5

Host -Based Intrusion Detection – Network -Based Intrusion Detection – Distributed or Hybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort.

UNITV INTRUSIONPREVENTION 5

Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy – Types of Firewalls – Firewall Basing – Firewall Location and Configurations – Intrusion Prevention Systems – Example Unified Threat Management Products.

30 PERIODS

PRACTICALEXERCISES: 30PERIODS

1. InstallKaliLinuxonVirtualbox
2. ExploreKaliLinuxandbashscripting
3. PerformopensourceintelligencegatheringusingNetcraft,WhoisLookups ,DNS Reconnaissance, Harvester and Maltego
4. Understandthenmapcommanddandscanatargetusingnmap
5. Installmetasploitable2onthevirtualboxandsearchforunpatchedvulnerabilities
6. UseMetasploittoexploitanunpatchedvulnerability
7. InstallLinusserveronthevirtualboxandinstallssh
8. UseFail2bantoscanlogfilesandbanIpsthatshowthemalicious signs
9. Launchbrute-forceattacksontheLinuxserverusing Hydra.
10. Performreal-timenetworktrafficanalysisanddatapocketloggingusingSnort

COURSEOUTCOMES:

Onsuccessfulcompletionofthiscourse,thestudentwillbeableto

CO1:Explainthebasicsofcybersecurity,cybercrimeandcyberlaw(K2)

CO2:Classifyvarioustypesofattacksandlearnthetoolstolaunchtheattacks(K2)

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

CO3 Applyvarioustoolstoperforminformationgathering(K3)
CO4:Applyintrusiontechniquestodetectintrusion(K3)
CO5:Applyintrusionpreventiontechniquestopreventintrusion(K3)
TOTAL:60PERIODS

TEXTBOOKS

1. AnandShinde,"IntroductiontoCyberSecurityGuidetotheWorldofCyberSecurity", Notion Press, 2021 (Unit 1)
2. NinaGodbole,SunitBelapure,"CyberSecurity:UnderstandingCyberCrimes,Computer Forensics and Legal Perspectives", Wiley Publishers, 2011 (Unit 1)
3. https://owasp.org/www-project-top-ten/

REFERENCES

1. David Kim, Michael G. Solomon, "Fundamentals of Information Systems Security", Jones & Bartlett Learning Publishers, 2013 (Unit 2)
2. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy", Elsevier, 2011 (Unit 3)
3. Kimberly Graves, "CEH Official Certified Ethical hacker Review Guide", Wiley Publishers, 2007 (Unit 3)
4. William Stallings, Lawrie Brown, "Computer Security Principles and Practice", Third Edition, Pearson Education, 2015 (Units 4 and 5)
5. Georgia Weidman, "Penetration Testing: A Hands-On Introduction to Hacking", No Starch Press, 2014 (Lab)

221AIDC66E QUANTUMCOMPUTING LTP C
202 3

COURSEOBJECTIVES:

- Toknowthebackgroundofclassicalcomputingandquantumcomputing.
- Tolearnthefundamentalconceptsbehindquantum computation.
- TostudythedetailsofquantummechanicsanditsrelationtoComputerScience.
- Togainknowledgeaboutthebasichardwareandmathematicalmodelsofquantum computation.
- Tolearnthebasicsofquantuminformationandthetheorybehindit.

UNITI QUANTUMCOMPUTINGBASICCONCEPTS 6

Complex Numbers - Linear Algebra - Matrices and Operators - Global PerspectivesPostulates of Quantum Mechanics – Quantum Bits - Representations of Qubits - Superpositions

UNITII QUANTUMGATESANDCIRCUITS 5

Universallogicgates-Basicsinglequbitgates-Multiplequbitgates-Circuitdevelopment- Quantum error correction

UNITIII QUANTUMALGORITHMS 7

Quantumparallelism-Deutsch'salgorithm-TheDeutsch–Jozsaalgorithm-QuantumFourier transform and its applications - Quantum Search Algorithms: Grover's Algorithm

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

UNITIV QUANTUMINFORMATIONTHEORY 6

Datacompression-Shannon'snoiselesschannelcodingtheorem-Schumacher'squantumnoiseless channel coding theorem - Classical information over noisy quantum channels

UNITV QUANTUMCRYPTOGRAPHY 6

Classicalcryptographybasicconcepts-Private keycryptography-Shor'sFactoringAlgorithm-Quantum Key Distribution - BB84 - Ekart 91

30 PERIODS

PRACTICALEXERCISES 30PERIODS

1. Singlequbitgatesimulation-QuantumComposer
2. Multiplequbitgatesimulation-QuantumComposer
3. Composingsimplequantumcircuitswithq-gatesandmeasuringtheoutputintoclassical bits.
4. IBMQiskitPlatformIntroduction
5. ImplementationofShor'sAlgorithms
6. ImplementationofGrover'sAlgorithm
7. ImplementationofDeutsch'sAlgorithm
8. ImplementationofDeutsch-Jozsa'sAlgorithm
9. IntegerfactorizationusingShor'sAlgorithm
10. QKDSimulation
11. MiniProjectsuchasimplementinganAPIforefficientsearchusingGrover'sAlgorithmsor

COURSEOUTCOMES:

Oncompletionofthecourse,thestudentswillbeableto:

CO1: Understandthebasicsofquantumcomputing.

CO2: UnderstandthebackgroundofQuantumMechanics.

CO3: Analyzethecomputationmodels.

CO4: Modelthecircuitsusingquantumcomputation.

environments and frameworks.

CO5: Understandthequantumoperationssuchasnoiseanderror–correction.

TOTAL:60PERIODS

TEXTBOOKS:

1. Parag K Lala, Mc Graw Hill Education, "Quantum Computing, A Beginners Introduction", First edition (1 November 2020).
2. MichaelA.Nielsen,IssacL.Chuang,"QuantumComputationandQuantumInformation", Tenth Edition, Cambridge University Press, 2010.
3. ChrisBernhardt,TheMITPress;Reprintedition(8September2020),"QuantumComputingfor Everyone".

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

REFERENCES

1. ScottAaronson,“QuantumComputingSinceDemocritus”,CambridgeUniversityPress,2013.
2. N.DavidMermin,“QuantumComputerScience:AnIntroduction”,Cambridge University Press, 2007.

221AIDC66H	3DPRINTINGANDDESIGN	LTP C
		202 3

COURSEOBJECTIVES:

- Todiscussonbasicsof3D printing Toexplaintheprinciplesof3Dprintingtechnique
- Toexplainandillustrateinkjettechnology
- Toexplainandillustratelasertechnology
- Todiscusstheapplicationsof3Dprinting

UNITI INTRODUCTION 6

Introduction;Designconsiderations–Material,Size,Resolution,Process;Modellingand viewing-3D; Scanning; Model preparation – Digital; Slicing; Software; File formats

UNITII PRINCIPLE 6

Processes – Extrusion, Wire, Granular, Lamination, Photopolymerisation; Materials - Paper, Plastics, Metals, Ceramics, Glass, Wood, Fiber, Sand, Biological Tissues, Hydrogels, Graphene; Material Selection - Processes, applications, limitations;

UNITIII INKJETTECHNOLOGY 6

Printer-WorkingPrinciple,PositioningSystem,Printhead,Printbed,Frames,Motioncontrol;Print head Considerations – Continuous Inkjet,Thermal Inkjet, Piezoelectric Drop-On-Demand; Material Formulation for jetting; Liquid based fabrication – Continous jet, Mulitjet; Powder based fabrication – Colourjet.

UNITIV LASERTECHNOLOGY 6

LightSources–Types,Characteristics;Optics–Deflection, Modulation;Materialfeeding andflow – Liquid, powder; Printing machines – Types, Working Principle, Build Platform, Print bed Movement, Support structures;

UNITV INDUSTRIALAPPLICATIONS 6

ProductModels,manufacturing –Printedelectronics,Biopolymers,Packaging,Healthcare,Food, Medical, Biotechnology, Displays; Future trends;

30PERIODS

PRACTICALEXERCISES:

30PERIODS

1. StudytheinterfaceandbasictoolsintheCADsoftware.
2. Study3Dprinter(s)includingprintheads,buildenvelope,materialsusedandrelated support removal system(s).

3. Reviewofgeometrytermsofa3D mesh.
4. Commandsformovingfrom2Dto3D.
5. AdvancedCADcommandstonavigatemodelsin3Dspace
6. Designanyfoureverydayobjects

RefertowebsiteslikeThingiverse, ShapewaysandGitFabtodesignfoureverydayobjectsthat utilize the advantages of 3D printing

. ChoosefourmodelsfromasharingsitelikeThingiverse,ShapewaysorGitfab.

a. Improveuponafileandmakeityourown.Someideasinclude:

- Redesignitwithaspecificuserinmind
- Redesignitforaslightlydifferentpurpose
- Improvethelookoftheproduct

7. UsetheCAMsoftwaretopreparefilesfor3Dprinting.
8. Manipulatemachinemovementandmateriallayering.
9. Repaira3Dmesh using

a) Freewareutilities:AutodeskMeshMixer(http://goo.gl/x5nhYc),MeshLab(http://goo.gl/fgztLl)or Netfabb Basic or Cloud Service (http://goo.gl/Q1P47a)

b) Freewaretooltutorials:NetfabbBasicorCloudService(http://goo.gl/Q1P47a),Netfab band MeshLab (http://goo.gl/WPOVec)

c) Professionaltools:MagicsorNetfabb

Equipment:one3Dprinterforevery10-15 students

COURSEOUTCOMES:

Attheendofthiscourse,thestudentswillbeableto:

CO1: Outlineandexaminethebasicconceptsof3Dprintingtechnology

CO2: Outline3Dprintingworkflow`

CO3 Explainandcategorisetheconceptsandworkingprinciplesof3Dprintingusinginkjet technique

CO4:Explainandcategorisetheworkingprinciplesof3Dprintingusinglasertechnique

CO5: Explainvariousmethodfordesigningandmodelingforindustrialapplications

TOTAL:60PERIODS

TEXTBOOKS

1. ChristopherBarnatt,3DPrinting:TheNextIndustrialRevolution,CreateSpaceIndependent Publishing Platform, 2013.
2. IanM. Hutchings,GrahamD.Martin,InkjetTechnologyforDigitalFabrication, JohnWiley& Sons, 2013.

REFERENCES:

1. Chua,C.K.,LeongK.F.andLimC.S.,Rapidprototyping:Principlesandapplications, second edition, World Scientific Publishers, 2010
2. IbrahimZeid,MasteringCADCAMTataMcGraw-HillPublishingCo.,2007
3. JoanHorvath,Mastering3DPrinting,APress,2014

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

22160E75C INDUSTRIALMANAGEMENT

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COURSEOBJECTIVES

- Tostudythebasicconceptsofmanagement;approachestomanagement;contributorstomanagementstudies;variousformsofbusinessorganizationandtradeunionsfunction in professional organizations.
- Tostudytheplanning;organizingandstaffingfunctionsofmanagementinprofessional organization.
- Tostudytheleading;controllinganddecisionmakingfunctionsofmanagementin professional organization.
- Tolearntheorganizationaltheoryinprofessionalorganization.
- Tolearntheprinciplesofproductivityandmodernconceptsinmanagementinprofessional organization.

UNI T–I INTRODUCTIONTOMANAGEMENT 9

Management: Introduction; Definition and Functions – Approaches to the study of Management – Mintzberg's Ten Managerial Roles – Principles of Taylor; Fayol; Weber; Parker – Forms ofOrganization: Sole Proprietorship;Partnership;Company(PrivateandPublic);Cooperative– PublicSectorVs Private Sector Organization – Business Environment: Economic; Social; Political; Legal – Trade Union: Definition; Functions; Merits & Demerits.

UNIT–II FUNCTIONSOFMANAGEMENT-I **9**

Planning:Characteristics; Nature;Importance; Steps;Limitation; Planning Premises; Strategic Planning; Vision & Mission statement in Planning– Organizing:Organizing Theory; Principles; Types; Departmentalization; Centralization andDecentralization; Authority&Responsibility – Staffing:Systems Approach; Recruiting and Selection Process; Human Resource Development (HRD) Concept and Design.

UNIT–III FUNCTIONSOFMANAGEMENT- II 9

Directing (Leading): Leadership Traits; Style; Morale; Managerial Grids(Blake-Mounton,Reddin)– Communication:Purpose;Model;Barriers– Controlling: Process; Types; Levels; Guidelines; Audit (External, Internal, Merits); Preventive Control – Decision Making: Elements; Characteristics; Nature; Process; Classifications.

UNIT–IV ORGANIZATIONTHEORY 9

Organizational Conflict: Positive Aspects;Individual; Role; Interpersonal; Intra Group; Inter Group;ConflictManagement–Maslow'shierarchyofneedstheory;Herzberg'smotivation-hygiene theory;McClelland'sthreeneedsmotivationtheory;Vroom'svalence-expectancytheory–Change Management: Concept of Change; Lewin'sProcessofChangeModel;SourcesofResistance; Overcoming Resistance; Guidelines to managing Conflict.

UNIT–V PRODUCTIVITYANDMODERNTOPICS 9

Productivity: Concept; Measurements; AffectingFactors; Methods to Improve – Modern Topics

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

(concept, feature/characteristics, procedure, merits and demerits): Business Process Reengineering (BPR); Benchmarking; SWOT/SWOC Analysis; Total Productive Maintenance; Enterprise Resource Planning (ERP); Management of Information Systems (MIS).

TOTAL:45PERIODS

COURSEOUTCOMES:

Attheendofthecoursethestudentswouldbeableto

CO1 Explainbasicconceptsofmanagement;approachestomanagement;contributorsto managementstudies;variousformsofbusinessorganizationandtradeunionsfunctionin professional organizations.

CO2 Discusstheplanning;organizingandstaffingfunctionsofmanagementinprofessional organization.

CO3 Applytheleading;controllinganddecisionmakingfunctionsofmanagementinprofessional organization.

CO4 Discusstheorganizationaltheoryinprofessionalorganization.

CO5 Applyprinciplesofproductivityandmodernconceptsinmanagementinprofessional organization.

TEXTBOOKS:

1. M.GovindarajanandS.Natarajan,“PrinciplesofManagement”,PrenticeHallofIndia,New Delhi, 2009.
2. Koontz.H.andWeihrich.H.,“EssentialsofManagement:AnInternationalPerspective”,8th Edition, Tata McGrawhill, New Delhi, 2010.

REFERENCES:

1. JosephJ,Massie,“EssentialsofManagement”,4thEdition,PearsonEducation,1987.
2. Saxena,P.K.,“PrinciplesofManagement:AModernApproach”,GlobalIndia Publications, 2009.
3. S.Chandran,“OrganizationalBehaviours”,VikasPublishingHousePvt.Ltd.,1994.
4. RichardL.Daft,“OrganizationTheoryandDesign”,SouthWesternCollegePublishing,11th Edition, 2012.
5. S.TrevisCerto,“ModernManagementConceptsandSkills”,PearsonEducation,2018.

22153FE76A	RENEWABLEENERGY SYSTEM	LTP C
		300 3

COURSEOBJECTIVES:

- ToProvideknowledgeaboutvariousrenewableenergytechnologies
- ToenablestudentstounderstandanddesignaPVsystem.
- Toprovideknowledgeaboutwindenergysystem.
- ToProvideknowledgeaboutvariouspossiblehybridenergysystems

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

- Togainknowledgeaboutapplicationofvariousrenewableenergytechnologies

UNITI INTRODUCTION 9

Primary energy sources, renewable vs. non-renewable primary energy sources, renewable energy resources in India, Current usage of renewable energy sources in India, future potential of renewable energy in power production and development of renewable energy technologies.

UNITII SOLARENERGY 9

Solar Radiation and its measurements, Solar Thermal Energy Conversion from plate Solar Collectors, Concentrating Collectors and its Types, Efficiency and performance of collectors,.Direct Solar Electricity Conversion from Photovoltaic, types of solar cells and its application of battery charger, domestic lighting, street lighting, and water pumping, power generation schemes. Recent Advances in PV Applications: Building Integrated PV, Grid Connected PV Systems,

UNITIII WINDENERGY 9

Wind energy principles, wind site and its resource assessment, wind assessment, Factors influencing wind, wind turbine components, wind energy conversion systems (WECS), Classification of WECS devices, wind electric generating and control systems, characteristics and applications.

UNITIVBIO-ENERGY 9

Energy from biomass, Principle of biomass conversion technologies/process and their classification, Bio gas generation, types of biogas plants, selection of site for biogas plant, classification of biogas plants, Advantage and disadvantages of biogas generation, thermal gasification of biomass, biomass gasifies, Application of biomass and biogas plants and their economics.

UNITVOTHERTYPESOFENERGY 9

Energy conversion from Hydrogen and Fuel cells, Geo thermal energy Resources, types of wells, methodsof harnessingthe energy, potential inIndia. OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants and their economics.

TOTAL:45PERIODS

COURSEOUTCOMES:

Attheendofthecoursestudentswillbeableto:

CO1: Attainedknowledgeaboutvariousrenewableenergytechnologies

CO2:AbilitytounderstandanddesignaPVsystem.

CO3:Understandtheconceptofvariouswindenergysystem.

CO4:Gainedknowledgeaboutvariouspossiblehybridenergysystems

CO5: Attainedknowledgeaboutvariousapplicationofrenewableenergytechnologies

REFERENCES

1. Twidell&Wier,'RenewableEnergyResources'CRCPress(Taylor&Francis).
2. TiwariandGhosal/Narosa,'Renewableenergyresources'.
3. D.P.Kothari,K.C.Singhal,'Renewableenergysourcesandemergingtechnologies',P.H.I.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

4. D.S.Chauhan,S.K.Srivastava,'Non–ConventionalEnergyResources',NewAge Publishers, 2006.
5. B.H.Khan,'Non–ConventionalEnergyResources',TataMcGrawHill,2006.

22153FE76B ELECTRICANDHYBRIDVEHICLES LTP C
30 03

COURSEOBJECTIVES:

- The objective of thiscourse is to prepare thestudents toknowabout thegeneral aspects of Electric and Hybrid Vehicles (EHV), including architectures, modelling, sizing, and sub system design and hybrid vehicle control.

UNITI DESIGNCONSIDERATIONSFORELECTRICVEHICLES 9

Need for Electric vehicle- Comparative study of diesel, petrol, hybrid and electric Vehicles. Advantages and Limitations of hybrid and electric Vehicles.- Design requirement for electric vehicles- Range, maximum velocity, acceleration, power requirement, mass of thevehicle. Various Resistance- Transmission efficiency- Electric vehicle chassis and Body Design, Electric Vehicle Recharging and Refuelling Systems.

UNITII ENERGYSOURCES 9

Battery Parameters- - Different types of batteries – Lead Acid- Nickel Metal Hydride - Lithium ion- Sodium based- Metal Air. Battery Modelling - Equivalent circuits, Battery charging- Quick Charging devices. Fuel Cell- Fuel cell Characteristics- Fuel cell types-Half reactions of fuel cell. Ultra capacitors. Battery Management System.

UNITIII MOTORSANDDRIVES 9

Types of Motors- DC motors- AC motors, PMSM motors, BLDC motors, Switched reluctance motors working principle, construction and characteristics.

UNITIV POWERCONVERTERSANDCONTROLLERS 9

Solid state Switching elements and characteristics – BJT,MOSFET, IGBT,SCR and TRIAC - Power Converters – rectifiers, inverters and converters - Motor Drives - DC, AC motor, PMSM motors, BLDC motors, Switched reluctance motors – four quadrant operations –operating modes

UNITV HYBRIDANDELECTRICVEHICLES 9

Main components and working principles of a hybrid and electric vehicles, Different configurations of hybridandelectricvehicles.PowerSplitdevicesforHybridVehicles - Operationmodes-Control Strategiesfor Hybrid Vehicle - Economy of hybrid Vehicles - Case studyon specification of electric and hybrid vehicles.

TOTAL:45PERIODS

COURSEOUTCOMES:

Attheendofthiscourse,thestudentwillbeableto

CO1: Understandtheoperationandarchitectureofelectricandhybridvehicles

CO2: Identifyvariousenergysourceoptionslikebatteryandfuelcell

CO3: Selectsuitableelectricmotorforapplicationsinhybridandelectricvehicles.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

CO4:Explain the role of power electronics in hybrid and electric vehicles
CO5:Analyzetheenergyanddesignrequirementforhybridandelectricvehicles.

TEXTBOOKS:

1. IqbalHusain,“ElectricandHybridVehicles-DesignFundamentals”,CRCPress,2003
2. MehrdadEhsani,“ModernElectric,HybridElectricandFuelCellVehicles”,CRCPress,2005.

REFERENCES:

1. JamesLarminieandJohnLowry,“ElectricVehicleTechnologyExplained“JohnWiley&Sons,2003
2. LinoGuzzella,“VehiclePropulsionSystem”SpringerPublications,2005
3. RonHodKinson,“LightWeightElectric/HybridVehicleDesign”,ButterworthHeinemann Publication,2005.

22154FE77A ADDITIVEMANUFACTURING LTPC
3003

COURSEOBJECTIVES:

- Tointroducethedevelopment,capabilities,applications,ofAdditiveManufacturing(AM), and its business opportunities.
- Tobeacquaintedwithvatpolymerizationandmaterialextrusionprocesses
- Tobefamiliarwithpowderbedfusionandbinderjettingprocesses.
- Togainknowledgeonapplicationsof directenergydeposition,andmaterialjetting processes.
- Toimpartknowledgeonsheetlaminationanddirectwritetechnologies.

UNITI INTRODUCTION 9

Overview - Need - Development of Additive Manufacturing (AM) Technology: Rapid Prototyping- Rapid Tooling - Rapid Manufacturing - Additive Manufacturing. AM Process Chain - ASTM/ISO 52900 Classification - Benefits - AMUnique Capabilities - AMFile formats: STL, AMF Applications: Building Printing, Bio Printing, Food Printing, Electronics Printing, Automobile, Aerospace, Healthcare. Business Opportunities in AM.

UNITII VATPOLYMERIZATIONANDMATERIALEXTRUSION 9

Photo polymerization: Stereolithography Apparatus (SLA)- Materials -Process - top down and bottom up approach - Advantages - Limitations - Applications. Digital Light Processing (DLP) - Process - Advantages - Applications.
Material Extrusion: Fused Deposition Modeling (FDM) - Process-Materials -Applications and Limitations.

UNITIII POWDERBEDFUSIONANDBINDERJETTING 9

PowderBedFusion:SelectiveLaserSintering(SLS):Process-PowderFusionMechanism- Materials andApplication.SelectiveLaserMelting(SLM),ElectronBeamMelting(EBM):Materials -Process-Advantagesand Applications.
13
BinderJetting:Three-DimensionalPrinting-Materials-Process-Benefits-Limitations- Applications.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

UNITIV MATERIALJETTINGANDDIRECTEDENERGYDEPOSITION 9

MaterialJetting:MultijetModeling-Materials-Process-Benefits- Applications.

Directed Energy Deposition: Laser Engineered Net Shaping (LENS) - Process - Material Delivery - Materials -Benefits -Applications.

UNITV SHEETLAMINATIONANDDIRECTWRITETECHNOLOGY 9

Sheet Lamination: Laminated Object Manufacturing (LOM)- Basic Principle- Mechanism: Gluing or Adhesive Bonding - Thermal Bonding - Materials - Application and Limitation. Ink-Based Direct Writing (DW): Nozzle Dispensing Processes, Inkjet Printing Processes, Aerosol DW - Applications of DW.

TOTAL:45PERIODS

COURSEOUTCOMES:

Attheendofthiscoursestudentsshallbeableto:

CO1: RecognizethedevelopmentofAMtechnologyandhowAMtechnologypropagatedinto various businesses and developing opportunities.

CO2: Acquire knowledge on process vat polymerization and material extrusion processes and its applications.

CO3:Elaboratetheprocessandapplicationsofpowderbedfusionandbinderjetting.

CO4:Evaluatetheadvantages,limitations,applicationsofmaterialjettinganddirectedenergy deposition processes.

CO5:Acquireknowledgeonsheetlaminationanddirectwritetechnology.

TEXTBOOKS:

1. IanGibson,DavidRosen,BrentStucker,MahyarKhorasani"Additivemanufacturingtechnologies". 3rd edition Springer Cham, Switzerland. (2021). ISBN: 978-3-030-56126-0
2. Andreas Gebhardt and Jan-SteffenHötter "Additive Manufacturing: 3DPrintingfor Prototyping and Manufacturing", Hanser publications, United States, 2015, ISBN: 978-1-56990-582-

REFERENCES:

1. Andreas Gebhardt,"Understanding Additive Manufacturing: Rapid Prototyping,
2. Rapid Manufacturing", Hanser Gardner Publication, Cincinnati., Ohio, 2011, ISBN :9783446425521.
3. Milan Brandt, "Laser Additive Manufacturing: Materials, Design, Technologies,
4. and Applications", Woodhead Publishing., United Kingdom, 2016, ISBN: 9780081004333.
5. AmitBandyopadhyay andSusmitaBose,"AdditiveManufacturing",1st Edition,CRCPress., United States, 2015, ISBN-13: 978-1482223590.
6. KamraniA.K.andNasrE.A.,"RapidPrototyping:Theoryandpractice",Springer.,UnitedStates ,2006,ISBN:978-1-4614-9842-1.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

7. Liou,L.W.andLiou,F.W.,“RapidPrototypingandEngineeringapplications:Atoolboxf or prototype development”, CRC Press., United States, 2011,

22152FE77A ELECTRICAL,ELECTRONICANDMAGNETICMATERIALS LTP C

300 3

COURSEOBJECTIVES:

Themainlearningobjectiveofthiscourseistopreparethestudentsfor:

- Understandingtheimportanceofvariousmaterialsusedinelectrical,electronics and
- magneticapplications
- Acquiringknowledgeonthepropertiesofelectrical,electronicsandmagneticmaterials.
- Gainingknowledgeontheselectionofsuitablematerialsforthegivenapplication
- KnowingthefundamentalconceptsinSemiconductingmaterials
- Gettingequippedwiththematerialsusedinopticalandoptoelectronicapplications.

UNITI DIELECTRICMATERIALS 9

Dielectric asElectric Field Medium, leakagecurrents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, flashover, liquid dielectrics, electric conductivity in solid, liquid and gaseous dielectrics, Ferromagnetic materials, properties of ferromagnetic materials in static fields, spontaneous, polarization, curie point, anti-ferromagnetic materials, piezoelectric materials, pyroelectric materials.

UNITII MAGNETICMATERIALS 9

Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, magnetic Anisotropy, Magnetostriction, diamagnetism, magnetically soft and hard materials,special purpose materials, feebly magnetic materials, Ferrites, cast and cermet permanent magnets, ageing of magnets. Factors effecting permeability and Hysteresis

UNITIII SEMICONDUCTORMATERIALS 9

Properties of semiconductors, Silicon wafers, integration techniques, Large and very large scale Integration techniques. Concept of superconductivity; theories and examples for high temperature superconductivity; discussion on specific superconducting materials; comments on fabrication and engineering applications.

UNITIV MATERIALSFORELECTRICALAPPLICATIONS 9

Materials used for Resistors, rheostats, heaters, transmission line structures, stranded conductors, bimetals fuses, soft and hard solders, electric contact materials, electric carbon materials, thermocouple materials. Solid, Liquid and Gaseous insulating materials, Effect of moisture on insulation.

UNITV OPTICALANDOPTOELECTRONICMATERIALS 9

Principles of photoconductivity - effect of impurities - principles of luminescence-laser principles - He-Ne, injection lasers, LED materials - binary, ternary photoelectronic materials - LCD materials - photo detectors - applications of optoelectronic materials - optical fibres and materials

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

- electro optic modulators - Kerr effect - Pockels effect.

TOTAL:45PERIODS

COURSEOUTCOMES:

Aftercompletionofthiscourse,thestudentswillbeableto

CO1: Understandvarioustypesofdielectricmaterials,theirpropertiesinvariousconditions.

CO2:Evaluatemagneticmaterialsandtheirbehavior.

CO3:Evaluate semiconductor materials and technologies.

CO4:Selectsuitablematerialsforelectricalengineeringapplications.

CO5: Identifyrightmaterialforopticalandoptoelectronicapplications

TEXTBOOKS:

1. PradeepFulay,“Electronic,MagneticandOpticalmaterials”,CRCPress,taylorandFrancis,2 nd illustrated edition, 2017.
2. “RKRajput”,“AcourseinElectricalEngineeringMaterials”,LaxmiPublications,2009.

REFERENCEBOOKS:

1. TKBasak,“AcourseinElectricalEngineeringMaterials”,NewAgeSciencePublications, 2009
2. TTTIMadras,“ElectricalEngineeringMaterials”,McGrawHillEducation,2004.
3. AdrianusJ.Dekker,“ElectricalEngineeringMaterials”,PHIPublication,2006.
4. S.P.Seth,P.V.Gupta“AcourseinElectricalEngineeringMaterials”,DhanpatRai& Sons, 2011.
5. C. Kittel,“IntroductiontoSolidStatePhysics”,7thEdition,
6.
7. JohnWiley&Sons,Singapore, (2006).

22153FE77A SENSORS LTPC 3 003

COURSEOBJECTIVES:

- To learn the various types of sensors, transducers, sensor output signal types, calibration techniques, formulation of system equation and its characteristics.
- Tounderstandbasicworkingprinciple,construction,Applicationandcharacteristicsof displacement, speed and ranging sensors.
- To understand and analyze the working principle, construction, application and characteristics of force, magnetic and heading sensors.
- To learn and analyze the working principle, construction, application and characteristics of optical, pressure, temperature and other sensors.
- To familiarize students with different signal conditioning circuits design anddata acquisition system.

UNITI SENSORCLASSIFICATION,CHARACTERISTICSANDSIGNALTYPES 9

Basics of Measurement – Classification of Errors – Error Analysis – Static and Dynamic Characteristics of Transducers – Performance Measures of Sensors – Classification of Sensors – Sensor Calibration Techniques – Sensor Outputs - Signal Types - Analog and Digital Signals,PWM and PPM.

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

UNITII DISPLACEMENT,PROXIMITYANDRANGINGSENSORS 9

Displacement Sensors – Brush Encoders - Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer – Range Sensors - Ultrasonic Ranging - Reflective Beacons - Laser Range Sensor (LIDAR) – GPS - RF Beacons.

UNITIII FORCE,MAGNETICANDHEADINGSENSORS 9

Strain Gage – Types, Working, Advantage, Limitation, and Applications: Load Measurement – Force and Torque Measurement - Magnetic Sensors – Types, Principle, Advantage, Limitation,and Applications - Magneto Resistive – Hall Effect, Eddy Current Sensor - Heading Sensors – Compass, Gyroscope and Inclinometers.

UNITIV OPTICAL,PRESSURE,TEMPERATUREANDOTHERSENSORS 9

Photo Conductive Cell, Photo Voltaic, Photo Resistive, LDR – Fiber Optic Sensors – Pressure – Diaphragm – Bellows - Piezoelectric - Piezo-resistive - Acoustic, Temperature – IC, Thermistor, RTD,Thermocouple–NonContactSensor-ChemicalSensors-MEMSSensors-Smart Sensors.

UNITV SIGNALCONDITIONING 9

Need for Signal Conditioning – Resistive, Inductive and Capacitive Bridges for Measurement - DC and AC Signal Conditioning - Voltage, Current, Power and Instrumentation Amplifiers – Filter and Isolation Circuits – Fundamentals of Data Acquisition System

TOTAL:45PERIODS

COURSEOUTCOMES

Uponsuccessfulcompletionofthecourse,studentsshouldbeableto:

CO1:Understandvarioussensoreffects,sensorcharacteristics,signaltypes,calibration methodsandobtaintransferfunctionandempiricalrelationofsensors.Theycanalso analyze the densor response.

CO2: Analyze and select suitable sensor for displacement, proximity and range measurement.

CO3:Analyzeandselectsuitablesensorforforce,magneticfield,speed,positionanddirection measurement.

CO4:AnalyzeandSelectsuitablesensorforlightdetection,pressureandtemperature measurement and also familiar with other miniaturized smart sensors.

CO5:Selectanddesignsuitablesignalconditioningcircuitwithpropercompensationand linearizing element based on sensor output signal.

22154FE77B INDUSTRIAL SAFETY

LTPC
3003

COURSEOBJECTIVES:

- To educate about the health hazards and the safety measures to be followed in the industrial environment.
- Describeindustriallegislations(FactoriesActs,Workmen'sCompensationandotherlaws) enacted for the protection of employees health at work settings

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENUEURSHIP

- Describemethodsofpreventionandcontrolof OccupationalHealthdiseases,accidents / emergencies and other hazards

UNITI INTRODUCTION 9

Need for developing Environment, Health and Safety systems in work places - Accident Case Studies - Status and relationship of Acts - Regulations and Codes of Practice - Role of trade union safety representatives. International initiatives - Ergonomics and work place.

UNITII OCCUPATIONALHEALTHANDHYGIENE 9

Definition of the term occupational health and hygiene - Categories of health hazards - Exposure pathways and human responses to hazardous and toxic substances - Advantages and limitationsof environmental monitoring and occupational exposure limits - Hierarchy of control measures for occupationalhealthrisks - Roleof personalprotective equipment andtheselection criteria- Effects on humans - control methods and reduction strategies for noise, radiation and excessive stress.

UNITIII WORKPLACESAFETYANDSAFETYSYSTEMS 9

Features of Satisfactory and Safe design of work premises – good housekeeping - lighting and colour, Ventilation and Heat Control – Electrical Safety – Fire Safety – Safe Systems of work for manual handling operations – Machine guarding – Working at different levels – Process and System Safety.

UNITIV HAZARDSANDRISKMANAGEMENT 9

Safetyappraisal-analysisandcontroltechniques–plantsafetyinspection–Accidentinvestigation - Analysis and Reporting – Hazard and Risk Management Techniques – major accident hazard control – Onsite and Offsite emergency Plans.

UNITV ENVIRONMENTALHEALTHANDSAFETYMANAGEMENT 9

Concept of Environmental Health and Safety Management – Elements of Environmental HealthandSafetyManagementPolicyandmethodsof itseffectiveimplementationand review– Elements of Management Principles – Education and Training – Employee Participation.

TOTAL:45PERIODS

COURSEOUTCOMES:

Aftercompletionofthiscourse,thestudentisexpectedtobeable to:

CO1: Describe,withexample,thecommonwork-relateddiseasesandaccidentsinoccupational setting

CO2: NameessentialmembersoftheOccupationalHealthteam

CO3: What rolescanacommunityhealthpractitionersplayinanOccupationalsetting toensurethe protection, promotion and maintenance of the health of the employee

SKILL DEVELOPMENT **EMPLOYABILITY** ENTREPRENEUERSHIP

1.1.3 Total number of courses having focus on employability/ entrepreneurship/ skill development offered by the University during the year

PRIST
DEEMED TO BE
UNIVERSITY
NAAC ACCREDITED
THANJAVUR – 613 403 - TAMIL NADU

SCHOOL OF ARTS AND SCIENCE

Department of Microbiology

B.Sc. Microbiology Syllabus

[Regulation 2022]

Skill development	
Employability	
Entrepreneurship	
Employability/Entrepreneurship/Skill development	

School of Arts and Science

Department of Microbiology

B. Sc., Syllabus-Regulation 2022

Bachelor of Science in Microbiology

Our curriculum is intended to educate our majors in a diversity of significant microbiological disciplines, as well as to inspire and improve Language and communicative skills and capabilities that take persistent value beyond the teaching space.

B. Sc Graduate Attributes

- Research, inquiry and analytical thinking abilities.
- Capability and motivation for intellectual development.
- Ethical, social and professional understanding.
- Communication in intra and inter disciplinary
- Teamwork, collaborative and management skills in scientific research
- Information literacy in respective discipline

Educational Objectives-PEO

- PEO1-To gain and apply knowledge of microorganisms concept to solve the problems.
- PEO2-To identify, analyze and understand the problems related to microbes.
- PEO3-Ability to design and develop solutions to the environment using the microbes.
- PEO4-Ability to design performs experiments, analyze, and interpret data for investigating complex problems.
- PEO5-To decide and apply appropriate tools and techniques for manipulations.

Programme Specific Outcomes (PSOs)

- PSO –Expose input practical skills/competencies in working through microbes for study and use in the laboratory as well as outside, with the use of good microbiological practices.
- PSO – obtain information and understanding of the microbiology perception as appropriate to various areas such as medical, industrial, environment, genetics, agriculture, food and others.
- PSO- proficient enough to use microbiology knowledge and skills to study problems involving microbes, clear these with peers/ team members/ other stakeholders, and undertake remedial measures/ studies etc.
- PSO - Developed a broader standpoint of the regulation of Microbiology to facilitate

individual to identify challenging societal troubles and plan them professional career to build up novel decision for such problems

B. Sc Programme Outcome-PO

- PO1-Vital Thinking: Able to acquire knowledgeable actions and give the impression of being at our thoughts and assessments (academic, organizational and individual) from diverse perception.
- PO2-Precious communication: Able to speak, read, write and listen noticeably in person and throughout electronic media in English and in one Indian language and build meaning of the globe by connecting people, thoughts books, media and technology.
- PO3-Effectual citizenship: Able to reveal empathetic social concern and fairness centred national progress and the capability to act with and take part in civic life through volunteering
- PO4- Ethics: Be aware of diverse value systems including the individual, under the ethical dimensions of personal choice, and believe responsibility for them.
- PO5- Environment and Sustainability: Able to analyze the importance of microbes for environmental clean-up and sustainable development.
- PO6- Self directed and life-long learning: Able to gain the talent to employ in self-determining and life-long learning in the broadest circumstance socio technological transforms.
- PO7- Economic liberty and employability potential: Attain the ability to be concerned in economically sustainable opening and pound entrepreneurial skill.

SCHOOL OF ARTS AND SCIENCE
DEPARTMENT OF MICROBIOLOGY

B. Sc., MICROBIOLOGY
REGULATION 2022
COURSE STRUCTURE

SEMESTER I					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
THEORY					
22110AEC11/ 22111AEC11/ 22132AEC11/ 22135AEC11	Language-I (Tamil-I/ Advanced English-I/ Hindi-I/ French-I	4	0	0	2
22111AEC12	English-I	4	0	0	2
22116AEC13	Fundamentals of Microbiology	6	1	0	5
22115AEC14B	Bio Chemistry I	6	1	0	4
PRACTICAL					
22116AEC15L	Fundamentals of Microbiology Lab	0	0	3	2
22115AEC16BL	Bio Chemistry I Lab	0	0	3	2
AUDIT COURSE					
221ACLSICN	Indian Constitution	-	-	-	2
221ACLSUHV	Universal Human Values	-	-	-	**2**
	Total	**20**	**2**	**6**	**17**
SEMESTER – II					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
THEORY					
22110AEC21/ 22111AEC21/ 22132AEC21/ 22135AEC21	Language-II (Tamil-II/ Advanced English-II / Hindi-II/ French-II)	4	0	0	2
22111AEC22	English-II	4	0	0	2
22116AEC23	Microbial Physiology	6	1	0	5
22115AEC24	Bio Chemistry II	6	1	0	4
PRACTICAL					
22116AEC25L	Microbial Physiology Lab	0	0	3	2
22115AEC26L	Bio Chemistry II Lab	0	0	3	2
RESEARCH SKILL BASED COURSE					
22116RLC27	Research Led Seminar	-	-	-	1
AUDIT COURSES					
221ACLSCOS	Communication Skills	-	-	-	**2**

221ACSSBBE	Basic Behavioral Etiquette	-	-	-	**2**
	Total	**20**	**2**	**6**	**18**
SEMESTER – III					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
THEORY					
22110AEC31/ 22111AEC31/ 22132AEC31/ 22135AEC31	Language-III (Tamil-III/ Advanced English-III / Hindi-III/ French-III)	4	0	0	2
22111AEC32	English-III	4	0	0	2
22116AEC33	Immunology	4	1	0	4
22116AEC34	Cell Biology	4	1	0	5
PRACTICAL					
22116AEC35L	Immunology Lab	0	0	3	2
22116AEC36L	Cell Biology Lab	0	0	3	2
	RESEARCH SKILL BASED COURSE				
22116RMC37	Research Methodology	2	0	0	2
	AUDIT COURSE				
221ACLSOAN	Office Automation	-	-	-	**2**
	Total	**18**	**2**	**6**	**19**
SEMESTER – IV					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
THEORY					
22110AEC41/ 22111AEC41/ 22132AEC41/ 22135AEC41	Language-IV (Tamil-IV/ Advanced English-IV/ Hindi-IV/ French-IV)	4	0	0	2
22111AEC42	English-IV	4	0	0	2
22116AEC43	Virology	4	1	0	4
22116AEC44	Biostatistics and Bioinformatics	5	1	0	5
221ENSTU45	Environmental studies	2	0	0	2
PRACTICAL					
22116AEC46L	Virology Lab	0	0	3	2
22116AEC47L	Biostatistics and Bioinformatics Lab	0	0	3	2
	Total	**19**	**2**	**6**	**19**
AUDIT COURSE					
221ACLSLMS	Leadership and Management Skills	-	-	-	**2**
221ACSSAQA	General Aptitude and Quantitative Ability	-	-	-	**2**
SEMESTER – V					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
THEORY					
22116AEC51	Food and Dairy Microbiology	4	1	0	4
22116AEC52	Molecular Biology	4	1	0	3
22116AEC53	Agricultural and Environmental Microbiology	4	1	0	4
22116DSC54__	Discipline Specific Elective -I	4	1	0	3
PRACTICAL					

22116AEC55L	Food and Dairy Microbiology and Molecular Biology Lab	0	0	3	2
22116AEC56L	Agricultural and Environmental Microbiology Lab	0	0	3	2
RESEARCH SKILL BASED COURSE					
22116BRC57	Participation in Bounded Research	-	-	-	1
AUDIT COURSE					
221ACLSPSL	Professional Skills	-	-	-	**2**
	Total	**16**	**4**	**6**	**19**
SEMESTER – VI					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
THEORY					
22116AEC61	Industrial Microbiology	4	1	0	4
22116SEC62	Clinical Microbiology	4	1	0	5
22116DSC63_	Discipline Specific Elective - II	4	1	0	3
221—OEC (2 DIGIT COURSE Name)	Open Elective	4	0	0	2
PRACTICAL					
22116AEC64L	Industrial Microbiology Lab	0	0	3	2
22116SEC65L	Clinical Microbiology Lab	0	0	3	2
22116PRW66	Project Work	-	-	-	4
22116PROEE	Program Exit Examination	-	-	-	1
AUDIT COURSE					
221ACSSIST	Interview Skills Training and Mock Test	-	-	-	**2**
221ACLSCET	Community Engagement	-	-	-	**1**
	Total	**16**	**3**	**6**	**23**
Total Credits -Programme					**115**
Total Credits - Audit Courses					**19**

Discipline Specific Electives

Semester	**Discipline Specific Elective Courses-I**
V	a) 22116DSC54A – Bioinoculants b) 22116DSC54B –Bioremediation practices c) 22116DSC54C- Advanced immunology d)22116DSC54D- Genomics and proteomics
	Discipline Specific Elective Courses-I
VI	a) 22116DSC63A - Bioethics b) 22116DSC63B – Biomolecules c) 22116DSC63C – Medical Microbiology d)22116DSC64D – Bacterial Genetics

Open Electives

Semester	Open Elective Courses
VI	a) 221TNOEC-Tamil Ilakkiya Varalaru b) 221ENOEC-Journalism c) 221MAOEC-Development of Mathematical Skills d) 221PHOEC-Instrumentation e) 221CEOEC-Food and Adulteration f) 221CSOEC – E-Learning g) 221CAOEC-Web Technology h) 221CMOEC-Banking service

Credit Distribution

Sem	AEC	SEC	DSC	OEC	Research	Others	Total
I	17	-	-	-	-	-	17
II	17	-	-	-	1	-	18
III	17	-	-	-	2	-	19
IV	17	-	-	-	-	2	19
V	15	-	3	-	1	-	19
VI	6	7	3	2	4	1	23
Total	**89**	**7**	**6**	**2**	**8**	**3**	**115**

SEMESTER I

Course Code	Course Title	L	T	P	C
22110AEC11	Tamil-I	4	0	0	2

பிரிஸ்ட் நிகர்நிலைப் பல்கலைக்கழகம்- வல்லம், தஞ்சாவூர்

பாட குறியாடு :

தமிழ் முதல் பருவம்

முதலாம் ஆண்டு

இக்கால இலக்கியம் - செய்யுள், சிறுகதை , நாடகம், இலக்கிய வரலாறு

அலகு : 1.செய்யுள்

1. தாயுமானவ சுவாமிகள் - ஆதார புவனம் - சிதம்பர ரகசியம் - 40 அடிகள்

2. இராமலிங்க அடிகள் - திருவருட்பா - கருணை விண்ணப்பம் - 40 அடிகள்

3. கவிமணி தேசிக விநாயகம் பிள்ளை - மலரும் மாலையும் - 52 அடிகள்

4. பாரதியார் - புதுமைப்பெண் - 40 அடிகள்

5. பாரதிதாசன் - பாரதிதாசன் கவிதைகள் ,தமிழ் இனிமை , தமிழ் உணவு

அலகு : 2. செய்யுள்:

6 . நாமக்கல் கவிஞர் - தமிழ் தேன் - தமிழ் வளர்க்க சபதம் செய்வோம் , 40 அடிகள்

7. ந.பிச்சமூர்த்தி - வழித்துணை - கவிதை கருடன் , 42 அடிகள்

8.சுரதா - தேன்மழை, கலப்பை , 22 அடிகள்

9. கண்ணதாசன் - இலக்கியம் , ஒரு பானையின் கதை , 54 அடிகள்

10. அப்துல் ரகுமான் - சொந்த சிறகுகள், குப்பையை கிளறும் சிறகுகள், 80 அடிகள்

அலகு : 3. சிறுகதை :

11. சு.சமுத்திரம் - வேரில் பழுத்த பலா

அலகு : 4. நாடகம் :

12. கு. வெ. பாலசுப்பிரமணியன் , கௌதம புத்தர் (உரைநடை நாடகம்)

அலகு : 5. இலக்கிய வரலாறு

13. சிறுகதை , புதினம், நாடகம் உரைநடை , கவிதை , புதுக்கவிதை

Course Code	Course Title	L	T	P	C
22111AEC11	Advanced English-I	4	0	0	2

Aim:
- To improve the knowledge of English

Objective:
- To familiarize with the glossary terms, figures of speech
- To enhance vocabulary
- To learn how to edit and proof read
- To know the comparison and contrast and cause and effect forms
- To understand the impact of the speeches of famous people

Outcome:
- Develop vocabulary
- Learn to edit and do proof reading
- Read and comprehend literature

UNIT –I
Glossary of grammar terms
Figures of speech
UNIT – II
Foreign words and phrases
British and American Vocabulary
UNIT – III
Comparison and contrast
Cause and effect
UNIT – IV
Editing
Proof reading
UNIT – V
Speeches of famous people:
Mahatma Gandhi-Abraham Lincoln-Swami Vivekananda-John F. Kennedy

Reference book:

Author	Title of the book	Edition / Year	Publisher
Wren and Martin	English Grammar	2009	S.Chand & Company Ltd
Meenakshi Raman & Sangeetha Sharma	Technical Communication	Second Edition 2011	Oxford University Press
Sudhir Kumar Sharma	The World's Great Speeches	-	Galaxy Publishers

Course Code	Course Title	L	T	P	C
22111AEC12	English-I	4	0	0	2

Aim:

- To acquaint with learning English through literature

Objective:

- To improve English delightfully through simple poems, essays
- To throw light on fiction
- To read and comprehend literature

Outcome:

- Read and comprehend literature
- Appreciate the different types of poetry and prose

UNIT –I

Because I could not Stop for Death -Emily Dickinson

Stopping by Woods on a Snowy Evening -Robert Frost

UNIT – II

Enterprise -Nissim Ezekiel

Love poem for a wife -A.K Ramanujam

UNIT –III

The Art of Reading - Lin Yutang

An Eco-Feminist Vision -Aruna Gnanadason

UNIT –IV

The Merchant of Death -Nanda Kishore Mishra & John Kennet

She Spoke for all Nature -Young world 'The Hindu'

UNIT –V

Oliver Twist -Charles Dickens

Text book:

Author	Title of the book	Edition / Year	Publisher
S.Murugesan/ Dr.K.Chellappan	The Art of Reading/ Experiencing Poetry	Reprint 2004	Emerald Publishers

Course Code	Course Title	L	T	P	C
22116AEC13	Fundamentals of Microbiology	6	1	0	5

Aim

- To impart the basic principles and applications of microorganism

Objectives

- To provide a essential informations of microorganism for progressive and applied reforms in biological sciences for human welfare

Out Comes

CO1 – To Describe the characteristics of microorganisms and classification

CO2 – To Understand the concepts of growth and reproduction of microbes

CO3 – To explain the beneficial and detrimental effects of microorganisms

CO4 - To Gather theoretical background of microbial cultivation

Unit – I

Introduction – definition, scope and history of microbiology, differences between the prokaryotic and eukaryotic microorganisms. Classification of microorganisms – general principles and nomenclature – Haeckel's three kingdom concept, Whittaker's five kingdom concept – Classification and characterization of bacteria according to Bergey's manual of Systematic Bacteriology. Basic understanding of classification of viruses, algae, fungi and protozoa.

Unit – II

Microscopy: Principles and application of simple, compound, bright field, dark field, phase contrast, fluorescent and Electron microscopy. Principles of staining: Nature of dyes, types of staining – simple, differential, negative and spore staining. Sterilization: Principles and methods – physical and chemical.

Unit – III

General characteristics and nature of archacbacteria, Eubacteria, Cyanobacteria, Ricketsiae, Chlamydiae, Spirochaetes, Actinomycetes, Protozoa, Viruses including phages, Mycoplasmas, Algae and fungi.

Unit – IV

Microbial Cell: Ultrastructure of bacteria, subcellular structures and cell envelope – slime, capsule, cell wall, pili, flagella, cell inclusions, biosynthesis of bacterial cell wall, cell membrane – Biomembrane, liposomes – membrane transport – diffusion, active and passive transport and osmoregulation

Unit – V

Culture techniques: types of media simple, defined, enriched and transport media with specific examples for each type. Methods of maintenance and preservation of cultures

Text book:

S. No	Author Name	Title of the Book	Edition/year	Publisher
1.	Jr. M.J. Pelczar, E.C.S. Chan and N.R. Kreig.	Microbiology	5^{th} /1993	Tata McGraw-Hill, Inc, Newyork

Reference Book:

1. Stainer R.Y., Ingraham J.L. Wheelia M.L. and Painter P.R. (1986). General Microbiology, Macmillan Education Ltd, London.
2. Fundamental of Microbiology (2005) By Purohit, Agrobios Publishers, Meerut

Course Code	Course Title	L	T	P	C
22115AEC14B	Bio Chemistry I	6	1	0	4

Aim

- To provide the basics of biochemistry and its application.

Objectives

- It serves as good research techniques and the ability to combine and analyzeinformation.

Outcomes

CO1 – To Develop fundamental knowledge about various biomolecules

CO2 - To Understand the basic concepts related to enzymes

CO3 - To Know various biochemical pathway

CO4 - To Understand the concept of microbial metabolism.

Unit I

Carbohydrates: Definition, Classification and Properties; Structural Elucidation of Glucose and fructose; Biological Functions of Glucose, fructose, starch, Cellulose, Chitin and Heparin.

Unit II

Amino acids: Structure, Classification, Properties.

Peptides: Amides and Peptides, Peptide bond, Peptide synthesis, Biologically important Peptides.

Proteins: Biological importance, Classification, properties; Structural orders; Protein stability; Separation and purification of proteins.

Unit III

Nucleotides and Polynucleotides; Terminology –Components.DNA and RNA – Composition, Structure, their biological importance.

Unit IV

Lipids: Biological Significance, Classification of lipids. Analysis of oils – Iodine Number, Saponification Value, Acid number, Acetyl value and Reichert-Meisel value; Qualitative Tests for Lipids.

Unit V

Vitamins: Source, Structure of Biological Role requirement, deficiency manifestation of fat soluble (A, D, E and K) and water soluble (B complexes and C) vitamins.

References:

1. Fundamentals of Biochemistry – O.P.Agarwal
2. Essentials of Biochemistry – M.C.Pant
3. Essentials of Biochemistry – A.J.Jain
4. Principles of Biochemistry – Lehninger.
5. Text book of Biochemistry – West & Todd.
6. Harper's Biochemistry , 25th edn., McGraw Hill.

Course Code	**Course Title**	**L**	**T**	**P**	**C**
22116AEC15L	Fundamentals of Microbiology Lab	0	0	3	2

Aim

- To understand the basic principles of Microbiology laboratory.

Objectives

- Microbiology laboratory guidelines and necessary equipment
- Isolation methods for microorganisms.
- Various staining techniques for the observation of microbes.

Outcomes

CO1 – To Develop basic skills in aseptic techniques formicrobiology practical.

CO2 – To gain Hands on experience in handling ofvarious important instruments.

CO3 - Able to perform basic experiments to grow and study microorganism in laboratory

CO4 - To Develop knowledge on identification of microorganisms.

1 Microscope and its operation
2 Cleaning of glassware's and sterilization methods – autoclaving and hot air oven
3 Preparation of culture media
4 Experimental demonstration of ubiquitous nature of microorganisms.
5 Quantitative estimation of microorganisms**.**
6 Observation of permanent slides to study the structural characteristics of algae**(***Anabaena, Nostoc, Scytonema, Spirulina, Oscillatoria,)* Fungi (*Pythium*, *Rhizopus*, Saccharomyces, Penicillium, Aspergillus, Agricus) and protozoa (*Entamoeba hystolytica* and *Plasmodium* Spp*)*
7 Isolation of microorganisms from soil, water and air.
8 Test for motility of bacteria – Hanging drop method and semi solid media inoculation
9 Staining techniques – simple staining. Gram's staining, Spore staining, Capsular staining

Course Code	Course Title	L	T	P	C
22115AEC16BL	Bio Chemistry I Lab	0	0	3	2

Aim

- To make students familiar with practical techniques used for studying biochemical structure and analysis of biochemical methods.

Objectives

- To familiarize the students with the basic cellular processes at molecular level

Outcomes

CO1 - To gain Practical knowledge about various techniques used in Biochemistry

CO2 - To Exhibit the well practical knowledge about estimation of carbohydrates, protein.

CO3 – To Learn the quantitative and qualitative estimation biochemical analysis.

1. Qualitative Analysis of Carbohydrate.
2. Qualitative Analysis of Proteins.
3. Colour Reactions for Amino Acids.

Course Code	Course Title	L	T	P	C
221ACLSICN	Indian Constitition	-	-	-	2

Objectives:

1. To make the students understand about the democratic rule and parliamentarian administration
2. To appreciate the salient features of the Indian constitution
3.To know the fundamental rights and constitutional remedies
4. To make familiar with powers and positions of the union executive,union parliament and the supreme court

To exercise the adult franchise of voting and appreciate the electoral system of Indian democracy.

Outcome

CO1- To gain Democratic values and citizenship Training

CO2- To know the Awareness on fundamental Rights are established

CO3- To learn the functions of union Government and State Government

CO4- To learn the Power and functions of the Judiciary thoroughly

CO5- To learn the Appreciation of Democratic Parliamentary Rule

Unit I::The making of Indian constitution

The constitution assembly organization –character -work salient features of the constitution- written and detailed constitution -socialism –secularism-democracy and republic.

Unit II: Fundamental rights and fundamental duties of the citizens

Right of equality -right of freedom- right against exploitation -right to freedom of religion- cultural and educational rights -right to constitutional remedies -fundamental duties .

Unit III: Directive principles of state policy

Socialistic principles-Gandhi an principles-liberal and general principles -differences between fundamental rights and directive principles

Unit IV: The union executive, union parliament and Supreme Court

Powers and positions of the president -qualification _method of election of president and vice president -prime minister -Rajya Sabah -Lok Sabah .the supreme court -high court -functions and position of supreme court and high court

Unit V: State council -election system and parliamentary democracy in India

State council of ministers -chief minister -election system in India-main features election commission-features of Indian democracy.

References:

1) Palekar.s.a. Indian constitution government and politics, ABD publications, India
2) Aiyer, alladi krishnaswami, Constitution and fundamental rights 1955.
3) Markandan. k.c.directive Principles in the Indian constitution 1966.
4) Kashyap. Subash c, Our parliament ,National book trust , New Delhi 1989

Course Code	Course Title	L	T	P	C
221ACLSUHV	Universal Human Values	-	-	-	2

Aim:

This course aims at making learners conscious about universal human values in an integralmanner, without ignoring other aspects that are needed for learner's personality development.

Course Objectives :

The present course deals with meaning, purpose and relevance of universal human values and how to inculcate and practice them consciously to be a good human being and realiseone's potentials.

Course Outcomes :

By the end of the course the learners will be able to:

1. Know about universal human values and understand the importance of values in individual, social circles, career path, and national life.
2. Learn from case studies of lives of great and successful people who followed and practised human values and achieved self-actualisation.
3. Become conscious practitioners of human values.
4. Realise their potential as human beings and conduct themselves properly in the ways of the world.

Unit I

- Introduction:What is love? Formsoflove—forself, parents, family, friend, spouse, community, nation, humanity and other beings, both for living and non-living
- Love and compassion and inter-relatedness
- Love, compassion, empathy, sympathy and non-violence
- Individuals who are remembered in history for practicing compassion and love.
- Narratives and anecdotes from history, literature including local folklore
- Practicing love and compassion: What will learners learn gain if they practice love and compassion? What will learners lose if they don't practice love and compassion?
- Sharing learner's individual and/or group experience(s)
- Simulated Situations
- Casestudies

Unit II

- Introduction: What is truth? Universal truth, truth as value, truth as fact (veracity, sincerity, honesty among others)
- Individuals who are remembered in history for practicing thisvalue
- Narratives and anecdotes from history, literature including localfolklore
- Practicing Truth: What will learners learn/gain if they practice truth? What will learners lose if they don't practiceit?
- Learners' individual and/or group experience(s)
- Simulated situations

- Casestudies

Unit III

- Introduction: What is non-violence? Its need. Love, compassion, empathy sympathy for others as pre-requisites for non-violence
- Ahimsa as non-violence and non-killing
- Individuals and organisations that are known for their commitment to non-violence
- Narratives and anecdotesaboutnon-violence from history,and literature including local folklore
- Practicingnon-violence: What will learners learn/gain if they practice non-violence? What will learners lose if they don't practice it?
- Sharing learner's individual and/or group experience(s) about non-violence
- Simulated situations
- Casestudies

Unit IV

- Introduction: What is righteousness?
- Righteousness and *dharma*, Righteousness and Propriety
- Individuals who are remembered in history for practicing righteousness
- Narratives and anecdotes from history, literature including local folklore
- Practicing righteousness: What will learners learn/gain if they practice righteousness? What will learners lose if they don't practice it?
- Sharing learners' individual and/or group experience(s)
- Simulated situations
- Casestudies

Unit V

- Introduction: What is peace? Its need, relation with harmony and balance
- Individuals and organisations that are known for their commitment to peace
- Narratives and Anecdotes about peace from history, and literature including local folklore
- Practicing peace: What will learners learn/gain if they practice peace? What will learners lose if they don't practice it?
- Sharing learner's individual and/or group experience(s) about peace
- Simulatedsituations
- Casestudies

Unit VI

- Introduction: What is service? Forms of service for self, parents, family, friend, spouse, community, nation, humanity and other beings—living and non-living, persons in distress ordisaster.
- Individuals who are remembered in history for practicing this value.
- Narratives and anecdotes dealing with instances of service from history, literature including local folklore

- Practicingservice: What will learners learn/gain gain if they practice service? What will learners lose if they don't practice it?
- Sharing learners' individual and/or group experience(s) regarding service
- Simulated situations
- Casestudies

Unit VII

- Introduction: What is renunciation? Renunciation and sacrifice. Self-restrainand Ways of overcoming greed. Renunciation with action as true renunciation
- Individuals who are remembered in history for practicing this value.
- Narratives and anecdotes from history and literature,including local folklore about individuals who are remembered for their sacrifice and renunciation.
- Practicing renunciation and sacrifice: What will learners learn/gain if they practice Renunciation and sacrifice? What will learners lose if they don't practiceit?
- Sharing learners' individual and/or group experience(s)
- Simulated situations
- Casestudies

SEMESTER II

Course Code	Course Title	L	T	P	C
22110AEC21	Tamil-II	4	0	0	2

தமிழ் இரண்டாம் பருவம்
முதலாம் ஆண்டு
செய்யுள் , பக்தி இலக்கியம், சிற்றிலக்கியம் , இலக்கிய வரலாறு

அலகு : 1. செய்யுள்:

1. திருஞானசம்பந்தர் தேவாரம் - கோளறு பதிகம்

2. திருநாவுக்கரசர் தேவாரம் - தனிக் குறுந்தொகை

3. சுந்தரர் தேவாரம் - திருநொடித் தான் மலை

4. மாணிக்கவாசகர் - திருவாசகம் - தருப்பொன் ஊசல்

அலகு : 2 . செய்யுள்:

5. குலசேகராழ்வார் - பெருமாள் திருமொழி

6. நம்மாழ்வார் திருவாய் மொழி - இரண்டாம் பத்து - உலகிற்கு உபதேசம்

7. ஆண்டாள் - நாச்சியார் திருமொழி - திருமணக்கனவை உரைத்தல்

8. திருமங்கை ஆழ்வார் - சிறிய திருமடல்

அலகு : 3 . செய்யுள்:

9 . திருமூலர் - மூன்றாம் திருமுறை

10 . குமரகுருபரர் - மானாட்சியம்மைப் பிள்ளை - தமிழ் வருகைப் பருவம்

11 . திரிகூடராசப்பக்கவிராயர் - குற்றாலக்குறவஞ்சி - குறத்தி நாட்டு வளங் கூறுதல்

12 . வீரமாமுனிவர் - திருக்காவலூர்க் கலம்பகம்

அலகு : 4 . புதினம்

13 . கு.வெ. பாலசுப்ரமணியன் - காளவாய்

அலகு : 5 . இலக்கிய வரலாறு

14 . சைவ வைணவ இலக்கியங்கள் , சிற்றிலக்கியங்கள் , (பள்ளு - பிள்ளைத்தமிழ் ,- பரணி)

Course Code	Course Title	L	T	P	C
22111AEC21	Advanced English-II	4	0	0	2

Aim:

- To improve the knowledge of English

Objective:

- To understand the format of e-mail, fax and memos
- To write itinerary, checklist, invitation, circular, instruction, recommendations
- To know the impact of the biographies of famous people

Outcome:

- Develop technological skill
- Able to write in a variety of formats
- Read biographies and develop personality

UNIT –I
E-mail
Fax
Memos
UNIT – II
Itinerary
Checklist
UNIT – III
Invitation
Circular
UNIT – IV
Instruction
Recommendations
UNIT – V
Biographies of famous people:
Mother Teresa-Madam Curie-Charles Chaplin-Vikram Sarabhai

Text Book

Author	Title of the book	Edition / Year	Publisher
Meenakshi Raman & Sangeetha Sharma	Technical Communication	2011	Oxford University Press
Rajendra Pal & J.S.Korlahalli	Business Communication	2015	Sultan

Course Code	Course Title	L	T	P	C
22111AEC22	English-II	4	0	0	2

Aim:

- To acquaint learners with different trends of writing

Objective:

- To acquire language skills through literature
- To enable the students to appreciate literature
- To develop the conversational skills through one act plays

Outcome:

- Appreciate different forms of literature
- Enhance language skills through literature
- Broaden the horizon of knowledge

UNIT – I

Ecology -A.K. Ramanujan
Gift -Alice Walker
The First Meeting -Sujata Bhatt

UNIT –II

Fueled -Marcie Hans
Asleep -Ernst Jandl
Buying and selling -Khalil Gibran

UNIT –III

The End of living and The Beginning of Survival - Chief Seattle
My Wood - E.M.Forster
The Meeting of Races - Rabindranath Tagore

UNIT – IV

The Refugee -K.A. Abbas
I Have a Dream -Martin Luther king
Those People Next Door -A.G. Gardiner

UNIT – V

Marriage is a private Affair -Chinua Achebe
The Fortune Teller -Karel Capek
Proposal -Anton Chekov

Text book:

Author	Title of the book	Edition / Year	Publisher
Gowri Sivaraman	Gathered Wisdom	Reprint 2010	Emerald Publishers

Course Code	Course Title	L	T	P	C
22116AEC23	Microbial Physiology	6	1	0	5

Aim

- To instruct the importance of microbial metabolism and energetics for regulation and application of microbes in industry.

Objectives

- To understand the microbial growth and nutritional requirements.
- Studying the comprehensive awareness on metabolic process involved in prokaryotic and eukaryotic microorganisms.

Outcomes

CO1- To Determining the growth features of the microbes with various environmental factors.

CO2– To Analysis the essential nutrients ensuring microbial growth.

CO3 - To understand the significance of microbial surveillance

CO4- To know the Electron transport and metabolic pathway of living systems

Unit – I

Nutrition and growth of microorganisms: Nutritional types of microorganisms, nutritional requirements. Factors influencing the growth of microorganisms temperature, pH, Osmotic pressure, moisture, radiations and different chemicals. Physiology of growth – significance of various phases of growth - Growth Measurements – batch, continuous and synchronous

Unit – II

Enzymes and co –enzymes: classification and nomenclature of enzymes, active site, Lock and key Machanism and induced fit hypothesis, Enzyme kinetics- negative and positive co-operatively, enzyme inhibition: Reversible – Competitive, Noncompetitive, uncompetitive, Irreversible inhibition.

Unit – III

Metabolism of carbohydrates: Anabolism – photosynthesis – oxygenic –anoxygenic, synthesis of carbohydrate – catabolism of glucose – Embden Mayer – Hoff – Parnas pathway – Pentose pathway, Kreb's cycle (TCA) – electron transport system and ATP production.

Unit – IV

Metabolism of protein – metabolic pathways of nitrogen utilization (urea cycle), synthesis of amino acids, peptides, proteins

Unit – V

Anaerbic – Respiration and fermentations. Anabolic and catabolic processes of lipids - Reproductive physiology of microorganisms.

Text Book:

S. No	Author Name	Title of the Book	Edition/year	Publisher
1	Jr. M.J. Pelczar, E.C.S. Chan and N.R. Kreig.	Microbiology	5th /1993	Tata McGraw-Hill, Inc, Newyork

Reference Book:

1. Holt J.S., Krieg N.R., Sneath P.H.A and Williams S.T.(1994). Bergey's Menual of Determinative Bacteriology(9th Edition) – Williams & Wilkins, Baltimore.
2. Brige E.A.(1992) Modern Microbiology – Wrn.C. Brown Publishers, Deubque, USA
3. Goodfellow M. and O'Dennell A.C.(1994) Chemical methods of prokaryote systematic – John Wiley & Sons, New York
4. Murray R.K., Cranner M.D., Mayea P.A. and Rodwell V.W.(1990). Biochemistry-prentice Hall International Inc., London
5. Bryant D.A. (1994). The molecular Biology of Cyan Bacteria – Khrwer Academic Publisher, London.

Course Code	Course Title	L	T	P	C
22115AEC24	Bio Chemistry II	6	1	0	4

Aim

- To provide the basic of biochemistry and its application.

Objectives

- It serves as good research techniques and the ability to combine and analyzeinformation.

Outcomes

CO1**-** To Develop a very good understanding of various biomolecules

CO2 **-** To gain knowledge about lipids and fatty acids

CO3**-** To gain knowledge about multifarious function of proteins

CO4- To understand about metabolism.

Unit I

Organization of Life. Water – Physical Properties, Structure of Water, Weak Interactions in aqueous environment; Role of Water in life.
Bioenergetics – Laws of thermodynamics; Free energy concepts; ATP and ADP cycles; ATP as energy currency of cells.

Unit II

Release of energy into cells - Major metabolic pathways – Glycolysis, TCA cycle, Glycogenolysis, Gluconeogenesis, Fatty acid oxidation, ETC and Oxidative phosphorylation.

Unit III

Composition and functions of plant and bacterial cell wall. Biological membrane – Fluid mosaic model; Transport across membranes. Phytohormones – Auxin, Gibberllin and cytokinin.

Unit IV

Cell and cell organelles – Structure and functions of cell organelles – Nucleus, Mitochondria, Chloroplast - Photosynthesis, Golgi apparatus, Endoplasmic reticulum and Micro bodies.

Unit V

Enzymes – Classification, Nomenclature, Mechanism of enzyme action; factors influencing enzyme action – pH and Temperature; Specific activity; MM equation and its significances.

References:

1. Principles of Biochemistry – Lehninger.
2. Cell Biology – DeRobertis and DeRobertis
3. Cell Biology – Rastogi
4. Cell Biology – C.B.Powar.
5. Biophysical Chemistry – Principles and techniques – Upadhayay, Upadhyay and Nath.
6. Principles and techniques of practical Biochemistry – Wilson & Walker.

Course Code	Course Title	L	T	P	C
22116AEC25L	Microbial Physiology Lab	0	0	3	2

Aim

- To study the nutritional requirement of microbes.

Objectives

- To study the growth patten of bacteria
- To test the biochemical characterization of microbes.

Outcomes

CO1- To Understand and predict the various metabolic reactions in microbial cell.

CO2- To Predict the intermediate products which can be employed in industrial production.

CO3- To know the Environmental growth kinetics of microorganism.

1. Bacterial culture / isolation techniques, a streaking method, b.Pour plate method
2. Isolation and cultivation of fungi
3. Bacterial growth curve: cell count / viable count / absorbance (total count)
4. Carbohydrate fermentation test:
   a. Glucose
   b. Lactose,
   c. Maltose
   d. Sucrose
   e. Mannitol

5. Biochemical test for identification of Bacteria:
   a. Indole test
   b. Methyl red
   c. Voges – Proskaur test
   d. Citrate utilization
   e. TSI agar test
   f. Urease
   g. Catalase
   h. Oxidase

Text Books:

1. Pelezar Jr. M.J. Chan E.C.S. and Kroig N.R.(1993). Microbiology – Mcgraw Hill Inc., New York

2 Stainer R.Y., Ingraham J.L. Wheelia M.L. and Painter P.R. (1986). General Microbiology, Macmillan Education Ltd, London
Pelczar, Jr. M.J.

3 Bucker, J.M. Caldwell, G.A., Zachgo, E.A. 1990. A Laboratory Course, Academic Press
4 Harold J.Benson, 1994. Microbial Applications, WM.C. Brown Publishers

Course Code	Course Title	L	T	P	C
22115AEC26L	Bio Chemistry II Lab	0	0	3	2

Aim

- To make students familiar with practical techniques used for studying biochemical structure and analysis of biochemical methods.

Objectives

- To familiarize the students with the basic cellular processes at molecular level

Outcomes

CO1- To demonstrate an understanding of fundamental biochemical principles

CO2-To learn the structure/function of biomolecules, metabolic pathways, and regulation

CO3- Students are able to make buffers, study enzyme kinetics

1. Estimation of reducing sugar by Benedict's Quantitative Method.
2. Estimation of Ascorbic acid by Titrimetric Method.
3. Estimation of Amino Acid by Formal Titration.
4. Estimation of RNA by Orcinol Method.
5. Estimation of DNA by Diphenylamine method.
6. Determination of Acid Number of edible oil.
7. Separation of amino acids by paper chromatography.
8. Separation of amino acids by TLC.
9. Separation of plant pigments by column chromatography.

References:

1. Manuals in Biochemistry – J.Jayaraman
2. Manual in Biochemistry – S,Ramakrishnan
3. Practical Biochemistry – Plummer

Course Code	Course Title	L	T	P	C
22116RLC27	Research Led Seminar	-	-	-	1

Course Code	Course Title	L	T	P	C
221ACLSCOS	Communication Skills	-	-	-	**2**

Aim:

Course Objectives :

This course has been developed with the following objectives:

1. Identify common communication problems that may be holding learnersback
2. Identify what their non-verbal messages are communicating toothers
3. Understand role of communication in teaching-learningprocess
4. Learning to communicate through the digitalmedia
5. Understand the importance of empatheticlistening
6. Explore communication beyondlanguage.

Course Outcome :

By the end of this program participants should have a clear understanding of what good communication skills are and what they can do to improve their abilities.

Unit I

- Techniques of effectivelistening
- Listening andcomprehension
- Probing questions
- Barriers tolistening

Unit II

- Pronunciation
- Enunciation
- Vocabulary
- Fluency
- CommonErrors

Unit III

- Techniques of effectivereading
- Gathering ideas and information from a giventext
    i. Identify the main claim of thetext
    ii. Identify the purpose of thetext

iii. Identify the context of thetext

iv. Identify the conceptsmentioned

- Evaluating these ideas andinformation

i. Identify the arguments employed in thetext

ii. Identify the theories employed or assumed in thetext

- Interpret thetext

i. To understand what a textsays

ii. To understand what a textdoes

iii. To understand what a textmeans

Unit IV

- Clearly state theclaims
- Avoid ambiguity, vagueness, unwanted generalisations and over simplification of issues
- Provide backgroundinformation
- Effectively argue theclaim
- Provide evidence for theclaims
- Use examples to explainconcepts
- Followconvention
- Be properlysequenced
- Use proper signpostingtechniques
- Be well structured

i. Well-knit logicalsequence

ii. Narrativesequence

iii. Categorygroupings

- Different modesofWriting -

i. E-mails

ii. Proposal writing for HigherStudies

iii. Recording the proceedings ofmeetings

iv. Any other mode of writing relevant forlearners

Unit V

- Role of Digital literacy in professionallife
- Trends and opportunities in using digital technology inworkplace
- InternetBasics
- Introduction to MS Officetools

i. Paint

ii. Office

iii. Excel

iv. Powerpoint

Unit VI

- Introduction to social mediawebsites

- Advantages of socialmedia
- Ethics and etiquettes of socialmedia
- How to use Google searchbetter
- Effective ways of using SocialMedia
- Introduction to DigitalMarketing

Unit VII

- Meaning of non-verbalcommunication
- Introduction to modes of non-verbalcommunication
- Breaking the misbeliefs
- Open and Closed Bodylanguage
- Eye Contact and FacialExpression
- HandGestures
- Do's andDon'ts
- Learning fromexperts
- Activities-BasedLearning

Reference:

1. SenMadhucchanda (2010), *An Introduction to Critical Thinking*, Pearson,Delhi
2. Silvia P. J. (2007), *How to Read a Lot*, American Psychological Association, Washington DC

SEMESTER – III

Course Code	Course Title	L	T	P	C
22110AEC31	Tamil-III	4	0	0	2

தமிழ் மூன்றாம் பருவம்
இரண்டாம் ஆண்டு

செய்யுள் , காப்பியங்கள் இலக்கிய வரலாறு

செய்யுள்

அலகு : 1

1. சிலப்பதிகாரம் - மனையறம் படுத்த காதை

2. மணிமேகலை - ஆதிரை பிச்சையிட்ட காதை

3. சீவக சிந்தாமணி - விமலையார் இலம்பகம்

அலகு :2

4. பெரியபுராணம் - இளையான் குடிமாற நாயனார் புராணம்

5. கம்பராமாயணம் - கைகேயி சூழ்வினைப் படலம்

அலகு :3

6. சீறாப்புராணம் - நபி அவதாரப் படலம் - 24 வரிகள்

7. தேம்பாவணி - வாமன் ஆட்சி படலம் - முதல் 5 பாடல்கள்

அலகு :4

8. நளவெண்பா - சுயம்வர காண்டம் (20 - 51)

அலகு . 5 : இலக்கிய வரலாறு

9. காப்பியங்கள் , ஐஞ்சிறு காப்பியங்கள் , புராணங்கள் , இதிகாசங்கள்

Course Code	Course Title	L	T	P	C
22111AEC31	Advanced English-III	4	0	0	2

Aim:

- To improve the knowledge of English

Objective:

- To familiarize with the organs of speech and the description and classification of speech sounds
- To understand consonant cluster, syllable, word accent and intonation.
- To know how to interpret graphics
- To write slogans and advertisements

Outcome:

- Understand phonetics
- Develop writing skill
- Able to develop creative writing

UNIT –I
The organs of speech
Classification of speech sounds
Vowels and Diphthongs
UNIT –II
Consonants
Consonant cluster
UNIT – III
Syllable
Word accent
Intonation
UNIT – IV
Idiom
Interpretation of graphics
UNIT – V
Slogan writing
Writing advertisement

Reference books:

Author	Title of the book	Edition / Year	Publisher
T.B. Balasubramaniyan	A text book of Phonetics for Indian Students	Reprint 2008	Macmillian
Meenakshi Sharma & Sangeetha Sharma	Technical Communication	2011	Oxford University Press

Course Code	Course Title	L	T	P	C
22111AEC32	English-III	4	0	0	2

Aim:

- To acquaint with learning English through literature

Objective:

- To sensitize language use through prescribed text
- To develop the conversational skills through one act plays

Outcome:

- Appreciate different types of prose
- Develop the conversational skills through one act plays
- Enhance the skill of making grammatically correct sentences.

UNIT – 1

The Doctor's World - R.K. Narayan
The Postmaster - Rabindranath Tagore
Princess September - E.Somerest Maugham

UNIT – II

The Price of Flowers -Prabhat Kumar Mukhopadhyay
The Open Window -Saki
The Model Millionaire -Oscar Wilde

UNIT –III

My Brother My Brother - Norah Burke
Uneasy Home Coming - Will F. Jenkins
Resignation - Premchand

UNIT –IV

The Referee -W.H. Andrews & Geoffrey Dreamer
The Case of the Stolen Diamonds -Farrell Mitchell

UNIT – V

The Dear Departed -Stanley Houghton
The Princess and the Wood Cutter -Alan Alexander Milne

Text book:

Author	Title of the book	Edition / Year	Publisher
Steuart H.King	Nine Short Stories	Reprint 2001	Blackie Books
T.Prabhakar	One – Act Play		Emerald

Course Code	Course Title	L	T	P	C
22116AEC33	Immunology	4	1	0	4

Aim:

- Intended to impart the basic and essential information on immune system.

Objectives

- This course focuses on the concepts of immune system in human body.
- To create awareness on immunity
- To give knowledge on antigen and antibody
- To learn human diseases and vaccine

Outcomes

CO1- To understand theory linked to cells and organs related to immune system.

CO2- Able to know Immune response and immune mechanism.

CO3- To Understand the mechanism of Immunological disorders.

CO4- To Learn the importance and precautions of Immunodeficiency syndromes

Unit I

Introduction- History of immunology-scope of immunology. Immunity and their types- Innate and Acquired immunity, Active and Passive immunity. Immune response- Humoral and Cell mediated immune response.

Unit II

Lymphoid organs- primary and secondary lymphoid organs and their role. Cells of the immune system – Stem cell, Lymphocytes, T and B lymphocytes. Plasma cell, T Helper cell, T suppressor cell, T-cytotoxic cell, Null cells, Killer cell, Macrophages, Blood cells and platelets.

Unit III

Antigen- types, chemical nature and essential factors of antigen, Hapten, Adjuvants, Immunoglobulin - Structure, classes, properties and functions. Antigen- antibody reactions.

Unit IV

Complement- Salient features, complement activation, Classical pathway, Alternative pathway, Biological function of complement system. Major Histocompatability complex (MHC)- Types and functions.

Unit V

Monoclonal antibodies, Hypersensitivity reactions, Immunoprophylaxis, Vaccines – types, Toxoid and antitoxin, Immunoelectrophoresis, HLA typing, ELISA and RIA

Text Books

S. No	Author Name	Title of the Book	Edition/year	Publisher
1.	Kuby	Immunology	4^{th} / 2000	W.H. Frumen and Company

Reference Book:

1. Abul. K. Abbas, Andrew H.Lichtman, Jordan S.Pobar 1994. Cellular and Molecular Immunology. II edition. W.B.Saunders, U.S.A.
2. William E.Paul 1993. Fundamental Immunology. II edition, Raven press, New York.
3. Topley & Wilson's 1990. Principles of Bacteriology, Virology and Immunity VIII edition Vol.I General Microbiology and Immunity. Edward Arnold, London.

4. Lesile Hudson, Frank C.Hay, 1989. III edition. Practical Immunology. Blackwell Scientific Publication.
5. Helen Chapel, Mansel Haeney. 1986. Essentials of clinical Immunology . ELBS.
6. Mackett M. and Wiliamson J.D.1995. Human vaccines and vaccination. BIOS Scientific Publishers.
7. Bernard R.Glick and Jack J.Pasternak 1994. Molecular Biotechnology – Principles and Applications of Recombinant DNA. ASM Press, Washington.

Course Code	Course Title	L	T	P	C
22116AEC34	Cell Biology	4	1	0	5

Aim:

- Students will understand the cellular basis of life and their importance.

Objectives:

- Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles
- Students will understand how these cellular components are used to generate and utilize energy in cells

Outcomes:

- To grasp the significance of cell and its components in living systems
- To understand the and describe the structures and basic components of prokaryotic and eukaryotic cells
- To understand the cyclical events of cell division and types of cell division
- To acquire the knowledge of cell biology for understanding various physiological process
- To understand the synthesis of cellular compounds and cell signaling

Unit - I

History of cell biology, cell as basic unit of life, cell theory, protoplasm theory and organismal theory, broad classification of cell types, Bacteria, Archaea (prokaryotic) and eukaryotic cells and their similarities and differences.

Unit - II

Cell Organelles- Nucleus, Endoplasmic Reticulum(link is external), Golgi Apparatus, Mitochondria(link is external), Chloroplast(link is external), Lysosome, Peroxisome – Protein Sorting & Transport – Cytoskeleton(link is external) & Cell Movement – The Plasma Membrane

Unit - III

Biogenesis of Cellular organelles – Biosynthesis of mitochondria, chloroplast, ER, Golgi complex; Biosynthetic process in ER and golgi apparatus; Protein synthesis and folding in the cytoplasm; Degradation of cellular components.

Unit - IV

Cell cycle - An overview of cell cycle; Components of cell cycle control system; Intracellular and Extra-cellular control of cell division, Programmed cell death (Apoptosis), intrinsic & extrinsic pathways of cell death, Apoptosis in relation with Cancer and Viral disease

Unit - V

Cell communication – overview – types of cell signaling – signal molecules – signal amplification – receptor types – quorum sensing.

REFERENCES

- Verma P.S. and Agarwal V.K. (2016) Cell Biology (Cytology, Biomolecules,Molecular Biology), Paperback, S. Chand and Company Ltd.
- Molecular Biology of the Cell by Bruce Alberts, Alexander Johnson, Julian Lewis, David Morgan, Martin Raff, Keith Roberts, Peter Walter, 6th Edn, 2015, Garland Science
- The Cell, A Molecular Approach(link is external) – 6th Edition – Geoffrey M.Cooper/Robert E.Hausman- Sinauer Associates, Inc.

Course Code	Course Title	L	T	P	C
22116AEC35L	Immunology Lab	0	0	3	2

Aim

- To learn the immunological techniques in disease diagnosis.

Objectives

- Acquire knowledge on antigen antibody reactions.
- Styding the immunology tests and their interpretations.

Outcomes

CO1- Able to know about principles and techniques Blood grouping
CO2- To Understand the immunological experiments for clinical field
CO3- To know the methods of Counting of RBC, WBC and platelets

Lab work

1. ABO Blood Grouping
2. Rh typing
3. WIDAL Test
4. White Blood Cell Count
5. Red Blood Cell Count
6. Antigen preparation
7. Radial Immunodiffusion
8. Double Immunodiffusion
9. Demonstration of ELISA
10. Demonstration of RIA

References

1. O'Gorman, Manrice RG and Albert David Donnenberg. Hand book of human Immunology. Boca Raton, FL: CRC press, Francis.2008.

2. Rajan S and Selvi Christy R. Experiments in Microbiology. Anjana Books House, Chennai. 2015.

Course Code	Course Title	L	T	P	C
22116AEC36L	Cell Biology Lab	0	0	3	2

Aim:

- Students will understand the cellular basis of life and their importance.

Objectives:

- Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles
- Students will understand how these cellular components are used to generate and utilize energy in cells

Outcomes:

- To grasp the significance of cell and its components in living systems
- To understand the and describe the structures and basic components of prokaryotic and eukaryotic cells
- To understand the cyclical events of cell division and types of cell division

1. Separation of nucleic acid bases by paper chromatography
2. Mitosis in onion root
3. Meiosis in flower bud
4. Normal human karyotyping
5. preparation of polytene chromosome
6. Isolation of chloroplast from spinach leaves
7. Isolation of protoplast
8. Life cycle of Drosophila
9. Culture of Human, Plant & Animal cells
10. Identification and study of cancer cells- Slides/Photomicrographs

REFERENCE:

- Experimental procedures in Life Sciences, S.Rajan and R. Selvi Christy, 2010, Anjanaa book house.
- Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley & Sons. Inc.

Course Code	Course Title	L	T	P	C
22116RMC37	Research Methodology	2	0	0	2

Aim:

To create a basic appreciation towards research process and awareness of various research publication

Objectives:

- To understand the steps in research process and the suitable methods.
- To identify various research communications and their salient features
- To carry out basic literature survey using the common data-bases
- To give exposure to MATLAB platform for effective computational and graphic works required for quality research

Outcomes:

CO1- To Understand research questions and tools

CO2- To gain Experience in scientific writings

CO3- To Practice in various aspects of scientific publications

CO4- To understand Inculcation of research ethics

Prerequesties:

Basic computer literacy & skills for working in window-environment

UNIT I: Introduction to Research Methodology

Meaning of research – Objectives of research – Types of research – Significance of research – Research approaches

UNIT II: Research Methods

Research methods versus methodology – Research and scientific method – Criteria of good research – Problems encountered by researchers in India.

UNIT III: Literature Survey

Articles – Thesis – Journals – Patents – Primary sources of journals and patents – Secondary sources – Listing of titles – Abstracts – Reviews – General treatises – Monographs.

UNIT IV: Database Survey

Database search – NIST – MSDS – PubMed – Scopus – Science citation index – Information about a specific search.

UNIT V:

Basic Principles of Laboratory Safety and Waste management

Introduction - Access to Laboratory and Emergency Exits - Personal Protective Clothing and Equipment - Good Working Practices-Maintenance of Laboratory Equipment - Working with Hazardous Substances - Storage of Chemicals - Working with Flammable Solvents - Gas Cylinders-Fire Precautions - Emergency Procedures - First Aid - Accident Follow-Up - Safety Manual - Safety Training - Management of Laboratory Safety and Responsibilities - Waste Management.

Course Code	Course Title	L	T	P	C
221ACLSOAN	OFFICE AUTOMATION	-	-	-	2

Aim:

Course Objectives :

To provide an in-depth training in use of office automation, internet and internet tools. The course also helps the candidates to get acquainted with IT.

Course Outcomes:

After completion of the course, students would be able to documents, spreadsheets, make small presentations and would be acquainted with internet.

UNIT I

Knowing the basics of Computers

UNIT II

Word Processing (MS word)

UNIT III

Spread Sheet (MS XL)

UNIT IV

Presentation (MS Power Point)

UNIT V

Communicating with Internet

Reference:

1. Fundamentals of computers - V.Rajaraman - Prentice- Hall of india

2. Microsoft Office 2007 Bible - John Walkenbach,Herb Tyson,Faithe Wempen,cary N.Prague,Michael R.groh,Peter G.Aitken, and Lisa a.Bucki -Wiley India pvt.ltd.

3. Introduction to Information Technology - Alexis Leon, Mathews Leon, and Leena Leon, Vijay Nicole Imprints Pvt. Ltd., 2013.

4. Computer Fundamentals - P. K. Sinha Publisher: BPB Publications

5. https://en.wikipedia.org

6. https://wiki.openoffice.org/wiki/Documentation

7. http://windows.microsoft.com/en-in/windows/windows-basics-all-topics

SEMESTER – IV

Course Code	Course Title	L	T	P	C
22110AEC41	Tamil-IV	4	0	0	2

தமிழ்.

நான்காம் பருவம்

இரண்டாம் ஆண்டு

செய்யுள் , சங்க இலக்கியம், அற இலக்கியம் , செம்மொழி , இலக்கிய வரலாறு

அலகு . 1 : பண்டைய இலக்கியம் - நற்றிணை;

1. நெய்தல் - தோழி கூற்று - பாடல் எண் . 11

2. குறிஞ்சி - தலைவி கூற்று - பாடல் எண். 64

3. முல்லை - தலைவன் கூற்று - பாடல் எண்.142

4. பாலை - நற்றாய் கூற்று - பாடல் எண். 29

5. மருதம் - தலைவி கூற்று - பாடல் எண். 70

பண்டைய இலக்கியம் குறுந்தொகை

1 . குறிஞ்சி - தோழி கூற்று - பாடல் எண்.1

2. முல்லை - செவிலித்தாய் கூற்று - பாடல் எண்.167

3. மருதம் - தலைவி கூற்று - பாடல் எண். 181

4. நெய்தல் - தலைவி கூற்று - பாடல் எண் . 290

5. பாலை - தலைவன் கூற்று - பாடல் எண் . 347

பண்டைய இலக்கியம் ஐங்குறுநூறு

1. மருதம் - கள்வன் பத்து - முதல் இரண்டு பாடல்கள்

2. நெய்தல் - தோழிக்குரைத்த பத்து - முதல் இரண்டு பாடல்கள்

3. குறிஞ்சி - குன்றக் குறவன் பத்து - முதல் இரண்டு பாடல்கள்

4. பாலை - இளவேனிற் பத்து - முதல் இரண்டு பாடல்கள்

5. முல்லை - பாசறைப் பத்து - முதல் இரண்டு பாடல்கள்

அலகு . 2 : கலிந்தொகை

1 . பாலை - பாடல் எண். 2

2. குறிஞ்சி - பாடல் எண். 37

அகநானூறு

1 . பாலை - பாடல் எண். 5

2. மருதம் - பாடல் எண். 6

புறநானூறு

பாடல் எண் : 6 ,121, 41, 153 ,172 191, 223, 246, 284, 358.

பதிற்றுப்பத்து

இரண்டாம் பத்து பாடல் எண். 4 (நிலம் நீர் வளி விசும்பு)

அலகு.3;

1 . பட்டினப்பாலை - முதல் 105 வரிகள்

2. திருக்குறள் - 1.மருந்து 2.ஊக்கமுடைமை 3.உழவு

அலகு . 4 : செம்மொழி வரனறு ;

(மொழி - விளக்கம் , மொழிக்குடும்பங்கள், உலகச் செம்மொழிகள், இந்தியச் செம்மொழிகள் , செம்மொழித் தகுதிகள் , வரையறைகள், வாழும் தமிழ் செம்மொழி, தொன்மை , தமிழின் சிறப்புகள், தமிழ் செம்மொழி நூல்கள்)

அலகு . 5 : இலக்கிய வரலாறு

சங்க இலக்கியங்கள் , பதினெண்கீழ்க்கணக்கு நூல்கள்.

Course Code	Course Title	L	T	P	C
22111AEC41	Advanced English-IV	4	0	0	2

Aim:

- To improve the knowledge of English

Objective:

- To familiarize with the objectives and types of interview
- To know the types of questions and answering techniques
- To prepare reviews and proposals
- To learn the grammatical forms
- To understand the meaning of a poem and write the content
- To write for and against a topic
- To draw a flowchart
- To write definitions

Outcome:

- Develop writing skill
- Comprehend and describe poems
- Learn interviewing skills

UNIT –I
Interviews
Objectives, types, ten success factors, ten failure factors - Planning and preparation –Presentation– Type of questions – Answering techniques.
UNIT – II
Flowchart
Proposals
UNIT – III
Discourse markers
Review
UNIT IV
Grammatical forms
Paraphrasing
UNIT –V
Definition
Writing for and against a topic.

Reference books:

Author	Title of the book	Edition / Year	Publisher
Rajendra Pal & J.S Korlahalli	Essentials of Business Communication	2015	Sultan Chand & Sons
Meenakshi Raman & Sangeetha Sharma	Technical Communication	2011	Oxford University Press
Wren & Martin	English Grammar & Composition	2009	S.Chand

Course Code	Course Title	L	T	P	C
22111AEC42	English-IV	4	0	0	2

Aim:

- To learn English through literature

Objective:

- To explore learners to the standard literary texts
- To impart wisdom through morally sound poems and essays
- To introduce Shakespeare to non-literature students

Outcome:

- Improve their ability to read and understand
- Know the genius of Shakespeare
- Express one's views in writing

UNIT –I

My Last Duchess -Robert Browning
The Toys -Coventry Patmore
I, too -Langston Hughes

UNIT –II

How to be a Doctor -Stephen Leacock
My Visions for India -A.P.J. Abdul Kalam
Woman, not the weaker sex -M.K. Gandhi

UNIT –III

The Best Investment I ever made-A.J.Cronin
The Verger -W.S Maugham
A Willing Slave -R.K.Narayan

UNIT –IV

Macbeth
As You Like It

UNIT –V

Henry IV
Tempest

Text book:

Author	Title of the book	Edition / Year	Publisher
Devaraj	English for Enrichment		Emerald Publishers
Board of Editors	Selected Scenes from Shakespeare Book I & II	2012	Emerald Publishers

Course Code	Course Title	L	T	P	C
22116AEC43	Virology	4	1	0	4

Aim:

- To study the characteristics of viruses and viral infections.

Objectives

- To study general aspects of classification and structure of viruses.
- Studyin the viral infections, their diagnosis and treatment strategies.

Outcomes

CO1**-** To Understand the characteristic features of viruses.

CO2– To Gain the knowledge about the biology of bacteriophages.

CO3– To Learn therange of plant viruses and animal viruses.

CO4 **-**To know the role of viruses in causing of cancer.

UNIT – I

Introduction – Definition, History of virology. General properties of Viruses classification of Viruses – cultivation of Viruses – Structure and replications Viruses.

UNIT – II

Bacterial Viruses – structure of bacteriophage, The Lytic life cycle (T-Even coliphages) – Lysogenic life cycle (*Escherchia coli*, Phage Lambda) noninteractive lysogeny (*Escheirchia coli*).

UNIT – III

Plant Viruses, Common plant viral diseases: Tobacco Mosaic **Virus** (TMV), Bunchy top of banana, satellite virus. Cucumber Mosaic **Virus** (CMV), Cauliflower Mosaic **Virus** (CaMV). Bacteriophages, Viroids.

UNIT – IV

Animal viruses: Morphology, pathogenesis and laboratory diagnosis of Prions, Animal viruses Rinder pest, Blue tongue, Raniket dion, Foot and Mouth Disease. Human Viruses – Herpes, HIV, Hepatitis Viruses. Viral Vaccines. Prevention and treatment of viral diseases. Antiviral agents.

UNIT - V

Virus: Assay, purification and characterization of Viruses, Separation and characterization of viral components and quantification of Viruses. Immune responses to viruses, Interferon and other cytokines, Antiviral therapy.

Text books:

S. No	Author Name	Title of the Book	Edition/year	Publisher
1	Nester, E.W, D.G. Anderson, C. Erans Roberts, N.N. Pearsan, M.T. Nester	Introduction Microbiology	4th / 2004	Mc Graw Hill Hyher Education

1.	R. C. Dubey, D.K. Maheswari	A Text Book of Microbiology	3rd / 2003	Chand Publishing

Reference Book:

1. Conrat, H.F.Kimball, P.C. and Levy, J.A.(1988). Virology. II Edition. Prentice Hall, Englewood cliff, New Jersey.
2. Harold J.Benson. 1994. Microbiological Applications. Wm.C.Brown Publishers, Melbourne, Austrialia.
3. James, C.Cappuccino. 1996. Microbiology. The Benjamin/Cummings Pub. Co. Calfornia.

Course Code	Course Title	L	T	P	C
22116AEC44	Biostatistics and Bioinformatics	5	1	0	5

Aim

To introduce the basic knowledge on Biostatistics and Bioinformatics tools and its applications

Objective

- The basic objective is to give students an introduction to the biostatistics and bioinformatics.
- Emphasis will be given to the application of biostatistics, bioinformatics and biological databases to problem solving in real research problems.

Outcome

- To understand the importance of principal concepts about biostatistics
- To know the knowledge about statistics and its relation with other science and research aspects
- To obtain the knowledge on bioinformatics databases, perform text- and sequence-based searches
- To become familiar with the use of a wide variety of internet applications, biological database and will be able to apply these methods to research problems.

Unit I

Concepts in statistics, Types of Data, presentation of data, types of graphics, relative frequency, cumulative frequency, Measurement of central tendency, Measures of variation, coefficient of variation, Measures of Skewness and Kurtosis, Probability and its applications, Laws of Addition and Multiplication, Compound probability, Baye's Theorem.

Unit II

Random Variables and Distributions. Binomial, Poisson, Exponential and Normal Distributions and their applications. Samples and Sampling Distribution, Standard Error, significance level, Degrees of freedom, Tests of significance, tests for proportion, t and F tests Confidence. Correlation: Simple, Partial and Multiple Correlation. Regression Analysis. Analysis of variance for one and two way classification

UNIT III

Biological Databases: Structure, Sequence and literature databases. Protein sequence database - PIR, SWISS-PROT, MIPS. Protein structure database - PDB, SCOP. DNA sequence databases – Gen Bank, ENBL, MBL, DDBJ. Literature data base – Med Line, PubMed. Patterns, motifs and profile Databases: Metabolic Pathway Databases.

UNIT IV

Sequence Alignment and Analysis: Local and Global alignment. Scoring matrices. Database Similarity Searches: BLAST, FASTA, PSI-BLAST algorithms; Pair wise sequence alignment - NEEDLEMAN and Wunsch, Smith Waterman algorithms; Multiple sequence alignments - CLUSTAL, PRAS; Patterns, motifs and Profiles in sequences.

UNIT V

Important parameters in Drug Discovery and the role of computational methods. Process of drug discovery – Target identification, target validation, lead identification, lead optimization and preclinical pharmacology and toxicology. Computer Aided Drug Design (CADD). Molecular docking - Concept of receptor and target. Receptor binding and activation. Ligand-receptor interaction, non-covalent bonds. Ligand into the binding site.

References

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Gautham, N. 2006. Bioinformatics- Databases and Algorithms, Narosa Publishing House Hall of India Pvt. Ltd, New Delhi.

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Lesk, A.M. 2006. Introduction to Bioinformatics. (2nd Edition). Oxford University Press, New Delhi.

Course Code	Course Title	L	T	P	C
221ENSTU45	Environmental studies	2	0	0	2

Objectives:

- Creating the awareness about environmental problems among people.
- Imparting basic knowledge about the environment and its allied problems.
- Developing an attitude of concern for the environment.
- Motivating public to participate in environment protection and environment improvement.
- Acquiring skills to help the concerned individuals in identifying and solving environmental problems.
- Striving to attain harmony with Nature.

Outcome

CO1- To Understand eco-system

CO2- To Know social issues and the environment

CO3- To Learn keep the environment eco-friendly

1. Nature of Environmental Studies

Definition, scope and importance.
Multidisciplinary nature of environmental studies
Need for public awareness.

2. Natural Resources and Associated Problems.

a) Forest resources: Use and over — exploitation, deforestation, dams and their effects on forests and tribal people.
b) Water resources: Use and over — utilization Of surface and ground water, floods, drought, conflicts over water, dams benefits and problems.
c) Mineral resources: Usage and exploitation. Environmental effects of extracting and using mineral resources.
d) Food resources: World food problem, changes caused by agriculture effect of modern agriculture, fertilizer — pesticide problems.
e) Energy resources: Growing energy needs, renewable and non — renewable energy resources, use of alternate energy sources. Solar energy, Biomass energy, Nuclear energy.
f) Land resources: Solar energy, Biomass energy, Nuclear energy, Land as a resource, land degradation, man induced landslides, soil erosion and desertification,

Role of an individuals in conservation of natural resources.

3. Ecosystems

Concept of an ecosystem.
Structure and function of an ecosystem.
Producers, consumers and decomposers.
Energy flow in the ecosystem.
Ecological succession.

Food chains, food webs and ecological pyramids.
Introduction, types, characteristics features, structure and function of the following ecosystem:
a) Forest ecosystem, b) Grassland ecosystem, c) Desert ecosystem,
d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

4. Biodiversity and its conservation

Introduction — Definition: genetic, species and ecosystem diversity.
Bio — geographical classification of India.
Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
India as a mega — diversity nation.
Western Ghat as a biodiversity region.
Hot— spot of biodiversity.
Threats to biodiversity habitat loss, poaching of wildlife, man — wildlife conflicts.
Endangered and endemic species of India.
Conservation of biodiversity: In — situ and Ex — situ conservation of biodiversity.

5. Environmental Pollution

Definition: Causes, effects and control measures of: Air pollution, Water pollution, soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards.
Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of a individual in prevention of pollution.

6. Social Issues and the Environment

Disaster management: floods, earthquake, cyclone, tsunami and landslides.
Urban problems related to energy Water conservation, rain water harvesting, watershed management
Resettlement and rehabilitation of people; its problems and concerns.
Environmental ethics: Issue and possible solutions.
Global wanTling, acid rain, ozone layer depletion, nuclear accidents and holocaust.
Wasteland reclamation.
Consumerism and waste products.

7. Environmental Protection

From Unsustainable to Sustainable development.
Environmental Protection Act.
Air (Prevention and Control of Pollution) Act.
Water (Prevention and control of Pollution) Act.
Wildlife Protection Act.
Forest Conservation Act.
Population Growth and Human Health, Human Rights.

8. Field Work

Visit to a local area to document environmental assets — River / Forest / Grassland / Hill / Mountain.

or

Visit to a local polluted site — Urban / Rural I lad Listrial / Agricultural.

or

Study of common plants, insects, birds.

or

Study of simple ecosystems -— ponds, river, hill slopes, etc.

References:

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3) Brunner R.C., 1989, 1-lazardous Waste Incineration, McGraw Hill Inc. 480p
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6) De A.K., Environmental Chemistry, Wiley Wastern Ltd.
7) Down to Earth, Centre for Science and Environment, New Delhi. (R)
8) Gleick, H., 1993, Water in crisis, Pacific Institute for studies in Dcv., Environment & Security. Stockholm Env Institute. Oxford Univ. Press 473p
9) Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bompay (R)
10) Heywood, V.K. & Watson, R.T.1995, Global Biodiversity Assessment, Crnbridge Univ. Press 1140 p.
11) Jadhav, H. and Bhosale, VJvI. 1995, Environmental Protection and Laws, Himalaya Pub. House, Delhi 284p.
12) Mickinney, M.L. and School. R.M. 1196, Environmental Science Systems and Solutions, Web enhanced edition, 639p.
13) Miller T.G. Jr. Environmental Science. Wadsworth Publications Co. (TB).
14) Odum, E.P. 1971, Fundamentals of Ecology, W.B. Saunders Co. USA,574zp.
15) Rao M.N. and Dana, A.K. 1987, Waste Water Treatment, Wxford & IBH Publ. Co. Pvt. Ltd., 345p
16) Sharma B.K., 2001, Environmental Chemistry, Gokel PubI. Hkouse, Meerut
17) Survey of the Environment, The Hindu (M)
18) Townsend C., Harper, J, and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
19) Trivedi R.K. Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, vol. 1 and II, Environmental Media (R)
20) Trivedi R.K. and P.K. Goel, Introduction to air pollution, Techno— Science Publications (TB)
21)Wagner K.D., 1998, Environmental management, W.B. Saunders Co. Philadelphia, USA 499p,
22) Paryavaran shastra — Gholap T.N,
23) Paryavaran Sahastra — Gharapure

(M) Magazine
(R) Reference
(TB) Textbook

Learning Outcomes:

Students who graduate with a major in environmental science will be able to:

1. Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale;
2. Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment;
3. Demonstrate ecology knowledge of a complex relationship between predators, prey, and the plant community;
4. Apply their ecological knowledge to illustrate and graph a problem and
5. describe the realities that managers face when dealing with complex issues; and
6. Understand how politics and management have ecological consequences.

Course Code	Course Title	L	T	P	C
22116AEC46L	Virology Lab	0	0	3	2

Aim:

- To study the isolation and cultivation methods for viruses.

Objectives

- Cultivation of viruses and various methods of propagation.

Outcomes

CO1- To Know the structure of plants, animal, bacteria and viruses.
CO2- To grasp the significance of isolation, propagation of various viruses

CO3- To build clinical laboratory testing devices

Lab work

1. Isolation of coliphage from sewage.

2. Determining Bacteriophage Titers

3. Cultivation of viruses in embryonated egg.

4. Chicks Embryo Fibroblast technique for virus cultivation

Demonstrations

1. Isolation of microorganisms from Phyllosphere.
2. Study of the following viral diseases: Tobacco mosaic; Cucumber Mosaic Virus.
3. Demonstrations of some plant, animal & human viruses (photographs, diagram etc.).

Course Code	Course Title	L	T	P	C
22116AEC47L	Biostatistics and Bioinformatics Lab	0	0	3	2

Aim

- To introduce the basic knowledge on Biostatistics and Bioinformatics tools and its applications

Objective

- The basic objective is to give students an introduction to the biostatistics and bioinformatics.
- Emphasis will be given to the application of biostatistics, bioinformatics and biological databases to problem solving in real research problems.

Outcomes

CO1: To Read and learn statistical measures individually.

CO2- To analysis the data from experiments and interpretation of the *results*

CO3- To study the multivariate analysis in biostatistics

CO4 - To understand the nucleotide sequence data of the given species using NCBI / EMBL / DDBJ.

CO5 - To identify the protein sequence of the species using PIR and Swissprot / UniProt

1. Mean and Standard deviation using biological samples
2. Chi – Square test, Student 't' test and Correlation coefficient
3. Regression Coefficient and regression lines
4. Pairwise alignment using FASTA, BLAST.
5. Multiple alignments using Clustal W.
6. Study of internet resources in Bioinformatics – NCBI, ENBL, EBI.

Course Code	Course Title	L	T	P	C
221ACLSLMS	Leadership and Management Skills	-	-	-	2

Aim:

The aim of the course cultivating and nurturing the innate leadership skills of the youth so that they may transform these challenges into opportunities and become torch bearers of the future by developing creative solutions.

Course Objective:

The Module is designed to**:**

- Help students to develop essential skills to influence and motivate others
- Inculcate emotional and social intelligence and integrative thinking for effective leadership
- Create and maintain an effective and motivated team to work for the society
- Nurture a creative and entrepreneurial mindset
- Make students understand the personal values and apply ethical principles in professional and social contexts.

Course Outcomes :

Upon completion of the course students will be able to:

1. Examine various leadership models and understand/assess their skills, strengths and abilities that affect their own leadership style and can create their leadership vision
2. Learn and demonstrate a set of practical skills such as time management, self management, handling conflicts, team leadership, etc.
3. Understand the basics of entrepreneurship and develop business plans
4. Apply the design thinking approach for leadership
5. Appreciate the importance of ethics and moral values for making of a balanced personality.

UNIT I- Leadership Skills

a. Understanding Leadership and its Importance

- What is leadership?
- Why Leadership required?
- Whom do you consider as an ideal leader?

b. Traits and Models of Leadership

- Are leaders born or made?
- Key characteristics of an effective leader
- Leadership styles
- Perspectives of different leaders

c. Basic Leadership Skills

- Motivation
- Team work
- Negotiation
- Networking

UNIT II - Managerial Skills

a. Basic Managerial Skills

- Planning for effective management
- How to organise teams?
- Recruiting and retaining talent
- Delegation of tasks
- Learn to coordinate
- Conflict management

b. Self Management Skills

- Understanding self concept
- Developing self-awareness
- Self-examination
- Self-regulation

UNIT III - Entrepreneurial Skills

a. Basics of Entrepreneurship

- Meaning of entrepreneurship
- Classification and types of entrepreneurship
- Traits and competencies of entrepreneur

b. Creating Business Plan

- Problem identification and idea generation
- Idea validation
- Pitch making

UNIT IV - Innovative Leadership and Design Thinking

a. Innovative Leadership

- Concept of emotional and social intelligence
- Synthesis of human and artificial intelligence
- Why does culture matter for today's global leaders

b. Design Thinking

- What is design thinking?
- Key elements of design thinking:
  - Discovery
  - Interpretation
  - Ideation
  - Experimentation
  - Evolution.
- How to transform challenges into opportunities?
- How to develop human-centric solutions for creating social good?

UNIT V- Ethics and Integrity

a. Learning through Biographies

- What makes an individual great?
- Understanding the persona of a leader for deriving holistic inspiration
- Drawing insights for leadership
- How leaders sail through difficult situations?

b. Ethics and Conduct

- Importance of ethics
- Ethical decision making
- Personal and professional moral codes of conduct
- Creating a harmonious life

Bibliography and Suggested Readings :

Books

- Ashokan, M. S. (2015). *Karmayogi: A Bbiography of E. Sreedharan*. Penguin, UK.
- Brown, T. (2012). *Change by Design.* Harper Business
- Elkington, J., & Hartigan, P. (2008). *The Power of Unreasonable People: How Social Entrepreneurs Create Markets that Change the World*. Harvard Business Press.
- Goleman D. (1995). *Emotional Intelligence*. Bloomsbury Publishing India Private Limited
- Kalam A. A. (2003). *Ignited Minds: Unleashing the Power within India*. Penguin Books India

- Kelly T., Kelly D. (2014). *Creative Confidence: Unleashing the Creative Potential Within Us All.* William Collins
- Kurien V., & Salve G. (2012). *I Too Had a Dream*. Roli Books Private Limited
- Livermore D. A. (2010). *Leading with cultural intelligence: The New Secret to Success*. New York: American Management Association
- McCormack M. H. (1986). *What They Don't Teach You at Harvard Business School: Notes From A Street-Smart Executive*. RHUS
- O'Toole J. (2019) *The Enlightened Capitalists: Cautionary Tales of Business Pioneers Who Tried to Do Well by Doing Good.* Harpercollins
- Sinek S. (2009). *Start with Why: How Great Leaders Inspire Everyone to Take Action*. Penguin
- Sternberg R. J., Sternberg R. J., & Baltes P. B. (Eds.). (2004). *International Handbook of Intelligence*. Cambridge University Press.

E-Resources

- Fries, K. (2019). 8 Essential Qualities That Define Great Leadership. *Forbes*. Retrieved 2019- 02-15 from https://www.forbes.com/sites/kimberlyfries/2018/02/08/8-essential-qualities-that-define-great-leadership/#452ecc963b63.
- How to Build Your Creative Confidence, Ted Talk by David Kelly - https://www.ted. com/talks/david_kelley_how_to_build_your_creative_confidence
- India's Hidden Hot Beds of Invention Ted Talk by Anil Gupta - https://www.ted.com/ talks/anil_gupta_india_s_hidden_hotbeds_of_invention
- Knowledge@Wharton Interviews Former Indian President APJ Abdul Kalam - . "A Leader Should Know How to Manage Failure" https://www.youtube.com/ watch?v=laGZaS4sdeU
- Martin, R. (2007). How Successful Leaders Think. *Harvard Business Review*, *85*(6): 60.
- NPTEL Course on Leadership - https://nptel.ac.in/courses/122105021/9

SEMESTER V

Course Code	Course Title	L	T	P	C
22116AEC51	Food and Dairy Microbiology	4	1	0	4

Aim:

- To learn the role of microbes in food production, food spoilage and food borne illness.

Objectives

- To learn about factors involed in microbial food spoilage
- Understanding the food preservation methods
- To make aware of food borne diseases

Outcomes

CO1– To identify the role of microorganisms in the production of food

CO2– To know the milk and foods quality test for detecting microorganisms

CO3– To Gain the knowledge regarding food preservation

UNIT – I

Introduction: Importance of food and dairy Microbiology – Types of microorganisms in food – Source of contamination (primary sources) – Factors influencing microbial growth in foods (extrinsic and intrinsic).

UNIT – II

Food fermentations: Cheese, bread, wine, fermented vegetables – methods and organisms used. Food and enzymes from microorganisms – single cell protein, production of enzymes.

UNIT – III

Contamination, spoilage and preservation of different kinds of foods, cereals and cereal products – sugar and sugar products – vegetable and fruits – meat and meat products – fish and other sea foods – eggs and poultry – dairy and fermentative products (ice cream/milk/bread/wine).

UNIT – IV

Food Poisoning: food borne infections (a) Bacterial: *Staphylococcal, Brucella, Bacillus*, *Clostridium, Escherichia*, *Salmonella* (b) Fungal: Mycotoxins including aflatoxins, (c) Viral: Hepatitis, (d) Protozoa – Amoebiasis.

UNIT – V

Food preservation: Principles of food preservation – methods of preservation. a. Physical (irradiation, drying, heat processing, chilling and freezing, high pressure and modification of atmosphere) b. Chemical (Sodium benzoate Class I & II). Food Sanitation: Good manufacturing practices – Hazard analysis, Critical control points, Personnel hygiene.

Text Books

S. No	Author Name	Title of the Book	Edition/year	Publisher
1.	W.C. Frazier, D.C. Westhoff	Food Microbiology	4^{th} /1988	TATA McGraw Hill Publishing company ltd

Reference Book:

1. Banwart, G.J.1989. Basic Food Microbiology, Chapman & Hall New York.
2. Board, R.C.1983. A Modern Introduction to Food Microbiology, Blackwell Scientific Publications, Oxford.
3. Robinson, R.K.1990. Dairy Microbiology, Elsevier Applied Science, London.
4. Hobbs, B.C. and Roberts, D.1993. Food Poisiong and Food Hygiene, Edward Arnold (A division of Hodder and Stoughton), London.

Course Code	Course Title	L	T	P	C
22116AEC52	Molecular Biology	4	1	0	3

UNIT – I

Historical and conceptual background - Discovery of DNA as genetic material, Griffith's experiment, Hershy and Chase warring blender experiment, Chargaff's rule. Structures of DNA and RNA: Types of genetic material. DNA Structure: Salient features of double helix, types of DNA. RNA Structure. Denaturation and renaturation, cot curves. DNA topology: linking number, topoisomerases. DNA organization in prokaryotes, viruses, eukaryotes

UNIT – II

DNA replication in prokaryotes: Replicons – models of DNA replication – origin and termination of replication – rolling circle replication – proof for semi conservative replication (Meselson and Stahl Experiment) – enzymes and proteins involved in DNA replication (nucleases, polymerases, ligases, helicases, gyrases, single strand binding protein, replisome and primosome) – mechanism of semi discontinuous replication.

UNIT – III

Transcription: Steps involved in transcription of prokaryotes, promoters, transcription factors, RNA polymerases I, II and III – ribosomal RNA transcription and processing – genetic code, deciphering the genetic code, characteristics of genetic code, Wobble hypothesis, central dogma of life and reversal of central dogma.

UNIT – IV

Translation: Steps involved in translation of prokaryotes – role of proteasomes in protein degradation – mechanism of action of antibiotics on protein synthesis (puromycin, chloramphenicol and streptomycin). Regulation of gene expression in prokaryotes – polycistronic mRNA and operons (lac operon and trp operon and attenuation mechanism).

UNIT – V

Mutation: spontaneous and induced mutations – UV and X - rays – mechanism of action of base analogues, alkylating agents, intercalating agents and teratogens – reversion suppressor mutations and mutation rate – repair of damaged DNA - excision repair, SOS, photoreactivation – CRISPR and their role in genome stability

Text Books

S. No	Author Name	Title of the Book	Edition/year	Publisher
1.	U. Sathyanarayana	Biotechnology	2010	Arunabha Sen Books and Allied (P)Ltd
2	Dr. P. Asokan	Molecular Biology	2006	Chinnaa Publications
3	U. Sathyanarayana	Biotechnology	2010	Arunabha Sen Books and Allied (P)Ltd

References

1. Maloy SR, Cronan Jr.JE, Freifelder D.1994. Microbial Genetics. Jones and Bartlett Publishers.
2. Eckstein F, Lilley DM. 1992 Nucleic acids and Molecular Biology – Springer – Verlag.
3. Blackburn CM, Gait MJ. 1996. Nucleic acids in Chemistry and Biology – Oxford University Press.
4. Stryer L.1995. Biochemistry. W.H.Freeman and company.
5. Eckstein F, Lilley DM.1996 Catalytic RNA – Springer – Verlag.
6. Frieldberg EC, Walker GC, Siede W.1995. DNA repair and Mutagenesis. ASM press.
7. Gardner EJ, Simmons MJ, Snustad DP, 1991. Principles of Genetics. John Wiley & Sons.
8. Singer M, Berg P.1991. Genes and Genomes. University Science Books.

Course Code	Course Title	L	T	P	C
22116AEC53	Agricultural and Environmental Microbiology	4	1	0	4

Aim:

- To learn about microorganisms in the environment and their importance in agriculture.

Objectives

- To know the microbes in various environments like soil, water and air.
- Importance of microbes in agricultute and waste treatment.

Outcome

CO1 - To acquire the information about microbes

CO2 - To Know about microbes and its role in environment.

CO3 - Able to understand about microbes in agriculture and environmental practice.

UNIT – I

Classification of soils. Physical and chemical characteristics and microflora of various soil types. Interactions among microorganisms: Symbiosis – mutualism – commensalisms – competition – amensalism – synergism – parasitism – predation. Biogeochemical cycles. Carbon, nitrogen, phosphorus and sulphur.

UNIT – II

Biofertilizers. Symbiotic nitrogen fixation – (*Rhizobium, Frankia*) –Symbiotic nutrient mobilizers – Endomycorrhizae and Ectomycorrizae – Non symbiotic microbes – *Azotobacter* – *Azospirillum* – Cyanobacteria (*Nostoc. Gloeocapsa Anabaena)*.

UNIT – III

Microbial Association with higher plants – Rhizosphere – *Rhizobium* – infection – inoculation – nodule formation. Phylloplane association with animals. A brief account of the symptoms, etiology, life-cycle and management of bacterial (blight of paddy, citrus canker) and fungal (late blight of potato and red rot of sugarcane) diseases.

UNIT – IV

Microbiology of air – organisms in air, distribution and sources. Droplet nuclei, aerosol, assessment of air quality. Types of aquatic ecosystems: fresh water – ponds, lakes, streams. Marine habitats – estuaries, mangroves, deepsea, hydrothermal vents, saltt pans, coral reefs. Zonations – upwelling – eutrophication – food chain. Potability of water – microbial assessment of water quality – water purification – brief account of water - borne diseases.

UNIT – V

Types of wastes – characterization of solid and liquid wastes. Solid waste treatment – saccharification – gasification – composting, Utilization of solid wastes – food (SCP, mushroom, yeast); fuel (ethanol, methane, hydrogen); fertilizers (composting). Liquid waste treatment.

Treatment methods – primary –secondary (anaerobic – methanogenesis; aerobic- trickling activated sludge – oxidation pond – tertiary treatment.

Text Books

S. No	Author Name	Title of the Book	Edition/year	Publisher
1.	K.C. Agarwal	Environmental Biology	1998	Agro Botanica
2.	P. Rajendran, P. Gunasekaran	Microbial Bioremediation	2007	MJP Publishers
3.	R. C. Dubey, D.K. Maheswari	A Text Book of Microbiology	3rd / 2003	Chand Publishing
4.	Jr. M.J. Pelczar, E.C.S. Chan and N.R. Kreig.	Microbiology	5th /1993	Tata McGraw-Hill, Inc, Newyork

References

1. Ec Eldowney, S., Hardman, D.J. and Waite, S. 1993. Pollution: Ecology and Biotreatment – Longman Scientific Technical
2. Baker, W.C. and Herson, D.S.1994. Bioremediations – McGraw Hill Inc., New York
3. Ernest, W.C.1982. The Environment of the Deep sea, Vol II, J. G. Morin Rubey.
4. Rheinmer, G.1977. Microbial Ecology of Brackish Water environment: Ecological Studies – Vol-25, Springer – Verlag Nerlin – Heidellberg New York.
5. Norris, J.R and Pettipher, G.L.(1987). Essays in Agricultural and Food Microbiology, John wiley and Sons, Singapore.
6. Harold J.Benson, 1994. Microbiological applications. Wm.C.Brown Publishers, Melbourne, Australia.
7. Burges, A. and Raw, F. 1967. Soil Biology. Academic Press, London.
8. Martin Alexander Wiley. 1961. Introduction to Soil Microbiology. International Edn., New York.
9. Vanghan, D. and Malcolm, R.E.1985. Soil Organic Matter and Biological Activity. Martinus Nighoff W.Junk Publishers.

Course Code	Course Title	L	T	P	C
22116AEC55L	Food and Dairy Microbiology and Molecular Biology Lab	0	0	3	2

Aim:

- To analyze microbiological quality of food samples.

Objectives

- Microbiological tests used in the food industry.
- To study and characterize the foor borne microorganisms.

Outcome

CO1 - To Analyze the microbes in food and dairy industry products

CO2 - To understand the Production methods of Food and dairy products using microbes

CO3 - To gain Knowledge about Molecular Genome analysis and quantification

CO4 - To understand the Isolation of DNA and amplification using PCR technique.

CO5 - To know about Protein and DNA separation technique

Lab work

1. Assessment of milk quality by methylene blue reduction test
2. Wet mount preparation of fungal organism from spoiled bread, tomato, grapes, potato.
3. Observation of food samples to *study Leuconostoc sp. Lactobacillus sp., Streptococcus lacti* and *Saccharomyces*
4. Preparation of yoghurt
5. Determination of thermal death time (TDT) and thermal death point (TIP) of microorganisms from spoiled foods
6. Direct microscopic examination of milk by standard plate count(SPC) method
7. Isolation of plasmid DNA from bacteria by Spectrophotometric assay.
8. Isolation of chromosomal DNA from bacteria by Spectrophotometric assay.
9. Development of competent cells in ***E. coli***.
10. Isolation of antibiotic resistant auxotropic mutants.
11. Protoplast and Spheroplast isolation

Demonstration

1. Fermenting ability of yeast
2. Antibiotic resistance – plasmid mediated – chromosomal mediated – Gel Electrophoretic methods.
3. Principles and applications of agarose gel electrophoresis and plasmid sepearation in agarose gel.

Discipline Specific Elective -I

Course Code	Course Title	L	T	P	C
22116DSC54A	Bioinoculants	4	1	0	3

Aim:

- To study the importance of microbes as bioinoculants/biofertilizers.

Objectives

- To give an overview about role of microorganisms for the cycle of carbon, nitrogen, phosphorus and sulphur in the nature with a special focus on agrosystems.
- Importance of microorganisms for agricultural production and commercial composts.

Outcomes

CO1- To acquire knowledge in microbial products

CO2- To know the Separation techniques of primary and secondary metabolites

CO3- To grasp the Applications of value added products

CO4- To know the microbial inoculants in agricultural practices

UNIT – I

General account of the microbes used as a biofertilizersmfor crop plants and their advantages. Symbiotic N2 fixers: Rhizobium- Isolation, characterization, identification, classification, inoculum, production and field application. Frankia- Isolation, characterization-actinorrhizal nodules-non-leguminous crop symbiosis.

UNIT – II

Non-symbiotic N2 fixers-Azospirillum-Free living-Azotobacter-free isolation, characterization, mass inoculum production and field application.

UNIT – III

Symbiotic N2 fixers- Cyanobacteria, Azolla- Isolation, characterization, mass multiplication- role in rice cultivation- Crop response- field application- immobilization.

UNIT – IV

Phosphate solubilizers- phosphate solubilizing microbes- Isolation, characterization, mass inoculum production, field application- Phosphate solubilization mechanism.

UNIT – V

Mycorrhizal bioinoculants- classification- importance of mycorrizal Ectomycorrhizae-Endomycorrhizae- Ectendo mycorrhizae- Taxonomy of mycorrhizae- Isolation of VA mycorrhizae- quantification and assessment of VAM in roots- Mass inoculum production VAm-field applications of Ectomycorrhizae and VAM.

Reference:

1. Kannaiyan, S. (2003). Biotecnology of Biofertilizers, CHIPS, Texas.
2. Mahendra K. Rai (2005). Hand book of Microbial biofertilizers, The Haworth press, Inc. New York.

3. Reddy, S. M. et al. (2002). Bioinoculants for sustainable agriculture and forestry, Scientific Publishers.
4. Subba rao N. S (1995). Soil microorganisms and plant growth. Oxford and IBH publishing co. Pvt. Ltd. New delhi.
5. Subba rao N. S (1998). Biofertilizers in Agriculture and forestry. Oxford and IBH publishing co. Pvt. Ltd. New delhi.

Course Code	Course Title	L	T	P	C
22116DSC54B	Bioremediation practices	5	0	0	4

AIM

To know the basic principles of Bioremediation practices

COURSE OUTCOME :

CO1- Students gain the knowledge about Bioremediation I

CO2- Get the information about Bioremediation – II Solid phase bioremediation

CO3- learn about Hazardous Waste Management

CO4- Learn to the concept of bioremediation

CO5 - To know about Concepts of phytoremediation

Unit I

Bioremediation- I Introduction, constraints and priorities of Bioremediation, Biostimulation of Naturally occurring microbial activities, Bioaugmentation, in situ, ex situ, intrinsic & engineered bioremediation

Unit II

Bioremediation – II Solid phase bioremediation - land farming, prepared beds, soil piles, Phytoremediation. Composting, Bioventing & Biosparging; Liquid phase bioremediation - suspended bioreactors, fixed biofilm reactors.

Unit III

Hazardous Waste Management biotechnology application to hazardous waste management - examples of biotechnological applications to hazardous waste management – cyanide detoxification - detoxification of oxalate, urea etc. - toxic organics -phenols.

Unit IV

Concept of bioremediation (in-situ & ex-situ), Bioremediation of toxic metal ionsbiosorption and bioaccumulation principles.

Unit V

Concepts of phytoremediation. Microbial leaching of ore-direct and indirect mechanisms. Mining and metal. Use of microorganisms in augmentation of petroleum recovery. Biotechnology-with special reference to Copper and Iron.

References:

1. Environmental Biotechnology by S. K. Agarwal
2. Biodegradation & Bioremediation (1999), Martin Alexander, Academic press.
3. Stanier R. Y., Ingram J.L., Wheelis M.L., Painter R.R., General Microbiology, McMillan Publications, 1989.
4. Foster C.F., John Ware D.A., Environmental Biotechnology, Ellis Horwood Ltd., 1987.
5. Karrely D., Chakrabarty K., Omen G.S., Biotechnology and Biodegradation, Advances in Applied Biotechnology Series, Vol.4, Gulf Publications Co. London, 1989.
6. Bioremediation engineering; design and application 1995 John. T. cookson, Jr. Mc Graw Hill, Inc.
7. Environmental Biotechnology by A.K. Chatterjee 8. Environmental Biotechnology by S.N.Jogdand Himalaya Publishing

Course Code	Course Title	L	T	P	C
22116DSC54C	Advanced immunology	5	0	0	4

AIM

To know the basic principles ofAdvanced immunology

COURSE OUTCOME :

CO1- Students gain the knowledge about the Immune system

CO2- Get the information to Immune responses generated by B and T lymphocytes

CO3- Rapidly evolving scientific area into B-cell maturation, activation and differentiation;

CO4- get the knowledge about Antigen-antibody interactions

Unit I

Immunology- fundamental concepts and anatomy of the immune system Components of innate and acquired immunity; Phagocytosis; Complement and Inflammatory responses; Haematopoesis; Organs and cells of the immune systemprimary and secondary lymphoid organs; Antigens - immunogens, haptens; Major Histocompatibility Complex - MHC genes, MHC and immune responsiveness and disease susceptibility, HLA typing.

Unit II

Immune responses generated by B and T lymphocytes Immunoglobulins-basic structure, classes and subclasses of immunoglobulins, antigenic determinants; Multigene organization of immunoglobulin genes; B-cell receptor; Immunoglobulin superfamily; Principles of cell signaling; Immunological basis of self – non-self discrimination; Kinetics of immune response, memory.

Unit III

B-cell maturation, activation and differentiation; Generation of antibody diversity; T-cell maturation, activation and differentiation and T-cell receptors; Functional T Cell Subsets; Cellmediated immune responses, ADCC; Cytokines-properties, receptors and therapeutic uses; Antigen processing and presentation- endogenous antigens, exogenous antigens, non-peptide bacterial antigens and super-antigens; Cell-cell co-operation, Hapten-carrier system.

Unit IV

Antigen-antibody interactions Precipitation, agglutination and complement mediated immune reactions; Advanced immunological techniques - RIA, ELISA, Western blotting, ELISPOT assay, immunofluorescence, flow cytometry and immunoelectron microscopy; Surface plasma resonance, Biosenor assays for assessing ligand –receptor interaction, CMI techniqueslymphoproliferation assay, Mixed lymphocyte reaction, Cell Cytotoxicity assays, Apoptotosis, Microarrays, Transgenic mice, Gene knock outs.

Unit V

Vaccinology Active and passive immunization; Live, killed, attenuated, sub unit vaccines; Vaccine technology- Role and properties of adjuvants, recombinant DNA and protein based vaccines, plant-based vaccines, reverse vaccinology; Peptide vaccines, conjugate vaccines; Antibody genes and antibody engineering- chimeric and hybrid monoclonal antibodies; Catalytic antibodies and generation of immunoglobulin gene libraries.

References

1. William E. Paul, Fundamental Immunology, Wolters Kluwer/ Lippincott Williams & Wilkins.

2. Stephen K Wikel, The Immunology Host-Ectoparasitic arthropod relationships. Cabinternational.
3. Herman N. Eisen, MD, General Immunology. J.B. Lippincott Company. F.M. Burnet, Immonology. W.H. Freeman and company
4. Jack G. Chirikjian, Plant Biotechnology, Animal cell culture Immunobiotechnology. Jones and Bartlett Publishers.

Course Code	Course Title	L	T	P	C
22116DSC54D	Genomics and Proteomics	5	0	0	4

AIM

To know the basic principles of genes and proteins

OBJECTIVES:

To understand the gene functions and its genetic engineering aspects To understand the protein functions and its genetic engineering aspects

COURSE OUTCOME :

CO1- Students gain the knowledge about the interactions between the proteins

CO2- Get the information to predict cell behavior or develop drug targets.

CO3- Rapidly evolving scientific area into ***genomes***, proteomes and databases

CO4- Learn to store various data NCBI, DDBJ and EMBL

Unit I

Genomics: genetic and physical maps, physical mapping and map-based cloning, choice ofmapping population, simple sequence repeat loci, southern and fluorescence in situ hybridization(FSH) for genome analysis, chromosome microdisection, molecular markers in genome analysis

Unit II

Genome sequencing: genome sizes, organelle genomes, genomic libraries, strategies for genome sequencing, packaging, transfection and recovery of clones, application of sequence information for identification of defective genes. Pharmacogenetics, cancer genetics; immunogenetics; mapping of human genome; somatic cell genetics; DNA polymorphism in mapping; structure and function; biochemical genetics; polygenic inheritance

Unit III

Proteomics: Sample preparation, Gel-based proteomics - two-dimensional gel electrophoresis (2- DGE), two-dimensional fluorescence difference in-gel electrophoresis (DIGE), Staining methods, PF- 2D, Tandem FPLC, Mass spectroscopy: basic principle, ionization sources, mass analyzers, different types of mass spectrometers (MALDI-TOF Q-TOF, LC-MS).

Unit IV

Nuclear magnetic resonance spectroscopy (NMR), basic principles, chemical shift, spinspin interaction, NOE, 2D-NMR, NOESY,COSEY. X-ray Crystallography: Principle of X-ray diffraction, scattering vector, structure factor, phase problem, reciprocal lattice and Ewald sphere, Miller indices, Zone axes, crystal lattice, Lane Equations, Bragg's law, special properties of protein crystals, model building, refinement and R-factor.

Unit V

Protein Engineering: Protein sources, Industrial and medical application of proteins, different expression of proteins for large scale purifications, protein engineering strategy, rational and random mutagenesis. Applications of protein engineering-protein in Chemical and Medical Industries: Generation of heat stable, pH stable engymes, application in vaccine development, drug development, sensor development.

References

1. Gupta, P.K. 2004. Biotechnology and Genomics. First edition. Rastogi Publications, Meerut.
2. Miglani, G.S. 2007. Advanced Genetics. New Delhi: Narosa Publishing House.
3. Primrose, S.B. and Twyman, R.M. 2006. Principles of Gene Manipulation and Genomics. Blackwell Publishing, Australia.
4. Singh, B.D. 2009. Biotechnology: Expanding Horizons. Second Edition. Kalyani Publishers, Ludhiana.
5. Singh, B.D. 2009. Plant Biotechnology. Kalyani Publishers, Ludhiana.

Course Code	Course Title	L	T	P	C
22116AEC56L	Agricultural and Environmental Microbiology Lab	0	0	3	2

Aim:

- Understanding the techniques to study the environmental / agriculture microorganisms.

Objectives

- Isolation and characterization of agriculture important microbes.
- To study the environmental microbes and their impact.

Outcome

CO1 - To acquire the information about microbes role in agriculture

CO2 - To Learn about Biofertilizer production

CO3 - To Know about microbes and its role in environment

Lab work

1. Isolation and culturing of *Rhizobium* from root nodules.
2. Isolation and culturing of *Azospirillum* from grassplant.
3. Isolation and culturing of *Azotobacter* from paddy field
4. Isolation and culturing of *Phosphobacter* from paddy field
5. Isolation and culturing of Blue Green Algae from paddy field
6. Isolation and identification of air-borne bio-particles using Open plate method
7. Effects of high salt concentration on microbial growth
8. Microbial flora of polluted water – Microbial flora of sewage
9. Bacterial examination of drinking water by membrane filter technique and MPN

Course Code	Course Title	L	T	P	C
221ACLSPSL	Professional Skills	-	-	-	2

Aim:

Course Objectives :

The Objectives of the course are to help students/candidates:

1. Acquire career skills and fully pursue to partake in a successful career path
2. Prepare good resume, prepare for interviews and group discussions
3. Explore desired career opportunities in the employment market in consideration of an individual SWOT.

Course Outcomes :

At the end of this course the students will be able to:

1. Prepare their resume in an appropriate template without grammatical and other errors and using proper syntax
2. Participate in a simulated interview
3. Actively participate in group discussions towards gainful employment
4. Capture a self - interview simulation video regarding the job role concerned
5. Enlist the common errors generally made by candidates in an interview
6. Perform appropriately and effectively in group discussions
7. Explore sources (online/offline) of career opportunities
8. Identify career opportunities in consideration of their own potential and aspirations
9. Use the necessary components required to prepare for a career in an identified occupation (as a case study).

Unit I: Resume Skills

Resume Skills : Preparation and Presentation

- Introduction of resume and its importance
- Difference between a CV, Resume and Bio data
- Essential components of a good resume

ii. Resume skills : common errors

- Common errors people generally make in preparing their resume
- Prepare a good resume of her/his considering all essential

components

Unit II: Interview Skills

i. Interview Skills : Preparation and Presentation

- Meaning and types of interview (F2F, telephonic, video, etc.)
- Dress Code, Background Research, Do's and Don'ts
- Situation, Task, Approach and Response (STAR Approach) for facing an interview
- Interview procedure (opening, listening skills, closure, etc.)
- Important questions generally asked in a job interview (open and closed ended questions)

ii. Interview Skills : Simulation

- Observation of exemplary interviews
- Comment critically on simulated interviews

iii. Interview Skills : Common Errors

- Discuss the common errors generally candidates make in interview
- Demonstrate an ideal interview

Unit III: Group Discussion Skills

Meaning and methods of Group Discussion

- Procedure of Group Discussion
- Group Discussion- Simulation
- Group Discussion - Common Errors

Unit IV: Exploring Career Opportunities

Knowing yourself – personal characteristics

- Knowledge about the world of work, requirements of jobs including self-employment.
- Sources of career information
- Preparing for a career based on their potentials and availability of opportunities

SEMESTER VI

Course Code	Course Title	L	T	P	C
22116AEC61	Industrial Microbiology	4	1	0	4

Aim:

- Understanding the industrial importance of microorganisms and their products.

Objectives

- To study the development of industrial microbiology and microbes of industrial prominence.
- To aquire knowledge on design of fermentors and its types.
- Industrial production of various pharmaceutical and commercial products using microbes.

Outcomes

CO1**-** To understand the vital role of various substrate used in fermentation.

CO2- To Learn the different types of reactors or fermenters.

CO3- To gain knowledge about upstream and downstream processing

Co4 - To acquire the knowledge on different product production

UNIT – I

Historical development of Industrial Microbiology, Industrially important microorganisms, Primary and secondary screening and preservation of industrially important strains. Microbial strains improvement. Primary and secondary metabolites.

UNIT – II

Fermenter: Design, types and basic functions of fermenter. Fermentation media formulation strategies, Essential factors (pH and temperature, incubation), carbon, nitrogen, vitamin and mineral sources, role of buffers, precursors, inhibitors, inducers and antifoams, types of fermentation.

UNIT – III

Downstream processing: Product recovery and purification (intracellular and extracellular), cell disruption, precipitation, filtration, centrifugation, solvent recovery, chromatography, ultrafiltration, drying, Enzyme and cells immobilizations and its applications.

UNIT – IV

Microbial products of pharmaceutical value – raw materials, organism and Industrial processes involved in the production of Pencillin, Streptomycin, Vitamin B12, Riboflavin and rabies vaccine.

UNIT – V

Microbial products of Industrial value – Raw materials, organism and Industrial processes involved in the production of ethanol, vinegar, amylase, protease, glutamic acid. Recycling and safe disposal of Industrial wastes through microbes.

Text Book

1. Stanbury, P.F.Whitaker, A.Hall, S.J. 1995. Principles of Fermentation Technology, Pergamon Press.
2. Sikyta, B.1983. Methods in Industrial Microbiology, Ellis horwood limited.
3. Click, B.R.Pasternak, J.J.1994. Molecular Biotechnology – ASM Press.

Reference:

1. Demain A.L.Solomon, N.A.1986. Mannuall of Industrial Microbiology and Biotechnology. ASM Press
2. Reed. G. 1982. Prescott and Dunn's Industrial Microbiology. Macmillian Publishers.
3. Prave, P.Faust, V, Sitting, W., Sukatsch, DA. 1987. Fundamentals of Biotechnology. ASM Press.
4. Malik V.S.Sridhar, P.1992. Industrial Biotechnology. Oxford & IBH.
5. Venkataraman, L.V.1983. A Monograph on Spirulina platensis. CFTRI, Mysore.

Course Code	Course Title	L	T	P	C
22116SEC62	Clinical Microbiology	4	1	0	5

Aim:

- To understand the clinical significance of microorganisms.

Objectives

- To study virulance of pathogenic microbes.
- To understand the pathogenesis and treatment methods of various diseases
- To understand the various diagnostic techniques.

Outcomes

CO1- To Understand the basic and general concepts of Normal flora of the human body

CO2 –To Understand the sources of infectious diseases and transmission

CO3 - To Study the pathogenicity of bacterial, fungal, protozoa and viral diseases

CO4- To Understand the preventive measures of Hospital acquired infections

UNIT – I

Basics in Medical microbiology - Infectious diseases overview. Medically important microbes. Normal microbial flora of the human body, Host-microbe interactions – virulence factors of microbes. Invasiveness and pathogenicity. Immunity of microbial diseases

UNIT – II

Diagnostic Microbiology – collection and transport of specimen for Microbiological examination – General methods for isolation and identification of bacteria. Typing of bacterial isolates. Sero-diagnosis.

UNIT – III

Clinical symptoms. Epidemiology, pathogenesis, laboratory diagnosis, prevention and treatment of the following bacterial infections (a) Streptococcal infections, (b) Staphylococcal infections, (c) Meningits, (d) Tuberculosis, (e) Leprosy, (f)Gastrointestinal disorders – typhoid, cholera, bacillary dysentery, (g) Sexually transmitted diseases – syphilis, gonorrhea. (h) Anerobic wound infection – tetanus, gas gangrene.

UNIT – IV

Clinical symptoms. Epidemiology, pathogenesis, laboratory diagnosis, prevention and treatment of the following viral infections (a) Respiratory infections, common cold, influenza, measles, mumps and rubella. (b) neurological infection – encephalitis (Dengue, Japanese encephalitis), Rabies (c) Liver diseases : Hepatitis A,B,C,D & E (d) Immunodeficiency diseases, AIDS, CMV (Cytomegaloviruses) Herpes simplex viruses.

UNIT – V

Clinical symptoms. Epidemiology, pathogenesis, laboratory, prevention and treatment of the following fungal and protozoan infections (a) Fungal – superficial, subcutaneous and systemic mycoses, (b) Protozoan: Amoebiasis, Malaria, Leishmaniasis, (c) Helminths – Filariasis, Ascariasis, Zoonotic diseases, Hospital acquired infections.

Text Book

1. Schaechter, M.Medoff, G. and Eisenstein, B.C.(1993). Mechanism of Microbial Diseases. 2nd edition. Williams & Wilkins, Baltimore.
2. J.C. Collee, J.P., Duguid, A. C. Fraser, B.P. and Marimon (1989). Mackie and Mc Carteny Practical Medical Microbiology – 13th Edition, Churchill Livingstone.

Reference:

1. Ronald M.Atias (1989). Microbiology, Fundamentals and Applications. II edition. Maxwell Macmillan International editions.
2. E.Joan Stokes, G.L.Ridgway and M.W.D.Wren(1993). Clinical Microbiology. 7th edition. Edward Arnold. A division of Hodder and Stoughton.
3. David Greenwood, Richard C.B.Stack and John Forrest Peutherer. (1992). Medical Microbiology. 14th edition. ELBS with Churchill Livingstone.
4. Huge W.B. and Russell A.D.(1989). Pharmaceutical Microbiology. IV edition. Blackwell Scientific Publicaiton, Oxford.
5. Topley / Wilson's (1990). Principles of Bacteriology, Virology and Immunity, VIII edition, Vol.III Bacterial Diseases, Edward Arnold, London.

Discipline Specific Elective - II

Course Code	Course Title	L	T	P	C
22116DSC63B	Bioethics	4	1	0	3

Aim:

- To recognise and understand ethical concepts in biological research.

Objectives

- Understands and can apply the various theories and principles of bioethics
- Can scrutinise and identify health, administrative and public health policies to identify ethical issues
- Bioethics in medicine and clinical research

Outcomes

CO1- To identify ethical issues in a research proposal

CO2- To Understand the Intellectual property Rights (IPR) and patent filling.

CO3- To gain Knowledge about to ensure ethical conduct of biomedical research

CO4- To Describe the basic concepts of legal, ethical, economic, and regulatory measurements.

UNIT – I

General Ethical concerns: the use of nature, Different views of nature, Dynamic nature, interfering with nature, integrity of species; Reducing genetic diversity; Biological warfare; public perception of science.

UNIT – II

Medical ethics; History and culture: The Hippocratic tradition: a profession, Philanthropy, Do no harm, adoption to the oath by western medicine. Competing ethical. Traditions; Retaining the Hippocratic oath.

UNIT – III

Status of Human embryo: Human Embryonic development; Ethics through embryo development: Fertilization, the fetus and feeling pain; Scientific Research on Human Embryos: Experimental goals of Human Embryo Research, Human Development; How much Embryo experimentation in ethical?

UNIT – IV

Animal Rights: Making new strains of animal: Ethical limits of animal use: Religious views of animal status; Philosophical views of animal status; regulations.

UNIT –V

Human Gene therapy: Ethics of somatic cells gene therapy: Efficiency of treatment; safety of transferred genes; protecting human life; Affect on family life; Economic factors; when we should use Gene therapy?

References:

Nancy, S. Jecker., Albert R. Johnson, Robert A. Pearlman. Bioethics: An Introduction to history, methods and practice (1997). Sudbury, M. A, ; Jones and Barlett Publishers.

Tom, L. Beauchamp., childress, F. Principles of biomedical ethics, 5th edition, Oxford University Press. 2000.

Course Code	Course Title	L	T	P	C
22116DSC63B	Biomolecules	4	1	0	3

AIM

To know the functions of Biomolecules

OBJECTIVE :

- To understand the structure and functions of carbohydrates, lipids , proteins and nucleic acids
- To understand the role of nucleic acid in proteins synthesis

OUTCOME

CO1- They acquire knowledge in the quantitative and qualitative estimation of biomolecules

CO2- They study the influence and role of structure in reactivity of biomolecules

CO3- Students have a thorough understanding on the role of biomolecules and their functions.

Unit I

Carbohydrates: Structure and biological functions of Mono, di and Polysaccharides. Types of polysaccharides: Homo polysaccharides -chitin, fructans, mannans, xylans, and galactans. Structure and biological importance of Hetero polysaccharides- Glycoprotein – bacterial cell wall polysaccharides, marine polysaccharides and Lectins.

Unit II

Aminoacids and its general properties. Classification of amino acids. Proteins– classification and general properties. Orders of protein structure, Primary- Secondary structure– the α-helix, β- pleated sheet. Protein sequencing methods.

Unit III

Lipids: Definition and classification of lipids. Biological significance of lipids. Types of Fatty acids-Essential, Non essential. Structure and biological functions of phospholipids, sphingolipids, glycolipids. Steroids – structure and functions of cholesterol, bile acids, sex hormones, ergosterol. Structure and biological role of prostaglandins, thromboxanes and leukotrienes.

Unit IV

Nucleic acid: Structure of purines, pyrimidines, nucleosides and nucleotides. DNA double helical structure. A, B and Z forms of DNA. Properties of DNA- Density, viscosity, hypochromicity, denaturation and renaturation. DNA sequencing– chemical and enzymatic methods. Chemical synthesis of DNA. RNA– types and biological role- Secondary, tertiary structures of RNA.

Unit V

Vitamins: Definition and Classification - Source, Structure and biological role - Daily requirements and deficiency manifestation of fat soluble vitamins and water soluble vitamins.

Text Books

S. No	Author Name	Title of the Paper	Edition/year	Publication
1.	J. L. Jain	Fundamentals of Biochemistry	1st / 2005	S. Chand and Company

References

1. Biochemistry Dubay 4th edition William C.Brown Publication, 1998.
2. Biochemistry. Davidson and Sittmann, NMS 4th ed. Lippincott William's and Wilkins, 1999
3. Biochemistry – Voet and Voet. J O H N WI VP &*Publisher* Kaye Pace Associate Publisher*,* 2011.
4. Biochemistry Student Companion, by Berg, 7th Edition Berg, Jeremy M. / Tymoczko, John L. / Stryer, Lubert Published by W. H. Freeman, 2011.

Course Code	Course Title	L	T	P	C
22116DSC63C	Medical Microbiology	4	1	0	3

AIM

- To inculcate on the role of normal flora and pathogenic microbes.

OBJECTIVE

- To understand the pathogenesis of various diseases
- To understand the various clinical microbiological techniques.

OUTCOME

CO1-Learn normal flora of human body

CO2- Get information about various sources ofinfection and transmission

CO3- Epidemiology, pathogenesis and treatment of bacterial, fungal and viral diseases

CO4- Learn Strategy of antimicrobial therapy.

Unit – I

Normal microbial flora of human – Host – parasite interaction: The Process of infection. Infective syndromes and diagnositic procedure - Strategy of antimicrobial therapy – Epidemiology and control of community infections.

Unit – II

General properties, epidemiology, transmission, pathogenesis, Symptoms, laboratory diagnosis, prevention and Treatment of the following Bacterial diseases:a) Pneumonia, b) Whooping-cough, c) Meningitisd) Diphtheriae) Pulmonary Tuberculosis,f) Leprosy, g) Typhoid, h) Cholera i) Tetanus, j) Syphillis, k) Gonorrhoea, d) Dental carries.

Unit - III

Mycobacterium: Mycobacterium tuberculosis, Mycobacterium leprae. Spirochaetes, Mycoplasma, Actinomycetes, Helicobacter, Compylobacter and other miscellaneous bacteria, Rickettsia, Chlamydia.

Unit – IV

General properties, epidemiology, transmission, pathogenesis, Symptoms, laboratory diagnosis, prevention and Treatment of the following viral diseases: Small pox, Influenza, Measles, Poliomyelitis, Common cold(Rhino virus), Hepatitis, Encephalitis, Rabies, AIDS.

Unit – V

Pathogenic Fungal diseases- Superficial, Subcutaneous and systemic mycoses, Protozoa-Amoebiasis, Malaria, Helminthes-Liverfluke, Filariosis, Hospital acquired infections:Hospital infections Principles of control – Committee – functions; Hospital waste disposal – Ethical committee – functions.

Text Books

S. No	Author Name	Title of the Paper	Edition/year	Publication
1.	Sherris	Medical Microbiology	4^{th}/2004	McGraw-Hill Companies, Inc.

2.	V.V. Kale, K.P. Bhusari	Applied Microbiology (Pharmacy and other Bioscience)	1^{st}/2001	Himalaya Publishing House
3.	Jr. M.J. Pelczar, E.C.S. Chan and N.R. Kreig.	Microbiology	5^{th} /1993	Tata McGraw-Hill, Inc, Newyork

References

1 Schachter, M., Med off, G. and Eisenstein, B.C.(1993) mechanism disease, 2^{nd} Edn. Williams and Wilkins Baltimore

2 Ananthanarayan & Paniker's Textbook of Microbiology, 8th Ed., Orient Longsman, India; 2009

3 Smith, C.G.C(1976).Epidemiology and Infections. Medowlealf PressL shildon, England

4 Stokes,J., Ridway, G.L., and Wren, M.W.D.,(1993). Clinical Microbiology 7^{th} Edn. Arnold a division of Hodder and Stoughton.

5 Wistriench, G.A. And lechtonan, M.D.(1988). Microbiology, 5^{th} Edn., Mac publishing company NY

6 Atlas, R.M. (1989) Microbiology – fundamentals and applications 2^{nd} Edn. Maxwell Mac Millan International Edition

Course Code	Course Title	L	T	P	C
22116DSC63D	Bacterial Genetics	4	1	0	3

AIM

- The emergence of molecular genetics has revolutionized large areas of modern biological and biochemical research work and has had a huge impact on the biotechnology industry.

OBJECTIVE

- To extend the knowledge on molecular basis of mutation at microbial level
- To focus on gene regulation and expression mechanisms
- To understand the principles role of plasmids and gene transfer methods

OUTCOME

CO1- Understood genome organization of model organisms.

CO2 - Learn molecular mechanisms that underlie mutations.

CO3- Study about transformation,transduction and conjugation.

CO4- Are able to describe the nature of the transposable elements

Unit I

Trends in Gene discovery. Nucleic acids as genetic information carriers: concept of gene – allele, cistron, replicon – origin of mutation – mutagens – physical, chemical and biological agents. Induced mutation types – mechanisms of mutation induction – suppression of mutations – Intergenic and intragenic suppression.

Unit II

Transformation- Griffith experiments, natural or artificial competence transformation in Bacillus, E. coli, ***Haemophilus*** and ***Streptococcus*** – mechanism of recombination – genetic mapping.

Unit III

Bacterial conjugation – F plasmid – structure and functions. Origin of Conjugation – Hfr and F’ strains. Interrupted and uninterrupted mating – time map and recombination map. Conjugation in ***E. coli, Pseudomonas.*** Plasmids, F-factors description and their uses in genetic analysis. Colicins and col factors.

Unit IV

Transduction – generalized and specialized transduction – P1 phage – mechanism of gene transfer through lambda and P1 phages. HFT and LFT lysate. Co- transduction – transduction mapping.

Unit V

Regulation of bacterial gene expression – Operon model – lac, ara, trp and his operons, operon concept, catabolite repression, instability of bacterial RNA, positive and negative regulation, inducers and co-repressors. Attenuation – lac and trp operons; Human genetics:

pedigree Analysis, Genetic disease through gene map, Micro array techniques, Single nucleotide polymorphisms (SNPs)

Text Books

S. No	Author Name	Title of the Paper	Edition/year	Publication
1.	Larry Snyder, Wendy Champness	Molecular Genetics of Bacteria	1997	American society of Microbiology
2.	David Freifelder	Molecular Biology	2^{nd}/1990	Narosa Publishing House
3.	William S. Klug, Michael R. cummings	Concept of Genetics	7^{th}/2003	Pearson Education(Singapore) Pte. Ltd.

References

1. Siger, M., Berg, P. (1991). Genes and Genomes, University Science Book.
2. Snustad, D., Simmons, J. and Jenkins, B. (1997). Principles of Genetics, First edition, John Wiley and Sons.
3. Watson, J.D., Hopkins, N.H., Roberts, J.W., Stietz, J.A. and Weiner, A.M. (1998). Molecular biology of the gene, 4^{th} edition, Benjamin / Cummings Publishing Company.

Course Code	Course Title	L	T	P	C
22116AEC64L	Industrial Microbiology Lab	0	0	3	2

Aim:

- To train students for industrial production of microbial products.

Objectives

- Methods for screening of industrial important microbes.
- Production of various commercial products using microorganisms.

Outcomes

CO1- To acquire hands on training various microbes for industrial practices

CO2- To know the Screening of desired microbes

CO3-To Learn the optimization process for scale up process

CO4-To understand the technical knowledge on upstream and downstream processing.

Lab work

1. Whole cell immobilization – alginate –Cyanobacteria
2. Estimation of citric acid - *Aspergillus*
3. Estimation of ethanol - Fruit juice
4. Spawn production - Mushroom
5. Mushroom cultivation
6. Starch hydrolysis

Demonstration

1. Preparation of fermented food –cheese

Course Code	Course Title	L	T	P	C
22116SEC65L	Clinical Microbiology Lab	0	0	3	2

Aim:

- To provide technical knowledge on collection and processing of clinical samples.

Objectives

- To isolate and identify the pathogens present in clinical samples.

Outcomes

CO1- To Get practical knowledge in specimen collection and processing

CO2- To gain Knowledge about cyst and protozoa identification.

CO3- To know the Technical practice on diagnosis of pathogenic infection

CO4- To Determine antimicrobial activity of microorganisms.

Lab work

1. Examination of parastic ova and cysts from faecal samples.
2. Identificaiton of pathogenic organism with a smear, culture and biochemical test
3. *Staphylococcus sp, E.coli, Klebsiella sp,*and *Salmonella typhi*

Demonstration

1. LP Mount - *Trichophyton sp.* *Microsporum sp*

Spotters:

2. Slides of pathogenic bacteria, fungi and parasites:
3. Electron micrographs of viruses – Pox viruses, Herpes simplex virus, HIV, HBV,

- *Staphylococci*
- *Streptococci*
- *Mycobacterium leprae*
- *Tryponema pallidium*
- *Leptospira sp.*
- *Bacillus subtilis*
- *Klebsiella sp.*
- *E.coil.*
- *Clostridium tetani*.
- Permanent mounts of dermatophytes
- *Candida* sp.
- *Cryptococcus* sp.
- *Maduromycetes*.

Course Code	Course Title	L	T	P	C
221ACLSCET	**Community Engagement**	-	-	-	1

Course Objectives:

- To develop an appreciation of rural culture, life-style and wisdom amongst students
- To learn about the status of various agricultural and rural development programmes
- To understand causes for rural distress and poverty and explore solutions for the same
- To apply classroom knowledge of courses to field realities and thereby improve quality of Learning

Course Outcomes:

After completing this course, student will be able to

- Gain an understanding of rural life, culture and social realities
- Develop a sense of empathy and bonds of mutuality with local community
- Appreciate significant contributions of local communities to Indian society and economy
- Learn to value the local knowledge and wisdom of the community
- Identify opportunities for contributing to community's socio-economic improvements

UNIT I - Appreciation of Rural Society

Rural life style, rural society, caste and gender relations, rural values with respect to community, nature and resources, elaboration of "soul of India lies in villages" (Gandhi), rural infrastructure.

UNIT II- Understanding rural economy & livelihood

Agriculture, farming, landownership, water management, animal husbandry, non-farm livelihoods and artisans, rural entrepreneurs, rural markets

UNIT III Rural Institutions

Traditional rural organisations, Self-help Groups, Panchayati raj institutions (Gram Sabha, Gram Panchayat, Standing Committees), local civil society, local administration

UNIT IV Rural Development Programmes

History of rural development in India, current national programmes: Sarva Shiksha Abhiyan, Beti Bachao, Beti Padhao, Ayushman Bharat, Swatchh Bharat, PM AwaasYojana, Skill India, Gram Panchayat Decentralised Planning, NRLM, MNREGA, etc.

Open Elective

Course Code	Course Title	L	T	P	C
221ENOEC	**Journalism**	**4**	**0**	**0**	**2**

Aim :

- To acquaint with the basic knowledge of journalism

Objective:

- To instil in the minds of students the different aspects of journalism
- To understand the different kinds of news
- To learn the qualities and duties of a reporter, editor and sub-editor
- To familiarize with the style and features of the different sections in a newspaper

Outcome:

- Become a journalist
- Explore the different kinds of news

UNIT- I

Journalism – Definition, Qualities of a journalist, Forms of journalism, Role and elements

UNIT- II

News – Definition, Kinds, Elements, Sources

UNIT- III

Reporters

UNIT- IV

The Editor and the Sub-editor

UNIT –V

Language of Journalism, Style

Qualities of a Writer

Writing a News story, Opinion Pieces, Reviews, Headlines, Editorials

Reference Book:-

Author	Title of the book	Edition / Year	Publisher
Susan	Journalism		
John Hogenberg	Professional Journalism	2012	
M.James Neal	News Writing and Reporting		Surjeet Publication
M.V Komath	The Journalist's Handbook		

Course code	Course Title	L	T	P	C
221MAOEC	Development of Mathematics Skills	4	0	0	2

Aim:

- To understand the concepts from the five branches of mathematics

Objectives

- Knowledge and understanding are fundamental to study mathematics and form the base from which to explore concepts and develop problem-solving skills. Through knowledge and understanding students develop mathematical reasoning to make deductions and solve problems.
- To develop student's ability to apply both conventional and creative techniques to the solution of mathematical problems

Outcomes

- Know and demonstrate understanding of the concepts from the five branches of mathematics (Operations Research, Set Theory, Statistics, Matrices and Business mathematics)
- Use appropriate mathematical concepts and skills to solve problems in both familiar and unfamiliar situations including those in real-life contexts
- Select and apply general rules correctly to solve problems including those in real-life contexts.

Unit I

Simple interest and compound interest

Unit II

Sinking fund – discounting – trade discount – quantity discount – cash discount

Unit III

Set theory – Series

Unit IV

Matrices – Determinants

Unit V

Assignment problems

References

P.A.Navanitham, Business Mathematics & Statistics

Kanti Swarup, P.K.Gupta and Manmohan, "Operations Research"

Course Code	Course Title	L	T	P	C
221PHGEC	Instrumentation	4	0	0	2

Aim:

Making and analyzing measurements is the primary task of the experimental physicist. This includes designing experiments. Most experimental work, whether in bench-top situations, or using complex instruments. To many physicists this can be as interesting and involving as the basic physics one is trying to do.

Objectives:

- To build the strong foundation in physics of students needed for the field of Instrumentation.
- To prepare student to apply reasoning informed by the contextual knowledge to practice.
- To provide opportunity for students to work as part of teams on multi-disciplinary projects.

UNIT – I: INTRODUCTION

Potentiometer - calibration of volt meter and ammeter, measurement of resistance, Principles of network theorems – Thevenin's and Norton's theorem – Bridges : AC bridges – Maxwell, Owen, Schering and deSauty's bridges – Wien bridges.

UNIT – II: ELECTRONIC INSTRUMENTS – I

Basic characteristics of instruments – resolution – sensitivity - Audio frequency oscillator, Conversion of galvanometer into voltmeter and ammeter – resistance meter - Amplified D.C. meter – Chopper stabilized amplifier – A.C. Voltmeter using ectifiers – Electronic multimeter – Differential voltmeter – Digital voltmeters – Component measuring instruments (quantitative studies)

UNIT – III: ELECTRONIC INSTRUMENTS – II

Signal conditioning systems – DC and AC carrier systems – Instrumentation amplifiers – ibrating capacitor amplifier – Analog to digital data and sampling – A/D and D/A convertor successive approximation, ladder and dual slope converseons).

Unit IV – Recording Devices

Recorders necessity – Recording requirements – Analog recorders – Graphic recorders – strip chart recorders – Galvanometer types recorders – Null type recorders.

Unit V – CRO

CRO – Construction and action – Beam transit time and frequency limitations – Measurement of potential, current, resistance, phase and frequency – Special purpose oscilloscopes – Sampling storage oscilloscope.

Books for Study

1. Electronic Instrumentation and Measurement techniques – W.D. Cooper and A.D. Helfrick – PHI – Third edn. – 1989

Learning Outcomes:

- Appreciate important practical aspects of theoretical knowledge: how important components work, when to impedance match, non-ideal behaviour of op-amps etc.
- Acquire a sound understanding of the role of noise in measurement systems and know how to apply noise reduction techniques.

Books for Reference:

1. A course in electrical and electronic measurements and Instrumentation – A.K. Sawhmey – DhanpatRai and Sons – 1990.

2. Electronic measurements and instrumentation – Oliver Cage – McGraw Hill – 1975.

Course Code	Course Title	L	T	P	C
221CEOEC	Food and Adulteration	4	0	0	2

Aim:

- To introduce students to food safety and standardization act and quality control of foods.

Objectives:

- To educate about common food adulterants and their detection.
- To impart knowledge in the legislatory aspects of adulteration.
- To educate about standards and composition of foods and role of consumer.

Outcomes:

- The students will have knowledge about different processing and preservation methods and principles involved.

Unit-I Introduction to Food Chemistry

Introduction to Food Chemistry- Water (Structure of water and ice, Physical constants of water, Types of water, Water activity) Composition of Food- Carbohydrates, Proteins, Lipids, Vitamins & Minerals.

Unit- II Food Pigments

Introduction- classification, types of food pigments- chlorophyll, carotenoids, anthocyanins, flavanoids.

Unit – III Food Preservation

Introduction - Importance, principle and Types.
High and low temperatures preservation - Pasteurization - Sterilization- Canning- Freezing- Refrigeration.

Unit – IV Food Additives

Introduction- antioxidants, sequestrants, preservatives, nutrient supplement, emulsifiers, stabilizers and thickening agents, bleaching and maturing agent, sweeteners, humectants and anti -caking agents, coloring and flavoring substance.

Unit-V Food Adulteration

Types of adulterants- intentional and incidental adulterants, methods of detection.
Detection of common food adulterants in Spices , Grains, Coffee , Tea, Oil fats , Food colours and Milk. Health hazards and risks.

References:

1. The Food Safety and Standard ACT, 2006 – Seth & Capoor
2. Hand book of Food Adulteration and Safety Laws – Sumeet Malik
3. Food Science – B.Srilakshmi

Course Code	Course Title	L	T	P	C
221CSOEC	E Learning	4	0	0	2

COURSE OBJECTIVES

- Learn the basics of E-Learning concepts.
- Learn the content development techniques.

COURSE OUTCOMES

- Develop e – learning application on their own.
- Ability to develop contents for e-learning.
- To perform course management using tools.

UNIT I INTRODUCTION

Introduction – Training and Learning, Understanding elearning, components and models of e-learning, Advocacy of e-learning – benefits, learning styles, criteria for choosing, - Applications of E-learning.

UNIT II CONCEPTS and DESIGN

E-Learning Strategy, the essential elements of elearning strategy, Quality assuring e-learning, suppliers and resources, virtual learning environments, authoring tools, e-assessment, Learning Design Issues – purpose, general principles, designing live e-learning, designing self managed learning.

UNIT III APPLICATIONS

Moodle 2.0 E-Learning Course Development – Features, Architecture, Installation and Configuring Site.

UNIT IV COURSE MANAGEMENT

Creating – Categories, Courses, Adding Static Course Material – Links, Pages, Moodle HTML Editor, Media Files, Interacting with Lessons and Assignments – Evaluating Students – Quizzes and Feedback.

UNIT V ENHANCEMENT

Adding Social Activities - Chat, Forum, Ratings, Blocks – Types, Activities, Courses, HTML, Online Users – Features for Teachers.

REFERENCE BOOKS:

1. Delivering E-Learning: A complete Strategy for Design, Application and Assessment, Kenneth Fee, Kogan page, 2009.
2. Designing Successful e-Learning, Michael Allen, Pfeiffer Publication, 2007.
3. Moodle 2.0 E-learning Course Development, William Rice, PACKT, 2011.
4. Moodle 2.0 First Look, Mary Cooch, 2010.

Course Code	Course Title	L	T	P	C
221CAOEC	Web Technology	4	0	0	2

AIM

To equip the students with basic programming skill in Web Technology.

OBJECTIVE

- To understand the concepts and architecture of the Worldwide Web.
- To understand and practice mark up languages
- To learn Style Sheet and Frames

OUTCOMES:

- Acquire knowledge about functionalities of world wide web
- Explore markup languages features and create interactive web pages using them
- Learn and design Client side validation using scripting languages
- Acquire knowledge about Open source JavaScript libraries
- Able to design front end web page and connect to the back end databases.

UNIT I

Introduction to the Internet: networking- internet – email – Internet Technologies: modem internet addressing .

UNIT II

Internet browsers: Internet Explorer – Netscape navigator- Introduction to HTML: Html document – anchor tag – hyperlink.

UNIT III

Head and body sections: Header section – titles – links- colorful web page – sample html document – Designing the body section: paragraph – tab setting.

UNIT IV

Ordered and unordered lists: list – unordered list – heading in a list- order list- nested list.

UNIT V

Table handling: tables – table creation in html cell spanning multiple rows and columns- coloring cells- sample tables- frames frame set definition- nested frames set.

REFERENCE BOOKS

1.World Wide Web design with HTML – C. Xavier – Tata McGraw – Hill – 2000.

2. Principles of web design – Joel Sklar – Vikas publishing house 2001.

Course Code	Course Title	L	T	P	C
221CMOEC	Open Elective – Banking Service	4	0	0	2

AIM:

To Provide the Bank is financial institution which is involved in borrowing and lending money.

OBJECTIVE:

- To provide a lending money to firms, customers and home buyers.
- To provide keep money for customers
- To provide offering financial advice and related financial services, such as insurance.

OUTCOME:

To help to gather knowledge on banking and financial system in India
To provide knowledge about commercial banks and its products
To create awareness about modern banking services like e-banking-banking and internet banking, ATM System
To introduce recent trends in banking system
To make the student understand the basic concept of banking and financial institutions and expose various types of risk based by banks

UNIT – I

Commercial Banking – An Overview: Banking-Classification- Banking system- Universal Banking- Commercial Banking- functions – Role of Banks in Economic Development

UNIT – II

E-banking –An Overview: Meaning-Service-E-banking and Financial Services –Benefits-Internet Banking –Internet Banking Vs Traditional Banking –Mechanics of Internet Banking-Services

UNIT – III

Mobile Banking and Telephone Banking –An Overview: Meaning-Features-Registration-Services –Security Issues –Banking Facilities- Telephone Banking System –Drawbacks- Call Centers

Unit – IV

ATM and Electronic Money: Concept of ATM-Features-Functions-Strategic importance of ATM- Electronic Money – Categories –Merits – E-Money and Monetary Policy-Policy Issues for the RBI

Unit-V

EFT System and INFINET: Meaning- Steps in EFT- RBI Guidelines-EFT Systems Vs Traditional System - ECS-Features-Factors- Benefits –Handicaps -Applications

REFERENCES:

1. Banking theory law and Practice
2. Banking Theory law and practice -Santhanam
3. Banking Awareness - N.K.Gupta
4. Management of Banking and financial Services-Padmalathasuresh,Justin paul .

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SCHOOL OF ARTS AND SCIENCE

Department of Microbiology

M.Sc. Microbiology Syllabus

[Regulation 2022]

Skill development	
Skill development/Employability	
Employability/Entrepreneurship/Skill development	

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THANJAVUR – 613 403 - TAMIL NADU

School of Arts and Science
Department of Microbiology
M. Sc., Syllabus-Regulation 2022

Master of Science in Microbiology

Our curriculum is intended to teach our majors in a diversity of significant microbiological disciplines, as well as to inspire, improve, technological skills and capabilities that take persistent value beyond the teaching space.

M. Sc., Graduate Attributes

- Capability and motivation for intellectual development.
- Research, inquiry and analytical thinking abilities.
- Communication in intra and inter disciplinary
- Ethical, social and professional understanding
- Information literacy in respective discipline
- Teamwork, collaborative and management skills in scientific research

M. Sc Programme Educational Objectives-PEO

- **PEO1**- To provide detailed knowledge of Microbiology and their application fields. To understand the beneficial and harmful role of microorganisms in the environment and in the industries.
- **PEO2**- To understand the fundamentals of physiological reactions including metabolic pathways and biochemical reactions in microorganisms. To understand the fundamental concepts of immunology, biochemistry, biotechnology and genetics etc.
- **PEO3**- To develop human resource and entrepreneurs in microbiology with the ability to independently start their own ventures or small biotech units in the field of biotechnology.
- **PEO4**- Understand modern microbiology - practices and approaches with an emphasis in technology application in pharmaceutical, medical, industrial, environmental and agricultural areas.
- **PEO5**- Gain experience with standard molecular tools and approaches utilized: manipulate genes, gene products and organisms. Become familiar with handling of Laboratory animals for the research purpose. Interpret differences in data distributions via visual displays.

M.Sc Programme Specific Outcomes (PSOs)

- **PSO -**Upon master graduation, Microbiology majors will master a set of advanced skills, which would be useful to function effectively as professionals and to their continued development and learning within the field of Microbiology.
- **PSO** - Able to explain why microorganisms are ubiquitous in nature, inhabiting a multitude of habitats and occupying a wide range of ecological habitats.
- **PSO** -Able to cite examples of the vital role of microorganisms in biotechnology,fermentation, medicine and other industries important to human well-being.
- **PSO -**Able to demonstrate that microorganisms have an indispensible role in the environment, including elemental cycles, biodegradation etc

M. Sc Programme Outcome-PO

- PO1- Vital Thinking: Acquire knowledgeable actions after identifying the hypothesis that frame our idea and dealings, read-through out the degree to which these hypothesis are precise and suitable, and give the impression of being at our thoughts and assessments (academic, organizational and individual) from diverse perception.
- PO2- Effectual citizenship: Reveal empathetic social concern and fairness centred national progress and the capability to act with and take part in civic life through volunteering
- PO3- Ethics: Be aware of diverse value systems including the individual, under the ethical dimensions of personal choice, and believe responsibility for them.
- PO4- Environment and Sustainability: Analyze the importance of microbes for environmental clean-up and sustainable development.
- PO5- Self directed and life-long learning: To gain the talent to employ in self-determining and life-long learning in the broadest circumstance socio technological transforms.
- PO6- Economic liberty and employability potential: attain the ability to be concerned in economically sustainable opening and pound entrepreneurial skill.

School of Arts and Science
Department of Microbiology
M. Sc., Syllabus-Regulation 2022

Course Code	Course Title	L	T	P	C
	SEMESTER I				
22216SEC11	Prokaryotic Microbiology	6	1	0	5
22216SEC12	Eukaryotic Microbiology	6	1	0	5
22216SEC13	Microbial Physiology	6	1	0	4
22216SEC14L	Fundamentals of Microbiology Lab	0	0	4	2
22216DSC15	Discipline Specific Elective I	5	0	0	4
22216RLC16	Research Led Seminar	-	-	-	1
	Total	**23**	**3**	**4**	**21**
	SEMESTER II				
22216SEC21	Industrial Microbiology	5	1	0	5
22216SEC22	Environmental and Agricultural Microbiology	5	1	0	5
22216SEC23	Clinical Microbiology	5	0	0	4
22216SEC24L	Industrial, Clinical and Environmental and Agricultural Microbiology Lab	0	0	4	2
22216DSC25_	Discipline Specific Elective II	5	0	0	4
22216RMC26	Research Methodology	3	0	0	2
22216BRC27	Participation in Bounded Research	-	-	-	2
	Total	**23**	**2**	**4**	**24**
	SEMESTER III				
22216SEC31	Microbial Genetics	6	1	0	6
22216SEC32	Microbial Biotechnology	6	1	0	6
2216SEC33L	Microbial Genetics and Biotechnology Lab	0	0	5	3
22216DSC34_	Discipline Specific Elective III	5	0	0	4
222_OEC	Open Elective	4	0	0	4
22216SRC35	Design/Socio technical research	-	-	-	2
	Total	**21**	**2**	**5**	**24**
	SEMESTER IV				
22216SEC41	Pharmaceutical Microbiology	6	1	0	6
22216SEC42	Biostatistics and Bioinformatics	6	1	0	6
22216SEC43L	Pharmaceutical Microbiology Lab	0	0	5	3
22216SEC44_	Discipline Specific Elective IV	5	0	0	4
22216PRW45	Project Work	-	-	-	6
22216PEE	Programme exit examinations	-	-	-	2
	Total	17	2	5	27
	Total Credits for the Program				**96**

Discipline specific Electives

Semester	Discipline specific Elective Courses-I
I	a) 22216DSC15A- Immunotechnology b) 22216DSC15B-Aquatic Microbiology c) 22216DSC15C - Food Technology d) 22216DSC15D - Modern Industrial Biotechnology
	Discipline specific Elective Courses-II
II	a) 22216DSC25A-Clinical research and development b) 22216 DSC25B- Soil and Water Engineering c) 22216 DSC25C- Fungal Immunology d)22216 DSC25D- Pollution Research
	Discipline specific Elective Courses-III
III	a) 22216DSC34A- Microalgal Technology b) 22216DSC34B -Drug Development Product Management c) 22216DSC34C - Biomolecules and Polymers d) 22216DSC34D - Nanotechnology
	Discipline specific Elective Courses-IV
IV	a) 22216DSC44A- Molecular Immunology b) 22216DSC44B-Metabolic Engineering of Bacteria c)22216DSC44C-Toxicology d)22216DSC44D-Biomedical Science

Open Electives

Semester	Open Elective Courses
III	a) 222ENOEC-Writing for the media b) 222MAOEC-Applicable Mathematics Techniques c) 222PHOEC-Bio-Medical Instrumentation d) 222CHOEC-Green Chemistry e) 222CSOEC – M-Marketing f) 222CMOEC- Financial Services

Credit Distribution:

Sem	SEC	DSC	GEC	RSB courses	Others	Total
I	16	4	-	1	-	21
II	16	4	-	4	-	24
III	15	4	3	2	-	24
IV	15	4	-	6	2	27
Total	**62**	**16**	**3**	**13**	**02**	**96**

SEMESTER I

Course Code	Course Title	L	T	P	C
22216SEC11	Prokaryotic Microbiology	6	1	0	5

AIM :

- Prokaryotic Microbiology introduces basic principles and then applies clinical relevance of many etiological agents responsible for global infectious diseases.

OBJECTIVES :

- The infectious disease cycle of the pathogens enables to solve the epidemics.
- The territory covered by infections and the immune response expands each year; we focus on pathogenic mechanisms in order to foster a student's ability to solve problems in their future clinical career.

COURSE OUTCOME

CO1- Scope and historical importance of microbiology

CO2- Understanding the features and classification of prokaryotes.

CO3- study about isolation and identification of microbes

CO4- Economic value of beneficial bacteria

Unit – I

Microbial classification and diversity of microorganisms – classification based on cellularity, cell and kingdom concepts – Whittaker's classification – major group of prokaryotic microorganisms – their characteristics – microbial diversity of viruses, bacterial and cyanobacteria.

Unit – II

Viruses: Introduction – Classification of viruses – cultivation of viruses, purification and assay, various methods of viral assays. Basic structure of viruses – symmetry – biochemical composition of viruses – Bacteirophages – Ultra structure of T_4 phage – multiplication of bacteriophages – viruses of fungi and algae, slow viruses, viroids, satellite viruses.

Unit – III

Plant viruses: Classification of plant viruses. Tobacco Mosaic Virus – Ultra structure of TMV, Multiplication of TMV. Viruses of various plant hosts / crops and diseases - Plant viruses as gene vectors.

Unit – IV

Bacteriology: Introduction – Diversity of bacterial flora – distribution – morphology of typical bacterial cell – Chemical composition of bacterial cell wall, Reproduction and genetic recombination, Transformation, Conjugation, Transduction, Bacterial growth rate, Bacterial culture methods and culture media for various bacteria. Isolation and enumeration of bacterial cultures, Identification – Gram staining technique, Bacterial diseases of Man.

Unit – V

General characteristics of other Bacteria – Mycobacteria, Myxobacteria, Rickettsia and Chlamydiae and Cyanobacteria – Classification of cyanobacteria – significance of Cyanobacteria in biofertilizers – *Archaeobacteria, Actinomycetes, Streptomyces, Actinoplanes, Maduramycetes* and their general characters

Text Books

S. No	Author Name	Title of the Paper	Edition/year	Publication
1.	Jr. M.J. Pelczar, E.C.S. Chan and N.R. Kreig.	Microbiology	5^{th} /1993	Tata McGraw-Hill, Inc, New york
2.	R.C. Dubey, D.K. Maheshwari	A Text Book of Microbiology	3^{rd}/ 2003	Chand Publishing

Reference Book:

1. Fundamental of Microbiology (2005) By Purohit, Agrobios Publishers, Meerut

Course Code	Course Title	L	T	P	C
22216SEC12	Eukaryotic Microbiology	6	1	0	5

AIM

- To gain the knowledge with the various inner and outer structures of prokaryotes and in detail.

OBJECTIVES

- To learn the general principles and applications of microbiology

COURSE OUTCOME

CO1- General Features and taxonomy of eukaryotes

CO2- Knowledge about advanced research in mycology, phycology.

CO3- Scope of Algae used as a food

CO4- Economic importance of Lichens and algae

Unit – I

Differentiation of Eukaryotes and Prokaryotes – Salient features of Eukaryotes – Major groups of Eukaryotes – Algae, Fungi, Protozoa and lichens – Classification of Algae, Fungi and Protozoans. Significance of various Algae and fungi in Agricultural Microbiology - Significance of various fungi, algae in environmental biology – biodegradation of Xenobiotics, heavy metals and pesticides, Eukaryotic microbes in Bio pesticides.

Unit – II

Algae: Phycology – Introduction – Distribution of Algae, General features of algae Classification and general characters of prochlorophyta, Rhodophyta, Phaeophyta: Significance of Algae in production.

Unit – III

Biology of Lichens – fungal components and algal component: general characteristics of lichens, physiology of lichens, classification of lichens, Reproduction of lichens, Economic uses of lichens. Single cell protein (SCP) – Spirulina and significance: BGA and significance in agriculture.

Unit – IV

Mycology – Introduction – General characters of Fungi – Structure of fungi – Fungal cell, multiplication of fungi – Fungal diseases of Plants, Animals and Human - Beneficial fungi, VAM – fungi in soil fertility. Predaceus fungi and nematophagous fungi – Fungi in food spilage and food infections.

Unit – V

Protozoans – Classification of Protozoa – General Characters of protozoa – general structure and life cycle of Amoeboid form – Nutrition and Reproduction in protozoans – Protozoan diseases of Animals and Man

Text Books

S. No	Author Name	Title of the Paper	Edition/year	Publication

1	Jr. M.J. Pelczar, E.C.S. Chan and N.R. Kreig.	Microbiology	5th /1993	Tata McGraw-Hill, Inc, New york
2	R.C. Dubey, D.K. Maheshwari	A Text Book of Microbiology	3rd/ 2003	Chand Publishing

References

1. Microbiology (1993) Jr. M.J. Peczar, E.C.S. Chan and N.R. Kreig, Mc Graw Hill Inc., NewYork
2. General Microbiology, 1976. Roger Stanier, Fifth Edition,
3. Fundamental of Microbiology (2005) By Purohit, Agrobios Publishers, Meerut

Course Code	Course Title	L	T	P	C
22216SEC13	Microbial Physiology	6	1	0	4

AIM :

- To enable the students to understand the physiology and metabolism of microorganismS.

OBJECTIVES :

- To impart knowledge on metabolic function and biochemical reaction going on inside the microbial cell.
- To teach metabolic pathways, their regulation and engineering, and methods used in their elucidation.
- To teach students about cell cycle, growth and methods to determine microbialgrowth.

COURSE OUTCOME (CO'S):

CO1- Understand the factors influencing the growth of microbes in ecosystem

CO2- Learn about Bioluminescence and their advantages.

CO3- Learn about microorganism to assimilate the nutrients for growth.

CO4- Study about metabolic pathway

Unit – I

Cell structure and function: Biosynthesis of peptidoglycan – Outer membrane, teichoic acid Exopolysacchairdes; Cytoplasmic membrane – Pilli, fimbriae, S-layer, Transport mechanisms – active, passive, facilitated diffusions – uni, sym, antiports. Electron carriers – artificial electron donors, inhibitors, uncouplers – energy bond – phosphorylation.

Unit – II

Microbial growth: Phases of growth cruve – measurement of growth – calculations of growth rate – generation time – synchronous growth – induct on of synchronous growth, synchrony index – factors affecting growth – pH, temperature, substrate and osmotic condition. Survival at extreme environments – starvation – adaptive mechanisms in thermophilic, alkalophilic, osmophilic and psychrophilic-Bioluminescence – mechanism – advantages.

Unit – III

Microbial pigments and carbon assimilation: Autotrophs – Cyanobacteria – photosynthetic bacteria and green algae – heterotrophs – bacteria, fungi, myxotrophs. Brief account of photosynthetic and accessory pigments – chlorophyll – fluorescences, phosphorescenses – bacterochlorophyll – rhodopsin – carotenoids – phycobiliproteins: Carbohydrates – anabolism – autotrophy – oxygenic – anoxygenic photosynthesis – autotrophic generation of ATP; fixation of CO_2 – Calvin cycle – C_3 – C_4 pathways. Chemolithotrophy – sulphur – iron – hydrogen – nitrogen oxidations – Brief account of methanotrophs in relation to CO_2 fixation.

Unit – IV

Microbial respiration and fermentative pathway: Respiratory metabolism – Embden Mayer Hoff pathway – Enter Doudroff pathway – glyoxalate pathway – Krebs cycle – Oxidative and substrate level phosphorylation – reverse TCA cycles – Gluconeogenesis – Pasteur Effect – Fermentation of carbohydrates – homo and heterolactic fermentations. Cell division – endospore – structure – properties – germination.

Unit – V

Spore structure – Function: Cell division – endospore – structure – properties – germination – Microbial development, sporulation and morphogenesis. Hyphae vs yeast forms and their significance. Multicellular organization of selected microbes – Dormancy.

Text Books

S. No	Author Name	Title of the Paper	Edition/year	Publication
1	Jr. M.J. Pelczar, E.C.S. Chan and N.R. Kreig.	Microbiology	5th /1993	Tata McGraw-Hill, Inc, Newyork
2	S. Meenakumari	Microbial physiology	1st / 2006	MJP Publishers

Reference Book:

1. Microbial physiology and metabolism (1995) D.R. Caldwell, Wm. C.Brown, Publishers. USA

2. Microbial Physiology (1988). A.G. Moat and J.W. Foaster, John Wiley & Sons, New York.

Course Code	Course Title	L	T	P	C
22216SEC14L	Fundamentals of Microbiology Lab	0	0	4	2

AIM

- A student undertaking this course will be learning the principles behind the basic techniques

OBJECTIVES

- This course is put forward with the objectives of equipping the candidates with practical knowledge on basic techniques involved in the isolation,
- Characterization and identificationdifferent types of microorganism.

COURSE OUTCOME :

CO1- practical knowledge about isolation and purification of microbes from various sources.

CO2- Training about staining experiments

CO3- Handling on light and compound microscope.

CO4- Learn essential biochemical analysis

EXPERIMENTS

1. Principles and methods and sterilization – (Wet, dry and cold sterilization)
2. Direct microscopic observations of bacterial shape – cocci, rods, chains, fungal spores, mycelium, yeast budding.
3. Preparation of Media: Nutrient broth, Nutrient agar, plates, slants, soft agar. Pure culture technique: Streak plate, spread plate and pour plate methods
4. Measurement of size of microbes – micrometry method. Motility determination – Hanging drop method.
5. Isolation and purification of cyanobacteria, actinomycetes, fungi and protozoans.
6. Staining methods: Simple, Negatives, acid fast, Gram staining, Capusule Metachromatic granular staining, Lactophenol cotton blue staining – Fungal slide preparation.
7. Measurement of growth – Direct haemocytometer count, viable count – growth curve,
8. Determination of growth rate and generation time.
9. Effect of pH, temperature and osmotic pressure on growth of bacteria.
10. Biochemical test: carbohydrate fermentation – acid – gas production: IMViC test; -Hydrolysis of starch: cellulose, gelatin, casein, catalase test, oxidase, urease test, nitrate reduction – triple sugar iron test, ONPG test, amino acid decarboxylase
11. Blood grouping
12. Widal test
13. Total count of RBC
14. Total count of WBC
15. Differential count of WBC
16. Erythrocyte Sedimentation Rate
17. Preparation of Buffer; pH measurement (Tris, phosphate, acetate buffer)

Reference:

1. Cappuccino and James, G(1996) Microbiology a laboratory manual, Addison Wesley Publishing company Inc. 4th Edition, England, California
2. Gerhardt. P. Murray, R.G. Wood, W.A. and Kreig, N.R. (1994) Methods of General and Molecular Bacteriology, Ed. Amercian Society for Microbiology, Washington D.C
3. David R. Brooke. Bergey's Manual of Systematic Bacteriology (Vol.I) Eastern Halz, Springer Publication
4. James T. Stanley, Marving, P. Bryant, Bergey's Manual of Systematic Bacterilogy (Vol.II), Nobert pfeming Springer Publishers

Discipline Specific Elective-I

Course Code	Course Title	L	T	P	C
22216DSC15A	Immunotechnology	5	0	0	4

AIM:

- To expose the students with the immune system of human body

OBJECTIVES:

- Objectives The aim of this course is to impart knowledge on the basic concepts of cells and components of immune system and immuno diagnostic techniques

COURSE OUTCOMES (CO'S):

CO1- Learn scope and history of immunology.

CO2- Study about immune system and lymphatic organs.

CO3- Learn tumor immunology

CO4- gain knowledge about various immunological techniques

Unit – I

Introduction: History of immunology – types of immunity – Innate and Acquired – Passive and Active - Humoral and cell Mediated Immunity. Lymphoid organs – autoimmunity, physiology of immune response — Immunohaematology

Unit - II

Antigens and Antibodies: Antigens – structure and properties – types – ISO and allo –haptons; adjuvants – antigen specificity, vaccines and toxoids. Immunoglobulins – structure - heterogeneity – types and subtypes – properties (physico – chemical and biological); theories of antibody production - Complement – structure – components - properties and functions of complement components; complement pathways and biological consequences of complement activation

Unit - III

Major Histocompatibility complex: Structure and function of MHC and the HLA system. Gene regulation and lr – genes. HLA tissue and transplantation – tissue typing methods for organ and tissue transplantation in humans; Graft versus host reaction and rejection. Autoimmunity –diseases-mechanism and disease with their diagnosis

Unit - IV

Tumor Immunology: tumour antigens – immune response to tumors immunodiagnosis of tumors – detection of tumor markers alphafoetal proteins, carcinoembryonic antigen etc. Immunotherapy of malignancy, Hypersensitivity – monoclonal antibody – production and their applications

Unit - V

Immunological techniques and their principles: In vitro of immunological methods – agglutination, precipitation, complement fixation, Immunolfluorescence, ELISA, Radio Immuno Assays. Immunodiffusion, Immunoelectrophoresis, isoelectric focusing –

cytotoxicity assay – labeled – antibody technique in light and Electron Microscopy and Immunohistochemistry. Techniques of Immunization – use of adjuvants – separation of lymphocytes – and preparation of Rosette forming cells - In vivo methods – skin tests and immune complex tissue demonstrations - Applications of these methods in diagnosis of microbial diseases.

Text Books

S. No	Author Name	Title of the Paper	Edition/year	Publication
1.	Ivaitt Roitt, Jonathan Brostoff, David Male	Immunology	3rd/1993	Mosby Inc, St. Louis, MO
2.	R.A. Goldsby, T. J. Kindt, B.A. Osborne, J. Kuby	Immunology	5th/2003	W.H. Freeman and Company
3.	M.S. Aslam	Immunobiology	1st/2000	Campus Book International

References

1. Immunology (2002), C.V Rao, First Edition, Narosa Publications.
2. Essentials of Clinical Immunology (1986) H.Chapel and Halbey, ELBS
3. Essentials Immunology (1994) M.Rolt Blackwell Scientific Publication, Oxford

Course Code	Course Title	L	T	P	C
22216DSC15B	Bioremediation and Waste Management	5	0	0	4

AIM

- To study the water and waste water treatment for recycleing process.

OBJECTIVES:

- To impart knowledge on the management of solid and liquid wastes frommunicipal and industrial sources and principles of remedial measures of recycling,reuse and recover from the wastes.

COURSE OUTCOMES:

CO1- Understanding on the management of solid and liquid wastes

CO2- Learn the principles of remedial measures of recycling, reuse and recover from the wastes.

CO3- Understand the mechanism and role of microbes in the degradation of various pollutants

UNIT – I

Wastes– Classification and Quantification – Solid Waste Management and Disposal: Sources and Generation of Solid Waste – characterization, composition and classification. Hazardous Waste Management: Cyanides, Dioxins, Detergents, Plastics, Nylon and Paper. Waste Minimization approaches – Monitoring and Management strategies. Radioactive Waste: Sources, half life of radioactive elements, modes of decay. Effects on Plants, Animal and Man. Low and High-level Radioactive Waste Management – Waste Minimization and Treatment, Radiation standards.

UNIT - II

Recycling of Wastes – Types – sources – composition of waste – recycling of waste for Industrial, Agricultural and Domestic Purposes; Recycling of Metals, Reuse, recovery and reduction of paper and plastics; Recycling in Food Manufacturing, Beverages, Apparel, Leather, Paper, Pulp, Chemical and other industries; Fly Ash utilization. Waste Disposal Methods – composting, incineration, pyrolysis, medical waste disposal strategies.

UNIT – III

Microbial Activity in Soil and Ground Water, Lithosphere as Microbial habitat, Microorganisms in rock and minerals, Mineral soil and Organic soil. Physiological groups of prokaryotes, Geomicrobial transformations – Biodegradation of carbonates – Biomobilization of silicon, phosphate, nitrogen. Geomicrobiology of fossil fuel, methane, peat, coal and petroleum.

UNIT – IV

Principles of Bioremediation – Rapid growth and Metabolism- Genetic plasticity – Metabolic pathways for the degradation of xenobiotics, hydrocarbons – Microbial site characterization – Biodegradation potential – Bioprocess design, optimization – Microbial removal rates – inherent problems associated with biotreatment studies. Microbiological methodologies – Standard biotreatability protocols – Quantification of biodegradation;

Biocleaning -Chernobyl radioactive contaminated area - Phytoremediation.

UNIT – V

Aerobic Bioremediation: Bioremediation of Surface Soils: Fate and transport of contaminants in the Vadose zone – Biodegradation in soil ecosystems – Types of soil treatment systems – Bioreactors. Subsurface Aerobic Bioremedidation: in situ Bioremediation – in situ Bioventing – in situ treatments of Harbour Sediments and Lagoons. Bioremediation in fresh water and marine systems: Bench and Pilot Scale studies – in situ Bioreactor treatment of sediments – in situ treatment in marine ecosystem. Anoxic/Anaerobic Bioremediation: Anoxic/Anaerobic Processes –Fermentation, Degradation of xenobiotics – Anoxic/Anaerobic bioremediation of hydrocarbons, Phenols, Chlorophenolic compounds, Polycyclic Aromatic Hydrocarbons (PAH), Heterocyclic Compounds, Cyanide, dyes,

REFERENCES

1. Microbial Ecology, IV Ed., Atlast, R.M and Bartha,R.,(2000) Addison Wesley Longman Inc.
2. Bioremediation, Baker,K.H. and Herson,D.S., (1994) Mc Graw–Hill Inc, New York.
3. Biology of Microorganisms, VII Ed., Brock,T.D., Madigan,M.T. Martinko,J.M. and Parker, J (1994) Prentice Hall, New Jercy.
4. Geomicrobiology, Ehrlich,H.L (1996) Marcel Dekker Inc., New York.
5. Bioremediation – Principles, Eweis,J.B., Ergas,S.J, Change,D.P.Y and Schroeder, E.D (1998). Mc Graw-Hill Inc.
6. Environmental Engineering, Kiely, G (1998) Irwin/Mc Graw Hill International, U.K.
7. Hazardous Waste Management, II Ed, LaGrega,M.D.,Buckingham,P.L., and Evans, J.C (2001) Mc Graw Hill Inc.

SEMESTER II

Course Code	Course Title	L	T	P	C
22216SEC21	Industrial Microbiology	5	1	0	5

AIM

- To study about the industrially importance microorganisms, fermenter design, fermentation process.

OBJECTIVE

- To give knowledge on strain improvement methods.
- To learn about upstream fermentation process .
- To understand about downstream fermentation process

OUTCOME.

CO1- Students will get knowledge on strainimprovement.

CO2- Enable them to work in fermentationindustry.

CO3- Students will get idea on upstream and downstream fermentationprocess

CO4- Economic importance of Bio products

Unit I

Historical development of industrial microbiology: major classes of products and processes and micro organisms used in industrial processes. Industrially important microbes and their development: Screening methods for industrial microbes –strain selection and improvement – Mutation and recombinant DNA techniques for strain development. Batch culture and continuous culture

Unit – II

Fermenters – Design of a fermenter, and components – asepsis and containment requirements – body construction and temperature control – aeration and agitation systems – sterilization of fermenter, air supply, and medium; aseptic inoculation methods – sampling methods, valve systems –monitoring and control devices and types of fermenters and its basic functions.

Unit – III

Downstream processing – extraction, separation, precipitation, filtration, centrifugation, cell disruptions, liquid-liquid extraction, chromatography, recovery & purification, process and quality control.

Unit – IV

Production of Primary metabolites: Organic acids (citric acid, lactic acid, acetic acid) and Amino acids (glutamic acid, lysine). Production of Vitamins (B2 and B12). Production of Secondary metabolites: Antibiotics: beta-lactams (Penicillins, Cephalosporins), aminoglycosides (streptomycin), macrolides (erythromycin) and Quinones (Tetracycline).

Unit –V

Bio products: Bio-pesticides, bio-fertilizers, natural bio-preservatives (Nisin), High Fructose Corn Syrup, Bioplastics and biopolymers (Poly Lactic acid, Poly Glutamic acid, Poly hydroxyl alkoanates, Xanthum Gum and Dextran), Biotransformations - steroids and non-steroids. Enzymes - Proteases, amylases, lipases, cellulases, pectinases, glucose isomerase, L-Asparaginase. Production of vaccines and recombinant proteins (Insulin, Streptokinase). Production of Biofuels (Biomethanol, Bioethanol, Biobutanol, Biohydrogen and Biodiesel).

Text Books

S. No	Author Name	Title of the Paper	Edition/year	Publication
1	L.E. Casida Jr	Industrial Microbiology	1968	Wiley
2	W. Crueger and A. Crueger	A text book of Industrial microbiology	2nd/1990	Sinauer Associates Incorporated
3	Prescott and Dunn's	Industrial Microbiology	4th/1987	CBS Publishers and Distributors

References

1 Alexander, M.(1961). Introduction to soil microbiology, Wiley and Sons Inc. New York and London

2 Demain, A.L. and Davies, J.E (1999) Manual of Industrial Microbiology and Biotechnolgy. ASM Press

3 Glick, B.R and Pasternak, JJ(1994) Molecular Biotechnology, ASM Press

4 Stanbury, P.F, Whitaker, A. and Hall, S.J.(1991). Principles of Fermentation Technology, Pergamon Press

5 Glick, B.R and Pasternak, JJ(1998) Molecular Biotechnology, II Edition , ASM Press, New York

6 Mittal, D.P.(1999) Indian Patents Law, Taxmann, Allied Services (P) limited

7 Tortora, G.J., Fernke, .B.R. and Case, C.L.(2001), Microbiology – An Introduction, Benjamin Cummings

Course Code	Course Title	L	T	P	C
22216SEC22	Environmental and Agricultural Microbiology	5	1	0	5

AIM

- To study about the biofertilizers, plant disease and increasing soil fertility.v

OBJECTIVES

- To educate the students about concepts of designs of water distribution systems, sewer networks, working principles and design of various physical, chemical and biological treatment systems of water and wastewater.

COURSE OUTCOME (CO)

CO1- Huge Insights into these precious areas of Environmental microbiology.

CO2- Students able to know detailed idea about biofertilizer production and plantdisease.

CO3- Role ofMicrobes in marine and fresh water environment

CO4- Scope of Recycling of Liquid and Solid wastes

Unit I

Aerobiology- Significance of air microflora - Microbial air pollution- sources, biological indicators and effects on plants and human beings. Enumeration of bacteria from air, Air sampling devices, Outline of Airborne diseases (Bacterial, Fungal and Viral), Air sanitation. Biogeochemical cycles -Nitrogen, Carbon,
Phosphorous, Sulphur, Iron and their importance.

Unit II

Microbes in marine and fresh water environment – eutrophication – Water pollution – sources and nature of pollutants in water – sewage – treatment of liquid waste – primary, secondary and tertiary treatment – water borne diseases – Assessment of water quality – BOD and COD. Solid waste treatment – saccarification and pyrolysis.

Unit III

Recycling of Liquid and Solid wastes-Composting-Biogas, Mushroom and SCP production from waste. Biodegradation of complex polymers (Cellulose, Hemicellulose, Lignin, Chitin and Pectin), Bioremediation (*In-situ, Ex-situ*, Intrinsic), Bioaugmentation and Biostimulation. Bioleaching (Copper and Uranium) -Xenobiotics degradation (Heavy metals).

Unit IV

Microbial association with plants - Phyllosphere, Rhizosphere, Mycorrhizae, nitrogen fixing organism – symbiosis, asymbiosis, associate symbiosis – phosphate solubilizers – application of biofertilizers in agriculture. Biology of nitrogen fixation – genes and regulations in

Rhizobium.

Unit V

Bacterial, viral and fungal plant pathogens. Morphological, physiological changes with reference to disease establishment in plants – plant protection – phenolics – phytoalexins and related compounds. Disadvantages of chemical pesticides. Microbial pesticides- types, mechanisms, advantages and limitations.

Text Books

S. No	**Author Name**	**Title of the Paper**	**Edition/year**	**Publication**
1.	B. Nagamani	Soil And Agricultural Microbiology	1^{st}/ 2007	Margham Publicat
2.	Dirk, J., Elasas, V., Trevors, J.T., Wellington	Modern Soil Microbiology	1997	Marcel Dekker INC
3.	**R.R. Mishra**	Soil Microbiology	1^{st}/2004	CBS Publication

References

1. Atlas Ronald M, Bartha Richard. Microbial Ecology 2nd Edition. Benjamin/Cummings Publishing Company, California. 1987.
2. Baker WC and Herson DS. Bioremediation – McGraw Hill Inc., New York. 1994.
3. Chatterji AK. Introduction to Environmental Biotechnology. 2005
4. Christon J Hurst, Manual of Environmental Microbiology.2nd edition. American Society for Microbiology, Washington. 2002.

Course Code	Course Title	L	T	P	C
22216SEC23	Clinical Microbiology	5	0	0	4

AIM

- To inculcate on the role of normal flora and pathogenic microbes.

OBJECTIVE

- To understand the pathogenesis of various diseases
- To understand the various clinical microbiological techniques.

OUTCOME

CO1-Learn normal flora of human body

CO2- Get information about various sources ofinfection and transmission

CO3- Epidemiology, pathogenesis and treatment of bacterial, fungal and viral diseases

CO4- Learn Strategy of antimicrobial therapy.

Unit – I

Normal microbial flora of human – Host – parasite interaction: The Process of infection. Infective syndromes and diagnositic procedure - Strategy of antimicrobial therapy – Epidemiology and control of community infections.

Unit – II

General properties, epidemiology, transmission, pathogenesis, Symptoms, laboratory diagnosis, prevention and Treatment of the following Bacterial diseases:a) Pneumonia, b) Whooping-cough, c) Meningitisd) Diphtheriae) Pulmonary Tuberculosis,f) Leprosy, g) Typhoid, h) Cholera i) Tetanus, j) Syphillis, k) Gonorrhoea, d) Dental carries.

Unit - III

Mycobacterium: Mycobacterium tuberculosis, Mycobacterium leprae. Spirochaetes, Mycoplasma, Actinomycetes, Helicobacter, Compylobacter and other miscellaneous bacteria, Rickettsia, Chlamydia.

Unit – IV

General properties, epidemiology, transmission, pathogenesis, Symptoms, laboratory diagnosis, prevention and Treatment of the following viral diseases: Small pox, Influenza, Measles, Poliomyelitis, Common cold(Rhino virus), Hepatitis, Encephalitis, Rabies, AIDS.

Unit – V

Pathogenic Fungal diseases- Superficial, Subcutaneous and systemic mycoses, Protozoa-Amoebiasis, Malaria, Helminthes-Liverfluke, Filariosis, Hospital acquired infections:Hospital infections Principles of control – Committee – functions; Hospital waste disposal – Ethical committee – functions.

Text Books

S. No	Author Name	Title of the Paper	Edition/year	Publication
1.	Sherris	Medical Microbiology	4th/2004	McGraw-Hill Companies, Inc.
2.	V.V. Kale, K.P. Bhusari	Applied Microbiology (Pharmacy and other Bioscience)	1st/2001	Himalaya Publishing House
3.	Jr. M.J. Pelczar, E.C.S. Chan and N.R. Kreig.	Microbiology	5th /1993	Tata McGraw-Hill, Inc, Newyork

References

1 Schachter, M., Med off, G. and Eisenstein, B.C.(1993) mechanism disease, 2nd Edn. Williams and Wilkins Baltimore

2 Ananthanarayan & Paniker's Textbook of Microbiology, 8th Ed., Orient Longsman, India; 2009

3 Smith, C.G.C(1976).Epidemiology and Infections. Medowlealf PressL shildon, England

4 Stokes,J., Ridway, G.L., and Wren, M.W.D.,(1993). Clinical Microbiology 7th Edn. Arnold a division of Hodder and Stoughton.

5 Wistriench, G.A. And lechtonan, M.D.(1988). Microbiology, 5th Edn., Mac publishing company NY

6 Atlas, R.M. (1989) Microbiology – fundamentals and applications 2nd Edn. Maxwell Mac Millan International Edition

Course Code	Course Title	L	T	P	C
22216SEC24L	Industrial, Clinical and Environmental and Agricultural Microbiology Lab	0	0	4	2

AIM

- To provide technical knowledge on collection and processing of clinical samples .

OBJECTIVE

- To prepare them to work in clinical laboratory .
- To learn the technique for isolation and identification of pathogens

OUTCOME

CO1- Get practical knowledge in specimen collection and processing

CO2- Become technically expert which will helpful to work in clinical laboratory

CO3- Learn practical understanding of diagnosis of pathogens.

CO4- Acquire knowledge on fermentation process

CO5- Learn bio fertilizer and inoculants production

Industrial and Clinical Microbiology

1. Citric acid fermentations by *Aspergillus niger*
2. Alcoholic fermentation of fruit juice by yeast (*Saccharomyces cerevisiae)*.
3. Immobilization techniques using any microbe- alginate beads
4. Hydrolysis of starch
5. Testing sensitivity of bacteria to antibiotics and Assessing minimum inhibitory concentration(MIC) of antibiotics
6. Isolation and identification of certain pathogenic microbes from urine
7. Hemoglobin content of blood
8. Serum analysis, sugar analysis in blood and urine

Agricultural and Environmental Microbiology

1. Isolation and enumeration of soil microorganisms (fungi, bacteria and actinomycetes)
2. Isolation and staining of vesicular arbuscular mycorrhizae from plant.
3. Isolation and culturing of Rhizobium from root nodules of higher plant
4. Mushroom cultivation
5. Isolation and identification of air-borne microbes
6. Effects of high salt concentration on microbial growth
7. Determintion of BOD and COD of polluted/pond water.
8. Bacterial examination of drinking water by membrane filter technique and MPN

Visit to commercial production units – ethanol, acetic acid, vaccine and Spirulina

Visit to CFTRI/DFRL/FOOD INDUSTRIES and report should be written in the practical record

Reference:

1. Clescri,L.S., Greeberg,A.E., and Eaton, A.D.(1998) Standard Methods for Examination of Water and Waste Water, 20th Edition, Amercian Public Health Association
2. Gerhardt,P., Murray R.G., Wood, W.A. and Kreig, N.R.(1994). Methods for General Land Molecular Bacteriology, ASM Publications, Washington
3. Pactricia Cunning(1995) Official Methods of Analysis, Vol I and II, 16th Edition, Arlington, Virginia, USA, AOAL.
4. Richard G., Burus and Howard Slater (1982) Experimental Microbial Ecology, Blackwell Scientific Publishers
5. Tuffery(1996). Laboratory Animal, an Introduction, II Edition, John Wiley and Sons New York

Discipline Specific Elective-II

Course Code	Course Title	L	T	P	C
22216DSC25A	**Clinical research and development**	5	0	0	4

AIM

To know the functions of Biomolecules

OBJECTIVE :

- To understand the structure and functions of carbohydrates, lipids , proteins and nucleic acids
- To understand the role of nucleic acid in proteins synthesis

OUTCOME

CO1- They acquire knowledge in the quantitative and qualitative estimation of biomolecules

CO2- They study the influence and role of structure in reactivity of biomolecules

CO3- Students have a thorough understanding on the role of biomolecules and their functions.

Unit I

Carbohydrates: Structure and biological functions of Mono, di and Polysaccharides. Types of polysaccharides: Homo polysaccharides -chitin, fructans, mannans, xylans, and galactans. Structure and biological importance of Hetero polysaccharides- Glycoprotein – bacterial cell wall polysaccharides, marine polysaccharides and Lectins.

Unit II

Aminoacids and its general properties. Classification of amino acids. Proteins– classification and general properties. Orders of protein structure, Primary- Secondary structure– the α-helix, β- pleated sheet. Protein sequencing methods.

Unit III

Lipids: Definition and classification of lipids. Biological significance of lipids. Types of Fatty acids-Essential, Non essential. Structure and biological functions of phospholipids, sphingolipids, glycolipids. Steroids – structure and functions of cholesterol, bile acids, sex hormones, ergosterol. Structure and biological role of prostaglandins, thromboxanes and leukotrienes.

Unit IV

Nucleic acid: Structure of purines, pyrimidines, nucleosides and nucleotides. DNA double helical structure. A, B and Z forms of DNA. Properties of DNA- Density, viscosity, hypochromicity, denaturation and renaturation. DNA sequencing– chemical and enzymatic methods. Chemical synthesis of DNA. RNA– types and biological role- Secondary, tertiary structures of RNA.

Unit V

Vitamins: Definition and Classification - Source, Structure and biological role - Daily requirements and deficiency manifestation of fat soluble vitamins and water soluble vitamins.

Text Books

S. No	Author Name	Title of the Paper	Edition/year	Publication
1.	J. L. Jain	Fundamentals of Biochemistry	1st / 2005	S. Chand and Company

References

1. Biochemistry Dubay 4th edition William C.Brown Publication, 1998.
2. Biochemistry. Davidson and Sittmann, NMS 4th ed. Lippincott William's and Wilkins, 1999
3. Biochemistry – Voet and Voet. J O H N WI VP &*Publisher* Kaye Pace Associate Publisher, 2011.
4. Biochemistry Student Companion, by Berg, 7th Edition Berg, Jeremy M. / Tymoczko, John L. / Stryer, Lubert Published by W. H. Freeman, 2011.

Course Code	Course Title	L	T	P	C
22216DSC25B	**Soil and Water Engineering**	5	0	0	4

AIM

To know the basic principles of genes and proteins

OBJECTIVES:

To understand the gene functions and its genetic engineering aspects

To understand the protein functions and its genetic engineering aspects

COURSE OUTCOME :

CO1- Students gain the knowledge about the interactions between the proteins

CO2- Get the information to predict cell behavior or develop drug targets.

CO3- Rapidly evolving scientific area into ***genomes***, proteomes and databases

CO4- Learn to store various data NCBI, DDBJ and EMBL

Unit I

Genomics: genetic and physical maps, physical mapping and map-based cloning, choice of mapping population, simple sequence repeat loci, southern and fluorescence in situ hybridization(FSH) for genome analysis, chromosome microdisection, molecular markers in genome analysis

Unit II

Genome sequencing: genome sizes, organelle genomes, genomic libraries, strategies for genome sequencing, packaging, transfection and recovery of clones, application of sequence information for identification of defective genes. Pharmacogenetics, cancer genetics; immunogenetics; mapping of human genome; somatic cell genetics; DNA polymorphism in mapping; structure and function; biochemical genetics; polygenic inheritance

Unit III

Proteomics: Sample preparation, Gel-based proteomics - two-dimensional gel electrophoresis (2-DGE), two-dimensional fluorescence difference in-gel electrophoresis (DIGE), Staining methods, PF-2D, Tandem FPLC, Mass spectroscopy: basic principle, ionization sources, mass analyzers, different types of mass spectrometers (MALDI-TOF Q-TOF, LC-MS).

Unit IV

Nuclear magnetic resonance spectroscopy (NMR), basic principles, chemical shift, spinspin interaction, NOE, 2D-NMR, NOESY,COSEY. X-ray Crystallography: Principle of X-ray diffraction, scattering vector, structure factor, phase problem, reciprocal lattice and Ewald sphere, Miller indices, Zone axes, crystal lattice, Lane Equations, Bragg's law, special properties of protein crystals, model building, refinement and R-factor.

Unit V

Protein Engineering: Protein sources, Industrial and medical application of proteins, different expression of proteins for large scale purifications, protein engineering strategy, rational and random mutagenesis. Applications of protein engineering-protein in Chemical and Medical Industries: Generation of heat stable, pH stable engymes, application in vaccine development, drug development, sensor development.

References

1. Gupta, P.K. 2004. Biotechnology and Genomics. First edition. Rastogi Publications, Meerut.
2. Miglani, G.S. 2007. Advanced Genetics. New Delhi: Narosa Publishing House.
3. Primrose, S.B. and Twyman, R.M. 2006. Principles of Gene Manipulation and Genomics. Blackwell Publishing, Australia.
4. Singh, B.D. 2009. Biotechnology: Expanding Horizons. Second Edition. Kalyani Publishers, Ludhiana.
5. Singh, B.D. 2009. Plant Biotechnology. Kalyani Publishers, Ludhiana.
6. Thompson, J.D., Schaeffer-Reiss, C., and Ueffing, M. 2008. Functional Proteomics. Methods and Protocols. Humana Press, New York.
7. Twyman, R.M. 2004. Principles of Proteomics. Taylor & Francis.

Course Code	Course Title	L	T	P	C
22216RMC26	Research Methodology	3	0	0	2

AIM:

- The course is to understand the principles and applications of classical and modern techniques in Biology develop skill in preparation of reports, writing research communications and thesis

OBJECTIVES:

- To impart understanding on the concepts of statistics and to improve the Computing knowledge of the statistical methods related to environment

COURSE OUTCOMES:

CO1- Understanding research questions and tools
CO2- Experience in scientific writings
CO3-Practice in various aspects of scientific publications
CO4-Inculcation of research ethics

Unit I

Research Selection of problem-stages in the execution of research: choosing a topic to publication- preparation of manuscript-report writing- format of journals – proof reading – sources of information: Journals, reviews, books, monographs, etc, Bibilograpy. Journal ; standard of research journals – Impact factor.

Unit II:

Statistical method -Measures of dispersion: Universe and population – delimiting population – sampling method – random sampling, stratified random sampling – types of variables: qualitative and quantitative variables – continuous and discontinuous variables – scaling method S- mean – standard deviation – standard error – coefficient of variation.

Unit III

Coparision of means, chisquard test, student test (ANOVA ''portioning of variation). F test – model sums on one way ANOVA with interpretation of data – introduction to MANIVA – Statistical and their use – significance test and fixing levels of significance – use of statistical software like COSTAT and STATISTICA. Breif introduction to pie and histograms. Use of LCD.

UNIT IV:

Chromatography – priniciple, operative technique and applications of paper, TLC, adsorption chromatography, GLC and HPLC. Ion-Exchange, molecular sieve, Electrophoretic techniques – principle and technique of gel, SDS, high voltage and discontinuous electrophoresis, Isoelectric focusing, plused field gel electrophoresis and capillary electrophoresis. Spectrometry – Centrifugation techniques.

UNIT V:

X-Rays – X-Ray diffraction, crystals and detectors, quantitative analysis and applications. Radio chemical methods – Basic concepts, counting methods and applications. Autoradiography, detection and measurement of radioactivity, applications of radioisotopes in biology.

Text Books

S. No	Author Name	Title of the Paper	Edition/year	Publication

1.	C. R. Kothari	Research Methodology	2^{nd} / 2004	New age international publishing (p) Ltd.
2.	S. Rajkumar	Research Methodology	1^{st} / 2008	Anuradha Publication
3.	Jerrold H. Zar	Biostatistical Analysis	4^{th}/2003	Pearson Education (Singapore) Pte. Ltd.
4.	D. J. Homie and Hazel Peck	Analytical Biochemistry	3^{rd} / 1998	Longman group

References

1. An introduction to practical biochemistry by David T. Plummer.
2. Physical Biochemistry – Application of Biochemistry and Molecular Biology, David Friefelder, W.H Freeman and Co, 2^{nd} Edition 1999.
3. Experimental Biochemistry, Robert Switzer and Liamgarrity, W.H. Freeman and Co, 3^{rd} 1999.
4. Davis, G.B and C.A Parker, 1997. Writing the doctoral dissertation, Barrons Education series, 2^{nd} edition, Pp 160, ISBN: 081208005
5. Duneary, P. 2003. Authoring a Ph. D thesis: how to plan, draft, write and finish a doctoral dissertation. Plagrave Macmillan, Pp256. ISBN 1403905843.

SEMESTER III

Course Code	Course Title	L	T	P	C
22216SEC31	Microbial Genetics	6	1	0	6

AIM

- The emergence of molecular genetics has revolutionized large areas of modern biological and biochemical research work it has had a huge impact on the biotechnology industry.

OBJECTIVE

- To extend the knowledge on molecular basis of mutation at microbial level
- To focus on gene regulation and expression mechanisms
- To understand the principles role of plasmids and gene transfer methods

OUTCOME

CO1- Understood genome organization of model organisms.

CO2 - Learn molecular mechanisms that underlie mutations.

CO3- Study about transformation,transduction and conjugation.

CO4- Are able to describe the nature of the transposable elements

Unit I

Trends in Gene discovery. Nucleic acids as genetic information carriers: concept of gene – allele, cistron, replicon – origin of mutation – mutagens – physical, chemical and biological agents. Induced mutation types – mechanisms of mutation induction – suppression of mutations – Intergenic and intragenic suppression.

Unit II

Transformation- Griffith experiments, natural or artificial competence transformation in Bacillus, E. coli, ***Haemophilus*** and ***Streptococcus*** – mechanism of recombination – genetic mapping.

Unit III

Bacterial conjugation – F plasmid – structure and functions. Origin of Conjugation – Hfr and F' strains. Interrupted and uninterrupted mating – time map and recombination map. Conjugation in ***E. coli, Pseudomonas.*** Plasmids, F-factors description and their uses in genetic analysis. Colicins and col factors.

Unit IV

Transduction – generalized and specialized transduction – P1 phage – mechanism of gene transfer through lambda and P1 phages. HFT and LFT lysate. Co- transduction – transduction mapping.

Unit V

Regulation of bacterial gene expression – Operon model – lac, ara, trp and his operons, operon concept, catabolite repression, instability of bacterial RNA, positive and negative regulation, inducers and co-repressors. Attenuation – lac and trp operons; Human genetics: pedigree Analysis, Genetic disease through gene map, Micro array techniques, Single nucleotide polymorphisms (SNPs)

Text Books

S. No	Author Name	Title of the Paper	Edition/year	Publication
1.	Larry Snyder, Wendy Champness	Molecular Genetics of Bacteria	1997	American society of Microbiology
2.	David Freifelder	Molecular Biology	2^{nd}/1990	Narosa Publishing House
3.	William S. Klug, Michael R. cummings	Concept of Genetics	7^{th}/2003	Pearson Education(Singapore) Pte. Ltd.

References

1. Siger, M., Berg, P. (1991). Genes and Genomes, University Science Book.
2. Snustad, D., Simmons, J. and Jenkins, B. (1997). Principles of Genetics, First edition, John Wiley and Sons.
3. Watson, J.D., Hopkins, N.H., Roberts, J.W., Stietz, J.A. and Weiner, A.M. (1998). Molecular biology of the gene, 4^{th} edition, Benjamin / Cummings Publishing Company.

Course Code	Course Title	L	T	P	C
22216SEC32	Microbial Biotechnology	6	1	0	6

AIM

To understand the gene and its role in genetic engineering aspects

OBJECTIVES

- To learn the basic principles of nucleic acid and recombinant technology.
- To understand the relationships between molecule/cell level phenomena.
- Studying the concepts and mechanism of central dogma.

COURSE OUTCOME

CO1- Developed an understanding in recombinant DNA technology.

CO2- candidate to recollect the basics of Molecular Genetics and apply a cognitive thinking.

CO3-Possibilities ranging from the treatment of human diseases to develop novel medicines

Unit I:

Nucleic acids – Types- DNA, RNA- structures, functions. Vectors – plasmids (Ti plasmids, pBR322, pSC101, pUC), cosmids, bacteriophages- Structures and functions. DNA replication- process,enzymology and inhibitors of replication. Enzymes-DNA polymerases, RNAses, Ligases, Taq polymerases, Topoisomerases-uses and applications. DNA damage-Types (deamination,oxidative damage, alkylation, pyrimidine dimmers. Repair mechanisms.

Unit II:

Gene-definition, concepts, structure and functions. Cloning techniques, Genomic librarary. RAPD, RFLP, AFLP and SSR marker in molecular studies and its application. Principles and techniques of Nucleic acid hybridization, protein sequencing and blotting techniques, PCR, DNA fingerprinting.

Unit III:

Biotechnology-Definitions, Concepts and Scope, History and achievements. Screening for products from microorganisms – Inoculum development – Long term preservation of microbes. Biological approaches in microbial production of aminoacids, organic acids, antibiotics, vitamins, steroids and sterols.

Unit IV:

Strain improvement – Applications of mutation, Recombination and DNA Technology. Recombinant DNA Technology – Principles and applications, enzymology of process. Restriction enzymes – Types, recognition sites and specificity.

Unit V:

Biotransformation – Strategies and techniques involved in the process. Immobilization methods – advantages, immobilization production of Mabs. Insulin, somatotropin, IFNs, Vaccines by cloning. Microalgal biotechnology – Dunaliella, Biotechnological potentials of microalgae as food, feed, fuel and pharmaceuticals.

Text Books:

1. Benjamin, L (1990). Gene. IV Edn. Oxford Univ. Press, Oxford.
2. Berg. M.M. and Howe, M.M(1989). Mobile DNA. American society for Microbiology, Washington D.C.
3. Brown, T.(1991) Essential Molecular Biology – A Practical approach. Vol.I Vol II Oxford Univ. Press. Oxford.

Course Code	Course Title	L	T	P	C
22216SEC33L	Microbial Genetics and Biotechnology Lab	0	0	5	3

AIM:

- To facilitate the students to know the biotechnological aspects in plant growth and improvement.

OBJECTIVES

- Genetic laboratory course to introduce the students to learn about prokaryotic and eukaryotic• genetic system using modern techniques.

OUTCOMES

- This curse will provide to this students about the mechanics of experimentation methods of genetics.

Experiments

1. Isolation of plasmid DNA from bacteria by Spectrophotometric assay.
2. Isolation of chromosomal DNA from bacteria by Agarose gel electrophoresis.
3. Development of competent cells in ***E. coli***.
4. Separation of protein by SDS PAGE
5. Isolation of antibiotic resistant auxotropic mutants.
6. Separation of proteins using Column chromatographic techniques (Gel filtration).
7. Immobilization techniques – alginate beads.
8. Estimation of citric acid and ethanol.

DEMONSTRATION

1. Gel Electrophoretic methods.
2. UV transillumination

Course Code	Course Title	L	T	P	C
22216SEC34A	**Microalgal Technology**	5	0	0	4

AIM:

- To facilitate the students to know the tissue culture aspects in crop improvement

OBJECTIVES

- To understand the basic principles of tissue culture technique and its applications

OUTCOMES

- To know the basic technique of tissue cultures
- To produce new plants through this tissue culture
- To gain the knowledge about tissue culture in crop improvements.
- To know the applications of tissue culture in various fields.

Unit I

Introduction - history, scope and concepts of basic techniques in plant tissue culture. Laboratory requirements and organisation. Sterilization-filter, heat and chemical. Media preparation - inorganic nutrients, organic supplements, carbon source, gelling agents, growth regulators and composition of important culture media (MS, White,s and Gamborg's media).

Unit II

Cell, tissue and organ culture - Isolation of single cells, selection and types of cells, tissue explants and organs for culture - paper, raft nurse technique, plating method, microchamber techniques, cell suspension cultures - batch, continuous, chemostat culture - synchronization of suspension culture, cellular totipotency, cytological, cytochemical and vascular differentiations - totipotency of epidermal and crown – gall cells.

Unit III

Micropropagation - clonal propagation of elite germplasm, factors affecting morphogenesis and proliferation rate, technical problems in micropropagation. Organogenesis - formation of shoots and roots - role of growth regulators and other factors, somaclonal and gametoclonal variations. Somatic embryogenesis - Process of somatic embryogenesis, structure, stages of embryo development, factors affecting embryogenesis, synthetic seeds.

Unit IV

Haploid production - androgenesis, gynogenesis - techniques of anther culture – segmentation pattern in microspore - isolated pollen culture - plantlets from haploids - diploidisation - factors influencing androgenesis, haploidy through gynogenesis, haploid mutants, utilization of haploids in plant breeding. Protoplast culture: Isolation of protoplasts - mechanical and enzymatic sources, culture of protoplasts, viability. Protoplastfusion - spontaneous, mechanical, induced electrofusion, selection of somatic hybrids, cybrids, importance.

Unit V

Cryopreservation and gene bank - Modes of preservation, preparation of materials for deep freezing, cryopotectors, storage strategies, assessment of successful cryopreservation, application and limitations. Application of tissue culture in forestry, horticulture, agriculture and pharmaceutical industry, transgenic plants.

REFERENCES

1. Bhojwani, S.S. and Razdan, M.K. (1983). *Plant Tissue Culture: Theory and Practice*. Elsevier Science Publishers, Netherlands.
2. Dodds, J.H. and Roberts, I.W. (1985). *Experiments in Plant Tissue Culture*. Cambridge University Press, UK.
3. Fowler, M.W. (1986). *Industrial Application of Plant Cell Culture. In: Yeoman, M. M. (ed.). Plant Cell Culture Technology*. Blackwell, Oxford, London.
4. Hammoond, J., McGarvey, P. and Yusibov, V. (2000). *Plant Biotechnology*. Springer Verlag, New York.
5. Johri, B.M. (1982). *Experimental Embryology of Vascular Plants*. Narosha Publishing House, New Delhi.
6. Kalyan Kumar, De (1992). *An Introduction to Plant Tissue Culture*. New Central Book Agency, Calcutta.
7. Ramawat, K.G. (2000). *Plant Biotechnology*. S. Chand and Co. Ltd., New Delhi.
8. Razdan, M.K. (2004). *Introduction to Plant Tissue Culture* (2nd ed.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
9. Reinert, J. and Bajaj, Y.P.S. (1977). *Plant Cell Tissue and Organ Culture: A Laboratory Manual*. Narosa Publishing House, New Delhi.

Vasil, I.K. (1986). *Cell Culture and somatic Cell Genetics of Plants* (3 Volumes). Academic Press Inc.

Course Code	Course Title	L	T	P	C
22216SEC34B	Nanotechnology	5	0	0	4

Aim

To understand about nanotechnology principles and its applications

Objective:

To gain knowledge about Nanotechnology and its commercial promise

Outcomes:

To understand the basic principles and method of Nanotechnology

To know the applications of Nanotechnology

To understand the groundbreaking innovations in medicine and medical implants, environment and other field

Unit I: Introduction to bionanotechnology

Milestones in History – bionanotechnology – concept and future prospects – application in Life Sciences. Terminologies – nanotechnology, bionanotechnology, nanobiomaterials, biocompatibility, nanomedicine, nanowires, quantum Dots, nanocomposite, nanoparticles, nanosensors. Biotechnology to bionanotechnology, natural bionanomachines. Current status of bionanotechnology.

Unit II: Synthesis of nanoparticles

Molecular nanotechnology – nanomachines – collagen. Uses of nanoparticles – cancer therapy – manipulation of cell and biomolecules. Cytoskeleton and cell organelles. Types of nanoparticles production – physical, chemical and biological. Microbial synthesis (bacteria, fungi and yeast) of nanoparticles – mechanism of synthesis.

Unit III: Types of nanoparticles and methods of characterization

Nanoparticles – types, functions – Silver, Gold and Titanium. Physical and chemical properties of nanoparticles. Characterization of nanoparticles – UV-Vis spectroscopy, particle size analyzer, Electron Microscopy – HRTEM, SEM, AFM, EDS, XRD. Other tools and techniques required for bionanotechnology: rDNA technology, site directed mutagenesis, fusion proteins, X- Ray crystallography, NMR. Bioinformatics: molecular modeling, docking, computer assisted molecular design.

Unit IV: Applications of bionanotechnology

Drug and gene delivery – protein mediated and nanoparticle mediated. Uses of nanoparticles in MRI, DNA and Protein Microarrays. Nanotechnology in health sectors. Nanomedicines, Antibacterial activities of nanoparticles. Nanotechnology in agriculture. Toxicology in nanoparticles – Dosimetry.

Unit V: Merits and demerits of nanoparticles

Advantages of nanoparticles – drug targeting, protein detection, MRI, development of green chemistry – commercial viability of nanoparticles. Disadvantages – pollution and health risks associated with nanoparticles.

REFERENCES

1. Parthasarathy BK. Introduction to Nanotechnology, Isha Publication. 2007.
2. Elisabeth Papazoglou and Aravind Parthasarathy. Bionanotechnology. Morgan and Claypool Publishers. 2007.
3. Bernd Rehm. Microbial Bionanotechnology: Biological Self-assembly Systems and Biopolymer-based Nanostructures. Horizon Scientific Press. 2006.
4. David E Reisner and Joseph D Bronzino. Bionanotechnology: Global Prospects. CRC Press. 2008.
5. Ehud Gazit. Plenty of Room for Biology at the Bottom: An Introduction to Bionanotechnology. Imperial College Press. 2006.
6. Kamali Kannangara. Nanotechnology: Basic science and emerging technologies- Mick Wilson, Overseas Press. 2005.
7. Mark A Ratner and Bandyopadhyay AK. Nano Materials. Nanotechnology: A gentle introduction to the Next Big Idea, New Age Publishers. 2002.
8. Pradeep T. Nano Essentials understanding nanoscience and Nanotechnology. 1st edition. TMH publications. 2007.
9. Parag Diwan and Asish Bharadwaj. Nanomedicines, Pentagan Press. 2006.
10. Vladimir P Torchilin. Nanoparticles as Drug Carriers. Imperial College Press, North Eastern University, USA. 2006.

OPEN ELECTIVE

Course Code	Course Title	L	T	P	C
222ENOEC	**Writing for the Media**	4	0	0	4

Aim:

- To equip students to enter into the realm of mass media.

Objective:

- To comprehend the intricacies of mass media
- To know about the barriers to mass communication
- To understand the function of mass media
- To learn the different kinds of news
- To enhance the different kinds of writing for media

Outcome:

- Understand the intricacies of mass media
- Learn to write for the media

UNIT-I

Mass communication- Barriers to mass communication and mass culture- Function of mass media - Media effects, Qualities of media men.

UNIT-II

News- Hard and soft news- Expected and unexpected news- Box news- Follow up news-Scoop-Filters- Human interest stories- Recognizing and evaluation news.

UNIT-III

News and views- News analysis, Editorial, Columns, Article, Middle reviews, Letters-Features.

UNIT-IV

Reporting- Crime, Court, Election, Legislature, Sports, Development Investigative, Interpretative depth.

UNIT-V

Writing for Media-Inverted pyramid style-Feature style-TV/Broadcast, New style writing TV/Radio Documentaries- Writing Advertisements-Practical

Reference Book:-

Author	Title of the book	Edition / Year	Publisher
Susan	Journalism		
John Hogenberg	Professional Journalism	2012	
M.James Neal	News Writing and Reporting		Surjeet Publication
M.V Komath	The Journalist's Handbook		
D.S Mehta	Mass Communication & Journalism		

Course Code	Course Title	L	T	P	C
222MAOEC	**Applicable Mathematical Techniques**	4	0	0	4

Aim:

- To acquaint with the basic concept of Interpolation.

Objectives:

- Understand the basic concept of Interpolation.
- To enhance the knowledge about Assignment Problems, Replacement Problems, Decision Analysis and Game Theory.

Outcomes:

- Students using OR techniques in business tools for decision making
- Students develop Assignment problem and Replacement problems
- Understand the concept of decision analysis and game theory
- Students gets the knowledge about interpolation

UNIT I

Interpolation with unequal intervals: Newton's, Lagrage's, and inverse interpolation

UNIT II

Assignment Problems

UNIT III

Replacement Problems

UNIT IV

Decision Analysis

UNIT V

Game Theory

References

Unit I, "Numerical Methods in Science and Engineering" M.K.Venkatraman

Units II to V, "Operations Research", Kantiswarup, P.K. Gupta and Manmohan

Course Code	Course Title	L	T	P	C
222PHOEC	**Biomedical Instrumentation**	4	0	0	4

Aim:

- To understand the concepts and application of electronic Instrumentation in the Medical field.

Objective:

- Understanding basic principles and phenomena in the area of medical diagnostic instrumentation,
- Theoretical and practical preparation enabling students to maintain medical instrumentation

OUTCOMES:

- Define basic medical terms and physical values that can be handled by medical instrumentation,
- Describe methods and implementation of electrical and nonelectrical medical parameters diagnostic,
- demonstrate measuring of basic medical parameters,
- Calculate basic parameters of the equipment for using in electro diagnostic and electro therapy,
- Apply safety standards and select disposal method and procedures for electrical diagnostic equipment.

UNIT – I: BIO ELECTRIC SINGNALS AND ELECTRODES

Fundamentals of medical instrumentation – Sources of biomedical signals – basic medical instrumentation – Intelligent medical instrumentation system – Origin of Bio electric signals – Recording Electrodes – Silver – Silver chloride electrodes – Electrodes for ECG – Electrodes for EEG – Electrodes for EMG.

UNIT – II: RECORDING SYSTEM AND RECORDERS

Basic recording system – General consideration for signal conditions – Preamplifiers – Biomedical signal analysis technique – main amplifier and driver stage – Writing systems – direct writing recorders – the ink jet recorders – Electrocardiograph, Electroencephalograph – Electromyography and other Biomedical recorders.

UNIT – III: MEASUREMENT AND ANALYSIS TECHNIQUES

Electro cardiography – measurements of Blood pressure - measurements of Blood flow and cardiac output, Respiratory therapy Equipment – Origin of EEG – Action Potentials of the brain – evoked potentials – Placement of electrodes – Recording set up – Analysis of EEG.

UNIT – IV: MAGNETIC RESONANCE AND ULTRASONIC IMAGILG SYSTEMS

Principles of NMR Imaging system – Image reconstruction Techniques – Basic NMR components – Biological efforts of NMR Imaging – Advantages of NMR Imaging System – Diagnostic ultra Sound – Physics of ultrasonic waves – metical ultra sound – basic pulse – echo apparatus, A – Scan – echocardiograph(M mode).

UNIT – V: ADVANCED BIO MEDICAL SYSTEMS

Pacemakers – Need for Cardiac pacemaker – External Pace makes – Implantable Pace makers – recent development in Implantable Pacemakers – Pacing system Analyzer – Defibrillator – Pacer – Cardioverter – Physiotherapy and electro therapy equipment – High frequency heat therapy – short wave diathermy – microwave and ultrasonic therapy – pain relief through electrical simulation.

Books for Study

1. R.S Khandpur, Handbook of Biomedical instrumentation, Tata McGraw Hill publishing company Limited. New Delhi,(2003). (Unit I,II,IV & V)
2. Lestlie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, Bio medical instrumentation and measurements, PHI, New Delhi.(Unit-III)

Book for Reference

1. M.Arumugam, Biomedical Instrumentation, Anuradha Agencies, Kumbakonam (2000).

Course Code	Course Title	L	T	P	C
222CHOEC	Open Elective-Green Chemistry	4	0	0	2

Aim:

- To reduce the soil and water pollution in environment.

Objectives:

- To learn about the environmental status, public awareness in evolution, principles involved in green chemistry, bio-catalytic reactions, global warming and its control measures, availability of green analytical methods.

Outcomes:

- To understand the environmental status and evolution.
  - · To know about the Pollution and its prevention measures.
  - · To familiarize the green chemistry.
  - · To learn about the bio-catalytic reactions.
  - · To understand about the vitamins and antiobiotics.

Unit I - Introduction

Introduction-Current status of chemistry and the Environment-Evolution of the Environmental movement: Public awareness - Dilution is the solution to pollution-Pollution prevention.

Unit II - Principles

Green Chemistry – Definition – Principles of Green Chemistry - Why is this new area of Chemistry getting to much attention - Why should chemist pursue the Goals of Green Chemistry - The roots of innovation – Limitations.

Unit III - Bio Catalytic Reactions

Green Chemistry Using Bio Catalytic Reactions – Introduction - Fermentation and Bio transformations - Production of Bulk and fine chemicals by microbial fermentation Antibiotics – Vitamins - Bio catalyses synthesis of industrial chemicals by bacterial constructs - Future Tends.

Unit IV - Green House Effect

Green house effect and Global Warming – Introduction - How the green house effect is produced - Major sources of green house gases - Emissions of CO_2 - Impact of green house effect on global climate - Control and remedial measures of green house effect - Global warming a serious threat - Important points.

Unit V - Green Analytical Methods

Future trends in Green Chemistry - Green analytical methods, Redox reagents, Green catalysts; Green nano-synthesis, Green polymer chemistry, Exploring nature, Biomimetic, Proliferation of solvent-less reactions; Non-covalent derivatization, Biomass conversion, emission control

References:

1. Introduction to Green Chemistry – M.Rayan and M.Tinnes
2. New Trends in Green Chemistry – V.K.Ahluwalia and M.Kidwai

Course Code	Course Title	L	T	P	C
222CSOEC	**M-Marketing**	4	0	0	4

OBJECTIVES

- Understand Mobile Business strategies.
- To understand Mobile marketing tools and techniques.
- To know Mobile technologies.

OUTCOMES

- Upon Completion of the course, the students should be able to:
- Analyze various mobile marketing strategies.
- Market Mobile based Applications.
- Apply various tools in mobile marketing.

UNIT I : Introduction

Mobile Marketing Campaign, Fortune 500 and Mobile Marketing, consumers engagement with mobile, Terminologies.

UNIT II : Businesses Vs mobile marketing

classic mistakes in mobile marketing, laying foundation for successful mobile marketing campaign, understanding technology behind mobile marketing – Android, iOS, Windows Phone.

UNIT III

Strategic thinking about Mobile marketing campaign, Mobile Marketing Tools – setting up mobile website for different firms, using SMS, MMS and apps to drive customers to business and other ways to attract customers.

UNIT IV: Location Based Marketing

LBS, NFC, Bluetooth and LBA, 2D codes, Tablet, Other Mobile Applications, Business Firms connecting to customers using Mobile – case study, Mobile Marketing for B2B companies, Mobile E-commerce to Drive Revenue.

UNIT V: Mobile Payments

Present and Future Mobile Technology, Mobile Application Development.

REFERENCE BOOKS:

1. Go Mobile: Location Based Marketing, Apps, Mobile Optimized Ad Campaigns, 2D codes and other Mobile Strategies to Grow your Business, Jeanne Hopkins, Jamie Turner, John Wiley&Sons Inc., 2012.
2. M- Commerce, Paul Skeldon, Crimson Publishing, 2012.
3. M-Commerce Technologies, Services and Business Models, Norman Sadeh , Wiley 2002.
4. Mobile Commerce, Opportunities, Applications and Technologies of Wireless Business, Paul Mary, Tom Jell, Cambridge University Press, 2001.

Course Code	Course Title	L	T	P	C
222CMOEC	Open Elective- Financial Services	4	0	0	2

AIM

To analyze the various financial institutions and their services.

OBJECTIVES

1. To gain knowledge on financial services.
2. To understand importance of various services including banking, insurance, mutual funds.

OUTCOME

To introduces meaning and functions of Financial Intermediaries
To understand the role of merchant bank and its services
To provide information regarding management of mutual funds and Regulations
To understand the role and functions of financial services Marketing
To know the structure and types of debt Instruments
To realize Foreign Exchange Market

UNIT – I

Financial system-An Overview: Indian Financial System-Global Financial System-Financial Services Environment- Credit Rating –Factoring and Forfeiting –Leasing

UNIT – II

Financial Markets –An Overview: Definition-Role-Functions-Constituents-Financial Instruments-Capital Market instruments-Indian money and Capital Market-Global Financial Markets.

UNIT – III

Money Market –An Overview:
Definition-Characterstistics-Objectives-Imporatance-Functions-Segment-Financial Institutions-Indian Money Market-Global Money Market

Unit – IV

Capital Market: Money Market-Characteristics-Functions-New financial Instruments-measures of Investor Protection-Indian Capital Market-Major Issues

Unit-V

Stock Exchange: History of Stock Exchange-Functions-Indian Stock Exchanges-Organization structure-Regulations of Stock Exchange –Recent Developments

REFERENCE BOOKS

1. Gordon , Natarajan – Financial Market and Services.
2. Dr. S. Gurusamy – Financial services and Market.
3. Kucchol S.C. – Financial Management
4. Pandey I.M. – Financial Management.

SEMESTER IV

Course Code	Course Title	L	T	P	C
22216SEC41	Pharmaceutical Microbiology	6	1	0	6

AIM

- The information gained will help the students to formulate novel drugs.

OBJECTIVES:

- To facilitate the students to know the definite path of metabolism of drugs and drug discovery

OUTCOMES:

- This course gives information on drug designing, novel techniques in drug discovery and the role of biotechnology in pharmaceutics.

Unit – 1 Antibiotics and synthetic antimicrobial agents

Antibiotics and synthetic antimicrobial agents, Antifungal antibiotics, antitumor substances.Peptide antibiotics, Chloramphenicol, Sulphonamides and Quinolinone antimicrobial agents.Chemical disinfectants, antiseptics and preservatives.

Unit – 2 Mechanism of action of antibiotics

Mechanism of action of antibiotics (inhibitors of cell wall synthesis, nucleic acid and protein synthesis). Molecular principles of drug targeting.Drug delivery system in gene therapy Bacterial resistance to antibiotics. Mode of action of non – antibiotic antimicrobial agents. Penetrating defenses – How the antimicrobial agents reach the targets (cellular permeability barrier, cellular transport system and drug diffusion).

Unit – 3 Microbial production and Spoilage of pharmaceutical Products

Microbial contamination and spoilage of pharmaceutical products (sterile injectibles, non injectibles, ophthalmic preparations and implants) and their sterilization.
Manufacturing procedures and in process control of pharmaceuticals.
Other pharmaceuticals produced by microbial fermentations (streptokinase, streptodornase). New vaccine technology, DNA vaccines, synthetic peptide vaccines, multivalent subunit vaccines. Vaccine clinical trials.

Unit – 4 Regulatory practices, biosensors and applications in Pharmaceuticals

Financing R&D capital and market outlook. IP, BP, USP. Government regulatory practices and policies, FDA perspective. Reimbursement of drugs and biologicals, legislative perspective. Rational drug design. Immobilization procedures for pharmaceutical applications (liposomes). Macromolecular, cellular and synthetic drug carriers. Biosensors in pharmaceuticals.Application of microbial enzymes in pharmaceuticals.

Unit – 5: Quality Assurance and Validation

Good Manufacturing Practices (GMP) and Good Laboratory Practices (GLP) in pharmaceutical industry. Regulatory aspects of quality control. Quality assurance and quality management in pharmaceuticals ISO, WHO and US certification. Safety in microbiology laboratory.

BOOKS/REFERENCE

1. Pharmaceutical Microbiology – Edt. by W.B.Hugo & A.D.Russell Sixth edition. Blackwell scientific Publications.

Course Code	Course Title	L	T	P	C
22216SEC42	Biostatistics and Bioinformatics	6	1	0	6

Unit I – Definitions

Scope of Biostatistics, probability analysis – variables in Biology, collection, classification and tabulation of data – Graphical and diagrammatical representation – scale diagrams – Histograms – frequency polygan – frequency curves. Measures of central tendency – arithmetic Mean, Median and Mode – calculation of mean, median, mode in series of individual observations, discrete series, continuous open – end classes. Measure of dispersion – Standard Deviation and Standard curves, Measures of central tendency on Variance.

Unit II – Correlation and regression

Simple correlation – Correlation coefficient – Regression simple linear regression. Basic ideas of significance test – Hypothesis testing level of significance – Test based on student 't' 'chi' square and goodness of fit. 'F' test – ANOVA.

Unit III – Databases

Biological resource databases – Examples and application – Sequence Analysis – protein and nucleic acid.

Unit IV – Genomics and proteomics

Sequencing genomes – sequence assembly – genome on the web – annotating and analyzing genome sequences. Proteomics pathway databases.

Unit V – Sequence analysis

Pair wise sequence comparison, protein data bank, SWISS-PROT, Genbank – sequence queries against biological databases – BLAST and FASTA – multifunctional tools for sequence analysis, multiple sequence alignments, phylogenetic alignment – profiles and motifs.

Text Books

S. No	Author Name	Title of the Paper	Edition/year	Publication
1.	D.R. Westhead, J. Howard Parish and Richard M. Twymans	Bioinformatics	1st /2003	Viva Books Private Limited
2.	S. Sundara Rajan, R. Balaji	Introduction to Bioinformatics	1st /2002	Himalaya Publishing House
3.	Rashidi, H.H. and Bvehler, L.K	Bioinformatics Basics: Applications in Biological Science and Medicine	2002	CRC Press, New York.

References

1. Cynthia Gibas and Per Jambek (2001) Developing Bioinformatics Computer Skills, Shroff Publishers and Distributions Pvt. Ltd., O'reilly, Mumbai.
2. Misener, S. and Krawetz, S.A. (2000). Bioinformatics Methods and protocols, Human Press Totowa, New Jessey.

3. Rashidi, H.H. and Bvehler, L.K. (2002). Bioinformatics Basics: Applications in Biological Science and Medicine, CRC Press, New York.
4. Cynthia Gibas and Per Jambek (2001) Developing Bioinformatics Computer Skills, Shroff Publishers and Distributions Pvt. Ltd., O'reilly, Mumbai.
5. Misener, S. and Krawetz, S.A. (2000). Bioinformatics Methods and protocols, Human Press Totowa, New Jessey.

Course Code	Course Title	L	T	P	C
22216SEC43L	Pharmaceutical Microbiology Lab	5	0	0	4

Aim

To provides knowledge and understanding with regards to the significance of the presence of bacteria, yeasts, moulds, viruses and toxins in **pharmaceutical** raw materials, intermediates, new products and **pharmaceutical** production.

Objective

Culture and identification of important human pathogens, microbial growth conditions, effect of antimicrobial agents, development of resistance against antimicrobial agents, sterilization and disinfection, bacterial virulence factors, production and control of vaccines.

Course outcome

CO1 - Aseptic condition relevance to healthcare and the pharmaceutical industry.

CO2 - Knowledge and understanding of the practical aspects of pharmaceutical microbiology.

CO3 - Perform practicals on antimicrobial activity

CO4- Learn the production of antibiotics from microbes.

Lab Work

1. Introduction to equipment and glassware used in microbiology laboratory (BOD, Incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, etc.,)
2. Study of morphology of different microbes
3. Preparation of various culture media (Determination of microbial colony characteristics)
4. Isolation of pure cultures by streak plate, spread plate & pour plate techniques.
5. Enumeration of bacteria by direct microscopic count.
6. Motility test by Hanging drop method
7. Microbiological assay of antibiotics by cup plate method and other methods
8. Characterization of microbes through Bio chemical reactions (IMViC)
9. Evaluation of any disinfectant by phenol coefficient test
10. Study of Oligodynamic action (of metals on bacteria)
11. Preservation of microorganisms (slant and stab cultures)
12. Sterility testing of Pharmaceuticals
13. Microbiological Analysis of Water.
14. Production of antibiotics using microbes

Course Code	Course Title	L	T	P	C
22216SEC44A	Bioethics and IPR	5	0	0	4

Aim

To understand the basic principles of Bioehtics and IPR

Objective

Students will gain awareness about Bioethics and Intellectual Property Rights (IPRs) to take measure for the protecting their ideas

Outcome

To know about Bioethics and Intellectual Property Rights (IPRs)

They will able to devise business strategies by taking account of IPRs

They will be able to assists in technology upgradation and enhancing competitiveness.

They will acquire adequate knowledge in the use of genetically modified organisms and its effect on human health

They will gain more insights into the regulatory affairs.

Unit I

Bioethics Concept, philosophical considerations, epistemology of science, ethical terms, principles and theories and relevance to biotechnology. Ethics and the law issues - genetic engineering, stem cells, cloning, medical techniques, transhumanism and bioweapons. Research concerns - animal rights, ethics of human cloning, reproduction and stem cell research.

Unit II

Emerging issues - biotechnology's impact on society, DNA on the witness stand and use of genetic evidence in civil and criminal court cases. Challenges to public policy, regulations, improving public understanding of biotechnology products to correct misconceptions.

Unit III Introduction to IPR & Legal Protection

Basics of patents, types of patents, Indian Patent Act 1970, recent amendments, filing patent application, precautions before patenting – disclosure and non-disclosure. WIPO treaties, Budapest treaty, PCT and implications, role of a country patent office and procedure for filing a PCT application. Types of IP - patents, trademarks, copyright & related rights, industrial design, traditional knowledge, geographical indications and international framework for the protection of IP. Introduction to history of GATT, WTO, WIPO and TRIPS. Global scenario of patents and Indian position, patenting of biological materials. IP as a factor in R&D and IP relevance to Biotechnology.

Unit IV Patent Filing and Infringement

Patent application - forms and guidelines, fee structure and time frames. Types of patent applications, provisional and complete specifications, PCT and convention patent applications. International patenting - requirement, procedures and costs. Financial assistance for patenting and introduction to existing schemes. Publication of patents -gazette of India, status in Europe and US. Patenting by research students, lecturers and scientists. University/organizational rules in India and abroad, credit sharing by workers and financial incentives. Patent infringement - meaning, scope, litigation, case studies and examples.

Unit V
Biosafety

Introduction and historical background. Introduction to biological safety cabinets, primary containment for biohazards, biosafety levels, biosafety levels of specific microorganisms, recommended biosafety levels for infectious agents and infected animals. Biosafety guidelines by Government of India. Definition of GMOs and LMOs. Roles of Institutional Biosafety Committee, RCGM, GEAC etc. for GMO's applications in food and agriculture. Environmental release of GMOs, risk assessment; risk management and communication. Overview of national regulations and relevant international agreements including Cartagena protocol.

Important Links

1. Bioethics - by Ellen Frankel Paul, Fred D. Miller, Jeffrey Paul, Fred Dycus Miller Cambridge University Press, 2002.
2. Bioethics & Science, John A. Bryant, Linda Baggott la Velle, John F. Searle – 2002.
3. http://www.w3.org/IPR/
4. http://www.wipo.int/portal/index.html.en
5. http://www.ipr.co.uk/IP_conventions/patent_cooperation_treaty.html
6. www.patentoffice.nic.in

Course Code	Course Title	L	T	P	C
22216SEC44B	Molecular Immunology	5	0	0	4

Aim:

- This subject considers immune responses at the molecular level and covers the role of immune receptors on immune cells in the initiation of immune responses

Objective:

- To understand the immune response in molecular level

Outcome

- To describe the structure and function of immunological receptors and apply this information towards building a comprehensive understanding of the initiation of immune responses at the molecular level
- To describe the various stages of immune cell development and compare this with abnormal development in a range of immunodefficiency conditions
- To explain how immunoregulation occurs and relate it to the overall function of the immune system in the healthy host as well as in immune disease states

Unit I Fundamental Concepts and Anatomy of the Immune System

Terminology – Antigen, immunogen, hapten, allergen, tolarogen, super antigens, antibody, immunoglobulin, antigenigity, immunogenicity. Self & nonself, innate & acquired immunity. Haematopoesis. Organs, tissues, cells and mediators of immune system - primary lymphoid organs, secondary lymphoid tissues, lymphocytes, cytokines and lymphokines. Lymphatic system, lymphocyte circulation and lymphocyte homing. Mucosal and Gut associated lymphoid tissue (MALT&GALT) and mucosal immunity. Principles of cell signaling.

Unit - II Immune Responses Generated by B and T lymphocytes

B cell: B cell development, maturation, activation and differentiation. B cell receptor and determinants. B cell subsets. Immunoglobulins - basic structure, classes & subclasses of immunoglobulins, antigenic determinants, multigene organization of immunoglobulin genes and immunoglobulin super gene family. Generation of antibody diversity.

T cell: T cell development, maturation, activation and differentiation. T cell receptor and determinant. T cell subsets. TCR complex. Antigen processing and presentation - endogenous antigens, exogenous antigens, non-peptide bacterial antigens Cell to cell co-operation and hapten-carrier system.

Unit - III Immune Response

Recognition & response: Non specific and Specific. **Nonspecific**: Natural built-in barrier, phagocytosis. Complements, natural killing, inflammatory response. **Specific:** HI & CMI. Antigen recognition and response. Major Histocompatibility Complex - MHC genes, MHC in immune responsiveness and disease susceptibility. HLA typing. Kinetics of immune response and memory. **Unresponsiveness:** tolerance, suppression and potentiation.

Unit - IV Vaccinology

Active, passive and combined immunization. Live, killed, attenuated, plasma derived, sub unit, recombinant DNA, protein based, plant-based, peptide, anti- idiotypic and conjugate vaccines – production & applications. Role and properties of adjuvants & ISCOMS. Antibody genes and antibody engineering - chimeric and hybrid monoclonal antibodies, catalytic antibodies and generation of immunoglobulin gene libraries.

Unit - V Clinical Immunology

Immunity to infection, bacteria, viral, fungal and parasitic infections (with examples from each group). Hypersensitivity – Type I, II, III and IV. Autoimmunity and types of autoimmune diseases. Mechanism and role of $CD4^{+}$ T cells, MHC and TCR in autoimmunity. Treatment of autoimmune diseases. Transplantation – immunological basis of graft rejection, clinical transplantation and immunosuppressive therapy. Tumor immunology, tumor antigens, immune response to tumors and tumor evasion of the immune system. Cancer immunology and immunotherapy. Immunodeficiency - primary immuno - deficiencies, acquired or secondary immuno - deficiencies.

Text Books

1. Peter J. Delves, Seamus J. Martin, Dennis R. Burton and Ivan M. Roitt. 2011. Essential Immunology 12th Edition. Wiley - Blackwell.
2. Charles A Janeway, Jr. Paul Travers, Mark Walport, and Mark J Shlomchik. 1999. Immunobiology. 4th Edition. Journal of Current Biology publications.
2. D. M. Weir and John Stewart. 1997. Immunology. 8th Edition. Churchill Livingstone.
3. P.J.Delves, I S.J.Artin, I D.R.Burton and I.M.Roitt. 2006. Essential Immunology. 11th Edition. Wiley - Blackwell.
4. Richard M. Hyde. 2012. Microbiology and Immunology. 3rd Edition. Springer Science & Business Media.

Reference Books

1. Brostoff J, Seaddin JK, Male D and Roitt IM., 2002. Clinical Immunology. 6th Edition. Gower Medical Publishing.
2. Paul William E. 1999. Fundamental of Immunology. 4th Edition. Lippencott Raven.
3. E Roitt. 2011. Essential Immunology. 12th Edition. Blackwell Publication.

SCHOOL OF ARTS AND SCIENCE

DEPARTMENT OF ENGLISH

2022 – 2023

1.1.3 Total number of courses having focus on employability/ entrepreneurship/ skill development offered by the University during the year
1.2.1 Number of new courses introduced of the total number of courses across all programs offered during the year

EMPLOYABLITY	
SKILL DEVELOPMENT	
ENTREPRENEURSHIP	
EMPLOYABLITY/ SKILL DEVELOPMENT	

PRIST
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UNIVERSITY
NAAC ACCREDITED
THANJAVUR – 613 403 - TAMIL NADU

SCHOOL OF ARTS AND SCIENCE

DEPARTMENT OF ENGLISH

2022 – 2023

EMPLOYABLITY

SKILL DEVELOPMENT

ENTREPRENEURSHIP

EMPLOYABLITY/ SKILL DEVELOPMENT

BA ENGLISH- REGULATION 2022
COURSE STRUCTURE
SEMESTER – I
COURSE STRUCTURE

SEMESTER – I

Course Code	Course Title	L	T	P	C
	THEORY				
22110AEC11/ 22111AEC11/ 22132AEC11/ 22135AEC11	Language-I (Tamil-I/ Advanced English-I/ Hindi-I/ French-I)	4	0	0	2
22111AEC12	English-I	4	0	0	2
22111AEC13	Literature in 1400-1600 Period	5	0	0	3
22111AEC14	Literature in Elizabethan Period	5	0	0	3
22111AEC15	Social History of England-I	4	0	0	3
22111AEC16	History of English Literature-I	5	0	0	4
	Total				**17**
	AUDIT COURSE				
221ACLSICN	Indian Constitution	-	-	-	**2**
221ACLSUHV	Universal Human Values	-	-	-	**2**

SEMESTER – II

Course Code	Course Title	L	T	P	C
	THEORY				
22110AEC21/ 22111AEC21/ 22132AEC21/ 22135AEC21	Language-II (Tamil-II/ Advanced English-II / Hindi-II/ French-II)	4	0	0	2
22111AEC22	English-II	4	0	0	2
22111AEC23	Literature in Jacobean Period	5	0	0	3
22111AEC24	Literature in Restoration Period	5	0	0	4
22111AEC25	Social History of England-II	4	0	0	3
22111AEC26	History of English Literature-II	5	0	0	4
	RESEARCH SKILL BASED COURSE				
22111RLC27	Research Led Seminar	-	-	-	1
	Total				**19**
	AUDIT COURSES				
221ACLSCOS	Communication Skills	-	-	-	**2**
221ACSSBBE	Basic Behavioral Etiquette	-	-	-	**2**

SEMESTER – III

Course Code	Course Title	L	T	P	C
	THEORY				
22110AEC31/ 22111AEC31/ 22132AEC31/ 22135AEC31	Language-III (Tamil-III/ Advanced English-III / Hindi-III/ French-III)	4	0	0	2
22111AEC32	English-III	4	0	0	2
22111AEC33	Literature in Augustan Period	4	0	0	3
22111AEC34	Literature in Romantic Period	4	0	0	3
22111SEC35	Literary Forms and Prosody	5	0	0	4
22111AEC36	Shakespeare	4	0	0	3
	RESEARCH SKILL BASED COURSE				
22111RMC37	Research Methodology	2	0	0	2
	Total				**19**
	AUDIT COURSE				
221ACLSOAN	Office Automation	-	-	-	**2**

SEMESTER – IV

Course Code	Course Title	L	T	P	C
THEORY					
22110AEC41/ 22111AEC41/ 22132AEC41/ 22135AEC41	Language-IV (Tamil-IV/ Advanced English-IV/ Hindi-IV/ French-IV)	4	0	0	2
22111AEC42	English-IV	4	0	0	2
22111SEC43	Language and Linguistics	4	0	0	3
22111AEC44	Literature in Victorian Period	4	0	0	3
22111AEC46	Literary Criticism	5	0	0	4
22111AEC47	Indian and European Classics in Translation	4	0	0	3
221ENSTU45	Environmental Studies	2	0	0	2
	Total				**19**
AUDIT COURSE					
221ACLSLMS	Leadership and Management Skills	-	-	-	**2**
221ACSSAQA	General Aptitude and Quantitative Ability				**2**

SEMESTER – V

Course Code	Course Title	L	T	P	C
THEORY					
22111AEC51	Literature in Modern Period-I	5	0	0	3
22111AEC52	American Literature	5	0	0	3
22111SEC53	English Language Teaching	5	1	0	5
22111SEC54	Translation	5	1	0	4
22111DSC55_	Discipline Specific Elective – I	5	0	0	3
RESEARCH SKILL BASED COURSE					
22122BRC57	Participation in Bounded Research	-	-	-	1
	Total				**19**
AUDIT COURSE					
221ACLSPSL	Professional Skills	-	-	-	**2**

SEMESTER – VI

Course Code	Course Title	L	T	P	C
THEORY					
22111AEC61	Literature in Modern Period-II	5	0	0	4
22111AEC62	Indian Writing in English	5	0	0	4
22111AEC63	Commonwealth Literature	5	1	0	5
22111DSC64_	Discipline Specific Elective –II	5	0	0	3
221_ _OEC(2 Digit Course Name)	Open Elective	4	0	0	2
PRACTICAL					
22112PRW65	Project Work	-	-	-	4
22111PEE	Programme Exit Examination	-	-	-	1
	Total				**23**
AUDIT COURSE					
221ACSSIST	Interview Skills Training and Mock Test	-	-	-	**2**
221ACLSCET	Community Engagement	-	-	-	**1**
Total Credits –Programme					**116**
Total Credits - Audit Courses					**19**

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Semester I

Course Code	Course Title	L	T	P	C
22111AEC13	Literature in 1400-1600 Period	5	0	0	3

Aim:

- To acquaint the with a sweep from the beginning to the summit stages of English Literature

Objective:

- To study the early English poetry fathered by Chaucer, followed by the early Elizabethan poets and the beginning of English prose and drama

Outcome:

- Understand British Literature from1400-1600 period
- Explain the connections between their own experiences and the world using the texts

UNIT I

The Prologue to Canterbury Tales-The Prioress, The Wife of Bath, The Parson-Chaucer

UNIT II

Epithalamion -Spenser

UNIT III

Prothalamion -Spenser

UNIT IV

Essays- Of Friendship, Of Studies -Bacon

UNIT V

Spanish Tragedy -Thomas Kyd

EMPLOYABLITY/ SKILL DEVELOPMENT

Course Code	Course Title	L	T	P	C
22111AEC14	Literature in Elizabethan Period	5	0	0	3

Aim:

- To acquaint with the different forms of literature during Elizabethan period

Objective:

- To study the different sonnet forms, ‘humor’ comedy, Shakespearean tragedy and early prose literature during Elizabethan period
- To learn to appreciate the different forms of literature during Elizabethan period

Outcome:

- Explore British Literature in Elizabethan period
- Interpret the texts

UNIT I

Astrophel & Stella(sonnets 1,3,7,15,22) -Sidney

UNIT II

Sonnets(love 29,73,116,129,130) -Shakespeare

UNIT III

Unfortunate Traveller -Thomas Nashe

UNIT IV

Alchemist -Ben Jonson

UNIT V

Othello -Shakespeare

EMPLOYABLITY/ SKILL DEVELOPMENT

Course Code	Course Title	L	T	P	C
22111AEC15	Social History of England-I	4	0	0	3

Aim:

- To acquaint with a total picture of the English society for a better understanding

Objective:

- To know the socio-economic aspects from fourteenth century to eighteenth century

Outcome:

- Learn the social background of British literature from 1400 to Puritan England
- Introduce about English life which have shaped English society

UNIT I

The age of Chaucer-Political history, London, Feudalism and the manor, Black Death, Peasants' Revolt, John Wycliffe, Literature

UNIT II

The fifteenth century- Political history, War of Roses, Landlords and tenants, London, Manor houses, Nunneries, Education, William Caxton, Literature

UNIT III

Renaissance

Reformation

UNIT IV

Shakespeare's England-Political history, Social life, Education

UNIT V

Puritan England- Political history, Colonial expansion, Social life, Religion, Literature

References

Author	Title of the book	Edition / Year	Publisher
G.M Trevelyan A.G.Xavier Padmaja Ashok	English Social History An Introduction to The Social History of England The Social History of England	2211	Surjeeth Publications

EMPLOYABLITY/ SKILL DEVELOPMENT

Course Code	Course Title	L	T	P	C
22111AEC16	History of English Literature-I	5	0	0	4

Aim:

- To acquaint with the literary background for a better understanding

Objective:

- To know the literary background from fourteenth century to seventeenth century
- To understand the biographies of different writers

Outcome:

- Understand the literary background of British Literature from Chaucer's age to Dryden's age
- Know about author's biography

UNIT I
The age of Chaucer
Fifteenth century literature
UNIT II
The age of Shakespeare-I
UNIT III
The age of Shakespeare-II
UNIT IV
The Caroline age
The age of Milton
UNIT V
The age of Dryden

Text book:

Author	Title of the book	Edition / Year	Publisher
Hudson	History of English Literature	2212	Maple Press

EMPLOYABLITY

SEMESTER – II

Course Code	Course Title	L	T	P	C
22111AEC23	Literature in Jacobean Period	5	0	0	3

Aim:

- To know the English literary history in Jacobean Period

Objective:

- To learn British Literature in Jacobean period

Outcome:

- Examine the writers of Jacobean period
- Provide information about the social and literary issues of Jacobean period

UNIT I

Valediction Forbidding Mourning - John Donne
The Retreat - Henry Vaughan

UNIT II

The Pulley - George Herbert
The Garden - Andrew Marvell

UNIT III

L'Allegro - John Milton
Il' penseraso - John Milton

UNIT IV

Dutchess of Malfi - Webster

UNIT V

The Shoemaker's Holiday - Dekker

SKILL DEVELOPMENT

Course Code	Course Title	L	T	P	C
22111AEC24	Literature in Restoration Period	5	0	0	4

Aim:

- To acquaint with the socio, religious aspects of the Restoration period

Objective:

- To learn how the literary world had repelled against the preceding period and how it finds expression in the literature of the Restoration period.

Outcome:

- Interpret and explain the connections between their own experiences and the world using the texts
- Gain knowledge about the contributions of writers in Restoration period

UNIT I

Mac Flecnoe -Dryden

UNIT II

The Pilgrim's Progress -John Bunyan

UNIT III

All for Love -Dryden

UNIT IV

School for Scandal -Sheridan

UNIT V

The Way of the World-William Congreve

Employablity

Course Code	Course Title	L	T	P	C
22111AEC25	Social History of England-II	4	0	0	3

Aim:

- To acquaint with a total picture of the English society for a better understanding

Objective:

- To know the socio-economic aspects from nineteenth century to the present age

Outcome:

- Analyse the social background of British literature from eighteenth century to present age
- Give an overview of social and cultural change vital to the development of English social identities

UNIT I

Restoration England-Political history, Religion, Commerce and industry, Social life, Morals and manners, Philosophy and science, Literature

UNIT II

Eighteenth century England- Political history, Colonial expansion, Religion, Social life, Literature, Agrarian revolution, Industrial revolution

UNIT III

The French Revolution and Cobbett's England-French revolution, The Machine age, Social life, William Cobbett, age of Romanticism

UNIT IV

The Victorian England - Political history, An Era of reform, Social life, Science and industry, Transport and communication, Religion, Literature

UNIT V

Twentieth century England- Political history, Social life, Education, Liberal reforms, Labour problem, World Wars, Literature

Text book:

Author	Title of the book	Edition / Year	Publisher
G.M Trevelyan	English Social History	2211	Surjeeth Publications
A.G.Xavier	An Introduction to The Social History of England		
Padmaja Ashok	The Social History of England		

EMPLOYABLITY/ SKILL DEVELOPMENT

Course Code	Course Title	L	T	P	C
22111AEC26	History of English Literature-II	5	0	0	4

Aim:
- To acquaint the students with the literary background of different ages for a better understanding

Objective:
- To know the literary background from eighteenth century to the present age
- To understand the biographies of different writers

Outcome:
- Understand the literary background of British literature from age of Pope to modern age the English society
- Know about author's biography

UNIT I
The age of Pope
The age of Dr. Johnson
UNIT II
The age of Wordsworth
UNIT III
The age of Tennyson
UNIT IV
The age of Hardy
UNIT V
Present age

Text book:

Author	Title of the book	Edition / Year	Publisher
Hudson	History of English Literature	2212	Maple Press

Employablity

SEMESTER – III

Course Code	Course Title	L	T	P	C
22111AEC33	Literature in Augustan Period	4	0	0	3

Aim:

- To acquaint with the far-reaching changes in literary form, content and style especially in Augustan period

Objective:

- To learn how Elizabethan excess got vitiated in the restricted and restrained form of poetry and satirical prose, poetry and fiction.

Outcome:

- Assess the writers in Augustan period
- Recognise and explain the connections between their own experiences and the world using the texts

UNIT I

An Epistle to Dr.Arbuthnot -Alexander Pope

UNIT II

Coverley Papers- Of Club, Sir Roger at the Theatre -Addison & Steele

UNIT III

Moll Flanders -Daniel Defoe

UNIT IV

Gulliver's Travel -Jonathan Swift

UNIT V

Tom Jones -Henry Fielding

EMPLOYABLITY/ SKILL DEVELOPMENT

Course Code	Course Title	L	T	P	C
22111AEC34	Literature in Romantic Period	4	0	0	3

Aim:

- To acquaint with an explosive reaction against the preceding Augustan Literature

Objective:

- To observe how the pendulum naturally swings away from the regulated and the restrained Augustan Literary products to the unbridled and spontaneous Romantic literary output.
- To appreciate the literary outputs of the Romantic period

Outcome:

- Understand British Literature in Romantic period
- Interpret and explain the connections between their own experiences and the world using the texts

UNIT I

Tintern Abbey -William Wordsworth

Kubla Khan -S.T. Coleridge

UNIT II

Ode to the West Wind -P.B. Shelley

Ode to a Nightingale -John Keats

UNIT III

Christ Hospital

Dream Children -Charles Lamb

UNIT IV

On Reading Old Books

On the fear of Dead -William Hazlitt

UNIT V

Emma -Jane Austen

Employablitly

Course Code	Course Title	L	T	P	C
22111SEC35	Literary Forms and Prosody	5	0	0	4

Aim

- To acquaint with the features of literary genres and prosody.

Objective:

- To learn the matter, manner and style of every literary form in English Literature
- To speak and write effectively by knowing the figures of speech

Outcome:

- Examine the features of literary genres
- Analyse and interpret the text to which genre it belongs

UNIT-1

Poetry- Subjective and Objective poetry

The Ode, The Elegy, The Lyric, The Sonnet, The Epic, The Ballad

UNIT- II

Prose -The Essay, The Short Story, Biography, Autobiography

UNIT- III

Fiction – Epistolary Novel, Historical Novel, Picaresque Novel, Science Fiction, Psychological Novel, Social Novel, Stream of Consciousness Novel

UNIT- IV

Drama –Liturgy, Mystery plays, Miracle plays, Morality plays, Interludes, Farce, Masque Tragedy, Comedy, Historical Play, One-Act Play

UNIT- V

Prosody-Metre, Syllable, Rhyme, Stanza forms

Introduction to Figures of Speech

[Simile, Metaphor, Hyperbole, Personification, Alliteration]

Text book:

Author	Title of the book	Edition / Year	Publisher
B.P.Prasad	A Background to the Study of English Literature	2228	Macmillan

SKILL DEVELOPMENT

Course Code	Course Title	L	T	P	C
22111AEC36	Shakespeare	4	0	0	3

Aim:

- To acquaint the students with the quintessence of English literature through the study of Shakespeare

Objective:

- To understand the intrinsic merits and the indispensability of the Shakespearean literature

Outcome:

- Understand the genius of Shakespeare
- Explore the plays of Shakespeare

UNIT I

Mid Summer Night's Dream

UNIT II

Antony and Cleopatra

UNIT III

Twelfth Night

UNIT IV

Romeo and Juliet

UNIT V

King Lear

Employablitly

SEMESTER – IV

Course Code	Course Title	L	T	P	C
22111SEC43	Language and Linguistics	4	0	0	3

Aim:

- To acquaint with the linguistic aspects

Objective:

- To understand the basic components of English language in terms of phonetics
- To enable the students to know how the different sounds are produced
- To transcribe the words

Outcome:

- Understand Linguistic aspects through Phonetics.
- Improve pronunciation
- Learn about intonation, syllable and stress

UNIT-I
Old English
Middle English
Standard English
Received Pronounciation
UNIT-II
Growth Of Vocabulary
Change Of Meaning
UNIT-III
Vowels & Diphthongs of English
Organs of Speech
Consonants
Consonant Clusters in English
UNIT-IV
Syllable
Word Accent
Intonation
Assimilation and Elision
UNIT-V
Transcription -Words

Text Book:

Author	Title of the book	Edition / Year	Publisher
T.B. Balasubramaniyan	A text book of Phonetics for Indian Students	1985	Macmillan
F.T. Wood	An Outline History Of English Language		

SKILL DEVELOPMENT

Course Code	Course Title	L	T	P	C
22111AEC44	Literature in Victorian Period	4	0	0	3

Aim:

- To acquaint with the Victorian poets, novelists and dramatists

Objective:

- To know the optimism and pessimism as reflected in Victorian poetry, some of the bleak aspects of the society

Outcome:

- Understand British Literature in Victorian period
- Interpret and explain the connections between their own experiences and the world using the texts

UNIT –I

Ulysses -Tennyson.

The Last Ride Together -Robert Browning

UNIT-II

The Scholar Gypsy -Mathew Arnold

The Blessed Damozel -D.G. Rossetti

UNIT-III

Great Expectation -Charles Dickens

UNIT-IV

Mayor of Casterbridge -Hardy

UNIT-V

Pygmalion -G.B Shaw

Employablity

Course Code	Course Title	L	T	P	C
22111AEC45	Literary Criticism	5	0	0	4

Aim:

- To acquaint with the area of criticism.

Objective:

- To learn the definition of criticism and its kinds
- To know the genesis of literary criticism and its development from the classical to the modern age
- To understand the features of different criticism

Outcome:

- Understand the art of criticism
- Provide the various phases of literary criticism

UNIT-I

Literary Criticism- Definition & Types
Classical Criticism-Plato

UNIT-II

Classical Criticism-Aristotle, Horace, Quintilian, Longinus

UNIT- III

Renaissance Criticism
Neo Classical Criticism

UNIT-IV

The Romantic Criticism
Victorian Criticism

UNIT-V

Modern Criticism
New Criticism

Text book:

Author	Name of the Book	Edition/Year	Publisher
M.S.Nagarajan	English Literary Criticism and Theory	2222	Orient Blackswan

ENTREPRENEURSHIP

Course Code	Course Title	L	T	P	C
22111AEC46	Indian and European Classics in Translation	4	0	0	3

Aim:

- To understand the art of translation

Objective:

- To familiarize with the classical poetry of antiquity and fictions of modernity.
- To facilitate the learners to approach the text from a cross cultural perspective.
- To appreciate the writings for their literary value, culture, philosophical and socio political background.

Outcome:

- Interpret the text from a cross cultural perspective.
- Appreciate classical poetry and drama

UNIT- I

The Odyssey -Homer

UNIT -II

Faust -Gothe

UNIT- III

Shakuntala -Kalidasa

UNIT- IV

Thirukkural -Virtues (The Blessing Of Rain ,The Wealth Of Children, Hospitality, Gratitude, Not Backbiting.)

UNIT –V

The Ramayana -Rajagopalachari

SKILL DEVELOPMENT

SEMESTER – V

Course Code	Course Title	L	T	P	C
22111AEC51	Literature in Modern Period-I	5	0	0	3

Aim:

i. To acquaint with the literary works of the modern period

Objective:

ii. To familiarize poetry, prose, fiction, and poetic drama in modern period

iii. To understand the social milieu of the modern period

Outcome:

- Understand British Literature in Modern period
- Explain the connections between their own experiences and the world using the texts

UNIT-I

The Three Companions -W.H. Auden

God's Grandeur -Hopkins

UNIT-II

On Smiles, On Saying Please -A.G Gardiner

UNIT-III

Sons and Lovers -D.H Lawrence

UNIT-IV

Murder in the Cathedral -T.S.Eliot

UNIT-V

Importance of Being Ernest -Oscar Wilde

EMPLOYABLITY

Course Code	Course Title	L	T	P	C
22111AEC52	American Literature	5	0	0	3

Aim:

- To acquaint with the American literature with the help of selected literary works belonging to the genres of poetry, prose and drama.

Objective:

- To understand the culture and aspirations of the American writers

Outcome:

I. Acquire knowledge about American text
II. Know American dream, culture, myth, race
III. Explore the connections between their own experiences and the world using the texts

UNIT I

I taste a liquor never Brewed -Emily Dickinson
Mending wall -Robert Frost

UNIT II

Brahma -Emerson
Annabel Lee -Edgar Allan Poe

UNIT III

The Old man and the sea -Hemingway

UNIT IV

Adventures of Huckleberry Finn -Mark Twain

UNIT V

The Glass Menagerie -Tennessee Williams

EMPLOYABLITY

Course Code	Course Title	L	T	P	C
22111SEC53	English Language Teaching	5	1	0	5

Aim:

- To acquaint with the inkling about the field of teaching English

Objective:

- To understand the problems of English teaching in India
- To know how to prepare a lesson plan
- To enable the students how to teach poetry, prose and drama
- To learn how to teach composition and pronunciation
- To enhance the students with the testing and evaluation techniques

Outcome:

1. Learn to teach English literature
2. Know how to teach LSRW
3. Able to prepare lesson plan

UNIT-I
Aims and objectives of teaching English
English teaching in India-Problems, Remedies
UNIT-II
Curriculum
Syllabus
Lesson plan
UNIT-III
Teaching of Pronunciation
Teaching of Vocabulary
Teaching of Grammar
UNIT –IV
Reading and Writing skills
Teaching of Composition
Teaching of Prose
UNIT –V
Teaching of Poetry
Testing and Evaluation
Types of Questions, Characteristics

Text books:

Author	Title of the book	Publisher
Dr.P.S.S Sastry	Methods of Teaching English- Book I, II	Madhava Publishers

SKILL DEVELOPMENT

Course Code	Course Title	L	T	P	C
22111SEC54	Translation	5	1	0	4

Aim:

- To cope withr in the multilingual and multicultural milieu

Objective:

- To know the different types of translation
- To encounter the problems in translation.
- To teach the techniques of translation.
- To develop their translation skill

Outcome:

- Learn the art of translation
- Provide the history of translation
- Understand the problems in translation

UNIT-I

Translation- definition, nature, scope

Translator and his qualities

UNIT–II

Types of Translation

UNIT–III

Problems in Translation

UNIT–IV

History of translation

UNIT–V

Techniques of translation-Translation Of sentences

Text books:

Author	Title of the book	Edition / Year	Publisher
Dr. R Shanthi	Towards Translation	2229	Emerald Publisher

SKILL DEVELOPMENT

Course Code	Course Title	L	T	P	C
22111DSC55A	Discipline Specific Elective – I -TAGORE	5	0	0	3

Aim:

- To acquaint with selected literary texts of Tagore belonging to the genres of poetry, prose and drama.

Objective

- To familiarize and know in detail Tagore's style and language in his poetry, prose, fiction and drama
- To appreciate Tagore's works

Outcome:

1. Understand Tagore's writings in different genres
2. Appreciate the artistic and use of language employed by Tagore

UNIT-I
Gitanjali
UNIT-II
The Hungry Stones
Once there was a king
UNIT-III
The Cabuliwallah
The Home Coming
UNIT-IV
The Home and the World
UNIT-V
Chitra

EMPLOYABLITY

SEMESTER – VI

Course Code	Course Title	L	T	P	C
22111AEC61	Literature in Modern Period-II	5	0	0	4

Aim:

- To have a glimpse into the modern literature

Objective :

- To familiarize with the twentieth century literary trends reflected in the form and content of poetry, fiction and drama

Outcome:

- Understand British Literature in Modern period
- Assess the connections between their own experiences and the world using the texts

UNIT-I

Sailing to Byzantium -W.B. Yeats

Gerontion -T.S Eliot.

UNIT-II

The Ideal House, Child's Play-R.L.Stevenson

UNIT-III

Cakes and Ale -Somerset Maugham

UNIT-IV

The Silver Box -Galsworthy

UNIT-V

The Birthday Party -Herald Pinter

EMPLOYABLITY

Course Code	Course Title	L	T	P	C
22111AEC62	Indian Writing in English	5	0	0	4

Aim:

- To acquaint with the Indian Writing in English

Objective:

- To familiarize with the Indian scenario in English presented by Indian poets, novelists and dramatists
- To learn to appreciate the variety and diversity of Indian Writing in English

Outcome:

- Familiarity with the wide range of literary works in Indian Writing in English
- Explore the cultural and social perspectives
- Analyse and explain the connections between their own experiences and the world using the texts

UNIT I

Palanquin Bearers -Sarojini Naidu
Our Casurina Tree -Toru Dutt

UNIT II

Obituary -A.K. Ramanujam
My Grand Mother's House - Kamala Das

UNIT III

An Astrologer's Day -R.K Narayan
Quilt -Ismat Chughtat

UNIT IV

Nagamandala -Girish Karnard

UNIT V

Untouchable -Mulk Raj Anand

EMPLOYABLITY/ SKILL DEVELOPMENT

Course Code	Course Title	L	T	P	C
22111AEC63	Commonwealth Literature	5	1	0	5

Aim:

- To learn the British influence in different countries.

Objective:

- To acquaint with the impact of British culture upon African and Australian societies as reflected in their literature
- To serve to sensitize the English literature which emerged in the twentieth century

Outcome:

- Understand Commonwealth literature
- Explain the connections between their own experiences and the world using the texts
- Know about the social and literary background of commonwealth countries

UNIT – I (POETRY)

The Dying Eagle -E.J. Pratt
Australia -A.D. Hope

UNIT-II (PROSE)

Relationships -Jayant Mahapatra
Fire at Murdering Hut -Judith Wright

UNIT-III (Play)

The Lion and the Jewel -Wole Soyinka

UNIT –IV(Short stories)

The Novelist as a Teacher -Chinua Achebe

UNIT –V (Novel)

The Stone Angel -Margaret Laurence

EMPLOYABLITY

Course Code	Course Title	L	T	P	C
22111DSC64B	Discipline Specific Elective –II NOVEL	5	0	0	3

Aim:

a. To acquaint with the different classifications of the novel

Objective:

b. To understand the features and narrative techniques of Historical, Epistolary, Social and Scientific and Stream of Consciousness novels

c. To appreciate the different forms of novels

Outcome:

- Appreciate the different forms of novel
- Analyse the novels and find the features of different types of novel

UNIT I

Historical Novel

Kennilworth -Scott

UNIT II

Epistolary Novel

The Sound and the Fury - Faulkner

UNIT III

Stream of Consciousness Novel

Mrs.Dalloway -Virginia Woolf

UNIT IV

Social Novel

A Tale of Two Cities -Charles Dickens.

UNIT V

Scientific Novel

The Time Machine -H.G Wells

EMPLOYABLITY

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SCHOOL OF ARTS AND SCIENCE
DEPARTMENT OF ENGLISH
MA ENGLISH – 20PGENGGE- COURSE STRUCTURE

Course Code	Course Title	L	T	P	C
	SEMESTER I				
22211AEC11	History of English Language and Structure	6	0	0	4
22211AEC12	Shakespeare	6	0	0	4
22211AEC13	British Literature	6	0	0	4
22211AEC14	Indian Writing in English	6	0	0	4
22211DSC15_	Discipline Specific Elective – I	5	0	0	4
22211RLC16	Research Led seminar	-	-	-	1
	Total	**29**	**0**	**0**	**21**
	SEMESTER II				
22211AEC21	Women's writing in English	5	0	0	4
22211AEC22	Post-Colonial Literature	6	0	0	4
22211AEC23	Diaspora Literature	6	0	0	4
22211AEC24	Comparative Literature & World Classics in Translation	5	0	0	4
22211DSC25_	Discipline Specific Elective – II	5	0	0	4
22211RMC26	Research Methodology	3	0	0	2
22211BRC27	Participation in Bounded Research	-	-	-	2
	Total	**30**	**0**	**0**	**24**
	SEMESTER III				
22211SEC31	Critical Approaches to English Literature	6	0	0	5
22211AEC32	American Literature	6	1	0	5
22211AEC33	Literary Criticism	6	1	0	5
2211DSC34_	Discipline Specific Elective – III	5	0	0	4
22_OEC	Open Elective	4	0	0	3
2211SRC36	Design/Socio Technical Research	-	-	-	2
	Total	**27**	**2**	**0**	**24**
	SEMESTER IV				
2211SEC41	Translation	5	1	0	5
2211SEC42	English Language Teaching	6	1	0	5
2211AEC43	English Literature for Competitive Examination	6	0	0	5
2211DSC44_	Discipline Specific Elective – IV	5	0	0	4
2211PRW45	Project Work	0	0	0	6
2211PEE	Programme Exit Examination	0	0	0	2
	Total	**22**	**2**	**0**	**27**
	Total Credits for the Programme				**96**

MA ENGLISH - SYLLABUS
SEMESTER I

Course Code	Course Title	L	T	P	C
2211AEC11	History of English Language and Structure	6	0	0	4

Aim:

- To acquaint with the historical evolution and development of English Language and structure.

Objective:

- To understand the origin and development of English language
- To learn the impact of time upon the language in terms of the insular and the international influences leading to growth of vocabulary, change in spelling, change of meaning, usage and the like.
- To know about the great makers of Modern English.

Outcome:

- Learn the impact of time upon the language in terms of the insular and the international influences leading to growth of vocabulary, change in spelling, change of meaning, usage and the like.
- Provide an overview of the different phases of the evolution of English language
- Introduce to the makers of English language

UNIT – I

The origin of language

The descent of the English language, Laws of language The Old English period

UNIT – II

The Middle English period

The Renaissance and after Modern period

UNIT – III

The evolution of Standard English

The shaping, building and ordering of words Spelling and pronunciation

UNIT –IV

Growth of Vocabulary Change of Meaning Idiom and metaphor

UNIT - V

Makers of Modern English: The Bible, Spenser, Shakespeare, Milton and Johnson. Foreign Influences: Greek, Latin, Scandinavian, French and Italian

SKILL DEVELOPMENT

Text book:

Author	**Title of the book**	**Edition / Year**	**Publisher**
F.T.Wood	An Outline History of English Language	First Edition 2008	Macmillan
C.L.Wren	The English Language	Second Reprint 2003	Vikas Publishing House Pvt. Ltd.

Course Code	Course Title	L	T	P	C
2211AEC12	Shakespeare	6	0	0	4

Aim:

- To acquaint with Shakespeare who is not of an age but of all times

Objective:

- To know the genius and the craftsmanship of Shakespeare
- To analyse Shakespeare’s heroes
- To explore Shakespeare’s heroines
- To examine Shakespeare’s villains
- To evaluate Shakespeare’s fools

Outcome:

- Understand the craftsmanship of Shakespeare.
- Assess Shakespeare's heroes, heroines, villains and fools

UNIT I

Love’s Labour’s Lost

Heroes in Shakespeare’s plays

UNIT II

Henry IV Part –I

Women in Shakespeare’s plays

UNIT III

Winter’s Tale

Fools in Shakespeare’s plays

UNIT IV

Tempest

Shakespeare’s Concept of tragedy

UNIT V

Hamlet

Soliloquies in Shakespeare’s plays

EMPLOYABLITY

Course Code	Course Title	L	T	P	C
2211AEC13	British Literature	6	0	0	4

Aim:

- To study the different genres of British Literature

Objective:

- To facilitate the study of the epic, Elizabethan prose, drama and fiction
- To analyse the text

Outcome:

- Understand the craftsmanship of Shakespeare.
- Assess Shakespeare's heroes, heroines, villians and fools

UNIT-I

Paradise Lost -John Milton Book IX

Church going -Philip Larkin

UNIT-II

Rape of the Lock -Alexander Pope

The Jaguar -Ted Hughes

UNIT-III

New Atlantis -Bacon

A Passage to India -E.M Forster

UNIT-IV

Pride and Prejudice -Jane Austen

To the Lighthouse -Virginia Woolf

UNIT-V

Doctor Faustus -Marlowe

The Cocktail Party -T.S Eliot

Self-study topics

Lord of the Flies	-William Golding
The Winslow Boy -	Terrence Rattigan

EMPLOYABLITY

Course Code	Course Title	L	T	P	C
2211AEC14	Indian Writing in English	6	0	0	4

Aim:

- To keep abreast with the study of Indian Writing in English as a class in itself.

Objective:

- To have a deeper insight into the genesis of Indian English literature and its output in different forms.
- To know about the style of Indian writers

Outcome:

- Understand the genesis of Indian English literature and its output in different forms.
- Learn the genius of different Indian authors
- Provide an overview of the different phases of the evolution of Indian writing in English

UNIT I

Origin and growth of Indian Literature – Poetry,Prose

UNIT II

Origin and growth of Indian Literature – Novel, Drama

UNIT III

Rumination -

Daruwallah Poet, Lover and Bird – Watcher

-Ezekiel

A Hot Noon in Malabar -Kamala Das

UNIT IV

My Experiments with Truth -M.K.Gandhi

That Long Silence -Shashi

Despandae **UNIT V**

Hayavadhana -Girish Karnad

Silence, The Court is in Session - Vijay Tendulkar

Text Book:

Author	Title of the book	Edition / Year	Publisher
K.R.Srinivasa Iyengar	Indian Writing in English	2019	Sterling Publishers Pvt Ltd

Self-study topics:

From Heaven Lake -Vikram Seth

The Doldrummers -Asif Currimbhoy

EMPLOYABLITY

Course Code	Course Title	L	T	P	C
221DSC15A	Discipline Specific Elective – I Romantic Movement	5	0	0	4

Aim:

- To acquaint with the Romantic Movement in English literature

Objective:

- To understand the features and background of romanticism
- To learn the impact of romanticism upon contemporaneous writings and later writings
- To appreciate the works of writers influenced by the Romantic Movement

Outcome:

- Explore the features and background of Romanticism
- Comprehend the works of writers influenced by the Romantic Movement

UNIT-I

Romanticism- Characteristics, origin and growth of the movement-British Literature

UNIT-II

Romanticism- Characteristics, origin and growth of the movement-American Literature, Indian Writing in English

UNIT-III

Ode to Intimation on Immortality -

Wordsworth La Belle Dame Sans Merci - Keats

To a Skylark -Shelley

UNIT-IV

The Philosophy of Composition - Edgar Allan

Poe A Red, Red Rose -Robert Burns

The Rhodora -Ralph Waldo Emerson

UNIT-V

The Lotus- Toru Dutt

The Snake Charmer - Sarojini Naidu
Transformation - Sri.Aurobindo

EMPLOYABLITY/ SKILL DEVELOPMENT

SEMESTER II

Course Code	Course Title	L	T	P	C
2211AEC21	Women's Writings in English	5	0	0	4

Aim:

- To keep abreast with feminine writings championing the cause of women.

Objective:

- To know the current social trends in favour of women
- To understand both old and modern literature dealing with the male chauvinism in all its ramifications.
- To learn the perspectives of women writers

Outcome:

- Comprehend the perspectives of women writers
- Give an awareness of class, race and gender and how they influence women's lives.
- Explore women's experiences

UNIT – I

Lady Lazarus - Sylvia Plath
The Queen's Rival - Sarojini
Naidu She - Lakshmi
Kannan

UNIT – II

The Tree of Life - Toru
Dutt An Introduction - Kamala Das
Success is counted Sweetest - Emily Dickinson

UNIT – III

Goblin Market - Rossetti
A Child Asleep -Elizabeth Browning.

UNIT – IV

Clear Light of Day -Anita Desai
Nectar in a Sieve -Kamala Markandaya

UNIT – V

The God of Small Things -Arundhati
Roy Ladies Coupe -Anitha Nair

EMPLOYABLITY

Course Code	Course Title	L	T	P	C
2211AEC22	Post-Colonial Literature	6	0	0	4

Aim:

- To observe how the backlash of colonialism is brought to bear upon literary works.

Objective:

- To know the background and features of the post colonialism
- To analyse how the deleterious impact of colonialism and imperialism has been delineated in literature

Outcome:

- Understand the background and features of the post-colonialism
- Learn the impact of colonialism
- Familiarise with the issues related to cultural and national identity

UNIT – I

Post Colonialism-origin, growth and its features

UNIT – II

Midnight's Children -Salman

Rushdie The Wretched of the Earth -Frantz

Fanon **UNIT – III**

The Vendor of Sweets -R.K Narayan

Things Fall Apart -Chinua

Achebe **UNIT – IV**

July's People -Nadine

Gordimer The Grass is Singing -

Doris Lessing **UNIT – V**

The English Patient -Michael Ondaatje

Heat and Dust -Ruth Jabwala

EMPLOYABLITY/ SKILL DEVELOPMENT

Course Code	Course Title	L	T	P	C
2211AEC23	Diaspora Literature	6	0	0	4

Aim:

- To acquaint with the diaspora literature

Objective:

- To trace the origin and growth of diaspora literature
- To offer a broad view of the literary corpus produced by the writers from the diasporic locations.
- To explore the issues specific to the phenomenon of migration that figure in the representation of diasporic experience.

Outcome:

- Learn the origin and growth of diaspora literature
- Explore the issues specific to the phenomenon of migration that figure in the representation of diasporic experience.
- Aware of the conflicts faced by the migrants

UNIT – I

History of Diaspora literature, theories, features

UNIT – II

A House of Mr. Biswas -V.S Naipaul

Shame -Salman Rushdie

UNIT – III

Jasmine -Bharathi Mukerjee

The Mango Coloured Fish -Kaveri Nambeesan

UNIT – IV

The Inheritance of Loss -Kiran Desai

The Namesake -Jhumpa Lahiri

UNIT – V

Can Love Happen Twice -Ravinder Singh

Family Life -Akhil Sharma

EMPLOYABLITY/ SKILL DEVELOPMENT

Course Code	Course Title	L	T	P	C
2211AEC24	Comparative Literature & World Classics in Translation	5	0	0	4

Aim:

- To familiarize with the comparative literature and world classics in translation

Objective:

- To widen the perspective of students in the larger context of world literature
- To learn different schools of thought
- To demonstrate the relationship between language and culture
- To facilitate a comparative study of literary texts based on themes, myths, archetypes and history

Outcome:

- Understand comparative literature and world classics in translation
- Equip to make comparative and contrastive analysis of literary texts.

UNIT – I

Comparative Literature –definition and scope

French and American Schools of thought

Influence and Reception study

UNIT – II

Genre Study

Thematology

Periodisation

UNIT – III

Translation

Literature and society

Literature and Psychology

UNIT – IV

Agamemnon -Aeschylus

The Wild Duck -Ibsen

UNIT – V

Crime and Punishment -

Dostoevsky Book of Job -Bible

Text Book :

Author	Title of the book	Edition / Year	Publisher
Dr. N. Subramanian Dr. Padma Srinivasan Dr. G.R..Balakrishnan	Introduction to the study of Comparative Literature Theory and Practice	First Edition 1997	TEESI

SKILL DEVELOPMENT

Course Code	Course Title	L	T	P	C
2211DSC25A	Discipline Specific Elective – II - Canadian Literature	5	0	0	4

Aim:

- To acquaint with the Canadian literature

Objective:

- To know how an indomitable urge for seeking separate identity find expression in the different genres of literature.
- To trace the origin and growth of Canadian literature
- To understand Canadian literature, their landscape, tradition, milieu, spirit, socio-cultural ethos, national identity

Outcome:

- Learn the origin and growth of Canadian literature
- Analyse Canadian literature, their landscape, tradition, milieu, spirit, socio-cultural ethos, national identity
- Explore the genius of Canadian writers

UNIT – I

Origin and growth of Canadian Literature - Poetry, Prose and drama

UNIT – II

The Canadian Authors Meet -F.R.Scott

The Cinnamon Peeler -Michael Ondaatje

The Lonely Land -A.J Smith

UNIT – III

The Loons -Margaret Lawrence.

Lamp at Noon -Sinclair Ross

UNIT – IV

The Old Woman -Joyce Marshall

The Book of Negroes -Lawrence Hill

UNIT – V

Surfacing -Margaret Atwood.

Ecstasy of Rita Joe -George Ryga

EMPLOYABLITY/ SKILL DEVELOPMENT

SEMESTER III

Course Code	Course Title	L	T	P	C
2211SEC31	Critical Approaches to English Literature	6	0	0	5

Aim:

- To acquaint with various approaches to literature.

Objective:

- To realize that an impassioned scientific approach even to aesthetic delight has its own validity.
- To analyse a text using various approaches

Outcome:

- Assess a text using various approaches to English Literature
- Know about various approaches

UNIT-I

Archetypal Approach

UNIT-II

Moral Approach

UNIT-III

Formalistic Approach

UNIT-IV

Psychological Approach

UNIT-V

Sociological Approach

Term paper:

Analyse a text using various approaches to English Literature

ENTREPRENEURSHIP

Course Code	Course Title	L	T	P	C
2211AEC32	American Literature	6	1	0	5

Aim:
- To acquaint how American Literature has evolved to be an independent entity.

Objective:
- To know the genesis and growth of literature such as 'American', involving the confluence of varied and variegated cultures
- To learn a historical background to American history and literature
- To analyse the major themes and concerns reflected in American literature

Outcome:
- Understand the major themes and concerns reflected in American literature
- Provide an overview of the different phases of the evolution of American literature

UNIT I
Origin and growth of American Literature- Poetry, Prose

UNIT II
Origin and growth of American Literature- Novel, Drama

UNIT III
Daddy -Sylvia Plath

After Apple Picking -Robert Frost
To Helen -Edger Allen Poe

UNIT IV
The American Scholar -Emerson

Walden-The Battle of Ants -Thoreau
Farewell to Arms -Hemingway

UNIT V
The Hairy Ape -O' Neil

All My sons -Arthur Miller

Self study topics:
The Age of Innocence -Edith
Wharton Who's Afraid of Virginia Woolf? -
Edward Albee

EMPLOYABLITY

Course Code	Course Title	L	T	P	C
2211AEC33	Literary Criticism	6	1	0	5

Aim:

- To recapitulate the origin and development of criticism from the period of Aristotle to modern age.

Objective:

- To introduce that criticism is a creative work bringing about far reaching impact.
- To analyse a text using various criticism
- To understand the theories formulated by various writers

Outcome:

- Assess a text using various criticism
- Get in touch with different views of critics

UNIT – I

Poetics. -Aristotle
An Apology for Poetry. -Sir Philip Sidney

UNIT – II

Preface to the Fables -Dryden

Essay on Criticism -Alexander Pope

UNIT – III

Preface to Shakespeare -Samuel Johnson

The Preface to Lyrical Ballads -William

Wordsworth **UNIT – IV**

Biographia Literaria -S.T.Coleridge

A Defence of Poetry -Shelley

UNIT – V

The Study of Poetry -Matthew

Arnold Tradition and Individual Talent -T.S.Eliot

ENTREPRENEURSHIP

Course Code	Course Title	L	T	P	C
2211DSC34A	Discipline Specific Elective - III A African Literature	5	0	0	4

Aim:

- To acquaint the students with the African literature

Objective:

- To give a glimpse into the British colonialism and its aftermath.
- To trace the origin and growth of African literature.
- To know how an indomitable urge for seeking separate identity finds expression in the different genres of literature.
- To understand African literature, their landscape, tradition, milieu, sprit, socio cultural ethos, national identity etc.

Outcome:

- Learn the origin and growth of African literature.
- Enable to understand African literature, their landscape, tradition, milieu, sprit, socio cultural ethos, national identity etc.

UNIT – I

Origin and growth of African Literature-Poetry, Prose and Drama

UNIT – II

Poets in Africa -Roy Campbell
The Casualties -J.P.Clark

A Far Cry from Africa -Derek Walcott

UNIT – III

The Arrow of God -Chinua

Achebe Cry the Beloved Country-Alan Patson

UNIT – IV

Waiting for the Barbarians -J.M Coetzee

A Grain of Wheat -Ngugi waThiongo

UNIT – V

The Road -Wole Soyinka
Devil on the Cross -Ngugi waThiongo

EMPLOYABLITY/ SKILL DEVELOPMENT

SEMESTER IV

Course Code	Course Title	L	T	P	C
2211SEC41	Translation	5	1	0	5

Aim:

- To initiate the students into the mechanics of translations

Objective:

- To know the origin and development of translation.
- To promote translation
- To understand the theories of translation
- To encounter the problems in translation.
- To develop their translation skill

Outcome:

- Enhance the translation skill
- Analyse the theories of translation
- Learn modern and cultural translation

UNIT – I

History of translation

UNIT – I

Theories of translation

Theory of meaning

UNIT – III

Literary Translation

Non-Literary Translation

UNIT – IV

Translatability Difficulties

in Translation **UNIT – V**

Modern Translation

Cultural translation

SKILL DEVELOPMENT

Text Book:

Author	Title of the book	Edition/Year	Publisher
P.K. Kalyani	Translation Studies	2001	Creative Books
Dr. Shanthi	Towards Translation	2002	Emerald Publishers

Course Code	Course Title	L	T	P	C
2211SEC42	English Language Teaching	6	1	0	5

Aim:

- To have a good stead for the career of English teacher

Objective:

- To analyse language theories
- To learn different approaches and methods
- To explore the audio-visual techniques
- To orient in the practical application of ELT
- To understand the principles of foreign language teaching

Outcome:

- Enhance to have a good stead for the career of English teacher
- Study the approaches, methods and techniques in teaching English
- Know how to use audio visual aids

UNIT- I

The place of mother tongue in teaching English

English as a second language

UNIT-II

Principles of foreign language teaching

Theories of Language Learning

UNIT-III

Approaches of Teaching English

Methods of Teaching English

UNIT-IV

Techniques for language teaching

Audio – Visual Teaching

UNIT-V

Micro Teaching

Macro Teaching

Case study

Text Book:

Author	Title of the book	Publisher
Dr. P.S.S Sastry	Methods of Teaching English Book I & Book II	Madhava Publishers

SKILL DEVELOPMENT

Course Code	Course Title	L	T	P	C
2211AEC43	English Literature for Competitive Examination	6	0	0	5

Aim:

- To attempt a relation of what is learnt to take up a competitive exam.

Objective:

- To resuscitate what has been learnt in every branch of English Language and Literature and compete with others for a career.
- To impart in students the confidence and skills to face the challenge of a competitive exam

Outcome:

- Take up a competitive exam.
- Learn the different areas in English literature

UNIT-I
British Literature

UNIT-II
American Literature

UNIT-III
Indian Writing in English

UNIT-IV
Literary Forms

UNIT-V
English Language Teaching

Text Book:

Author	Title of the book	Publisher
William Henry Hudson	An Outline History of English literature	Maple Press
Dr. P.S.S Sastry	Methods of Teaching English -Book I & Book II	Madhava Publishers

EMPLOYABLITY

Course Code	Course Title	L	T	P	C
2211DSC44A	Discipline Specific Elective - IVA Australian Literature	6	0	0	4

Aim:

- To acquaint with the Australian literature

Objective:

- To trace the origin and growth of Australian literature
- To appreciate the works of different writers
- To understand Australian literature, their landscape, tradition, milieu, sprit, socio-cultural ethos, national identity etc.

Outcome:

- Learn the origin and growth of Australian literature
- Analyse Australian literature, their landscape, tradition, milieu, sprit, socio-cultural ethos, national identity etc.

UNIT – I

Origin and growth of Australian Literature-Poetry, Prose and Drama

UNIT – II

Legend -Judith Wright.

Mister Man -Kevin Gilbert

The Australian Dream -David

Campbell **UNIT – III**

The Drover's Wife -Henry

Lawson The Seizure of the Cyprus -Marcus

Clarke **UNIT – IV**

Tirra Lirra by the River -Jessica

Anderson Voss -Patrick White

UNIT – V

Remembering Babylon -Malouf

The Piano Teacher -Elfriedie Jelinek

EMPLOYABLITY/ SKILL DEVELOPMENT

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THANJAVUR – 613403 - TAMILNADU

SCHOOL OF ARTS AND SCIENCE

Department of Mathematics

B.Sc. Mathematics Syllabus

[Regulation 2022]

EMPLOYABILITY
SKILL DEVLOPMENT

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THANJAVUR – 613 403 - TAMIL NADU

SCHOOL OF ARTS AND SCIENCE

DEPARTMENT OF MATHEMATICS

B.Sc., MATHEMATICS - REGULATION 2022
COURSE STRUCTURE
SEMESTER – I

Course Code	Course Title	L	T	P	C
	THEORY				
22110AEC11/ 22111AEC11/ 22132AEC11/ 22135AEC11	Tamil – I/Advanced English-I/Hindi-I/ French - I	4	0	0	2
22111AEC12	English-I	4	0	0	2
22112AEC13	Differential Calculus and Vector Calculus	5	0	0	3
22112AEC14	Trigonometry, Analytical Geometry 3D and Calculus	5	0	0	3
22120AEC15	Programming in C	6	0	0	5
	PRACTICAL				
22120AEC16L	Programming in C Lab	0	0	3	2
	Total	**24**	**0**	**3**	**17**
	AUDIT COURSE				
221ACLSICN	Indian Constitution	-	-	-	**2**
221ACLSUHV	Universal Human Values	-	-	-	**2**

SEMESTER – II

Course Code	Course Title	L	T	P	C
	THEORY				
22110AEC21/ 22111AEC21/ 22132AEC21/ 22135AEC21	Tamil – II/ Advanced English-II/Hindi-II/ French – II	4	0	0	2
22111AEC22	English-II	4	0	0	2
22112AEC23	Integrals & Differential Equations	5	0	0	3
22112SEC24	Sequence and series	5	0	0	3
22120AEC25	Web Programming	5	1	0	5
	PRACTICAL				
22120AEC26L	Web Programming Lab	0	0	3	2
	RESEARCH SKILL BASED COURSE				
22112RLC27	Research Led Seminar	-	-	-	1
	Total	**23**	**1**	**3**	**18**

AUDIT COURSES					
221ACLSCOS	Communication Skills	-	-	-	**2**
221ACSSBBE	Basic Behavioral Etiquette	-	-	-	**2**

SEMESTER – III

Course Code	Course Title	L	T	P	C
	THEORY				
22110AEC31/ 22132AEC31/ 22111AEC31/ 22135AEC31	Tamil – III/Hindi-III/Advanced English-III/ French – III	4	0	0	2
22111AEC32	English-III	4	0	0	2
22112AEC33	Number Theory	4	0	0	3
22112AEC34	Numerical Analysis	4	0	0	3
22118AEC35	Mathematical Statistics-I	5	1	0	5
	PRACTICAL				
22118AEC36L	Mathematical Statistics-I Lab	0	0	3	2
	RESEARCH SKILL BASED COURSE				
22112RMC37	Research Methodology	2	0	0	2
	Total	**23**	**1**	**3**	**19**
	AUDIT COURSE				
201ACLSOAN	Office Automation	-	-	-	**2**

SEMESTER – IV

Course Code	Course Title	L	T	P	C
	THEORY				
22110AEC41/ 22111AEC41/ 22132AEC41/ 22135AEC41	Tamil-IV/Advanced English-IV /Hindi-IV/ French – IV	4	0	0	2
22111AEC42	English-IV	4	0	0	2
22112SEC43	Operations Research	4	0	0	3
22112AEC44	Image Processing	4	0	0	3
221ENSTU45	Environmental Studies	2	0	0	2
22118AEC46	Mathematical Statistics-II	5	1	0	5
	PRACTICAL				
22118AEC47L	Mathematical Statistics- II Lab	0	0	3	2
	Total	**23**	**1**	**3**	**19**
	AUDIT COURSE				
221ACLSLMS	Leadership and Management Skills	-	-	-	**2**
221ACSSAQA	General Aptitude and Quantitative Ability				**2**

SEMESTER – V

Course Code	Course Title	L	T	P	C
	THEORY				
22112AEC51	Modern Algebra	5	0	0	4
22112AEC52	Real Analysis	5	1	0	4
22112SEC53	Statics	5	1	0	4
22112SEC54	Programming in C++	5	0	0	3
22112DSC55_	Discipline Specific Elective -I	5	0	0	3
	RESEARCH SKILL BASED COURSE				
22112BRC56	Participation in Bounded Research	-	-	-	1
	Total	**25**	**2**	**0**	**19**
	AUDIT COURSE				
221ACLSPSL	Professional Skills	-	-	-	**2**

SEMESTER – VI

Course Code	Course Title	L	T	P	C
	THEORY				
22112AEC61	Complex Analysis	5	0	0	4
22112SEC62	Dynamics	5	1	0	4
22112AEC63	Discrete Mathematics	5	0	0	4
22112DSC64_	Discipline Specific Elective –II	5	0	0	4
221_ _OEC(2 Digit Course Name)	Open Elective	4	0	0	2
	PRACTICAL				
22112PRW65	Project Work	-	-	-	4
22112PROEE	Program Exit Examination	-	-	-	1
	Total	**24**	**1**	**0**	**23**
	AUDIT COURSE				
221ACSSIST	Interview Skills Training and Mock Test	-	-	-	**2**
221ACLSCET	Community Engagement	-	-	-	**1**
Total Credits -Programme					**115**
Total Credits - Audit Courses					**19**

Discipline Specific Electives

Semester	Discipline Specific Elective Courses-I
V	a) 22112DSC55A–Fuzzy Analysis b) 22112DSC55B - Formal Languages and Automata Theory
	Discipline Specific Elective Courses-I
VI	a) 22112DSC64A - Graph Theory b) 22112DSC64B – Quantitative Aptitude

Open Electives

Semester	Open Elective Courses
VI	a) 221TNOEC-Tamil IlakkiyaVaralaru b) 221ENOEC-Journalism c) 221PHOEC-Instrumentation d) 221CEOEC-Food and Adulteration e) 221MBOEC- Wildlife Conservation f) 221CSOEC – E-Learning g) 221CAOEC-Web Technology h) 221CMOEC-Banking service

Credit Distribution

Sem	AEC	SEC	DSC	OEC	Research	Others	Total
I	17	-	-	-	-	-	17
II	13	4	-	-	1	-	18
III	17	-	-	-	2	-	19
IV	14	3	-	-	-	2	19
V	8	7	3	-	1	-	19
VI	8	4	4	2	4	1	23
Total	**77**	**18**	**7**	**2**	**8**	**3**	**115**

SEMESTER I

Course Code	Course Title	L	T	P	C
22110AEC11	Tamil -I	4	0	0	2

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Course Code	Course Title	L	T	P	C
22111AEC11	Advanced English-I	4	0	0	2

Aim:

- To improve the knowledge of English

Objective:

- To familiarize with the glossary terms, figures of speech
- To enhance vocabulary
- To learn how to edit and proof read
- To know the comparison and contrast and cause and effect forms
- To understand the impact of the speeches of famous people

Outcome:

- Develop vocabulary
- Learn to edit and do proof reading
- Read and comprehend literature

UNIT –I

Glossary of grammar terms
Figures of speech

UNIT – II

Foreign words and phrases
British and American Vocabulary

UNIT – III

Comparison and contrast
Cause and effect

UNIT – IV

Editing
Proof reading

UNIT – V

Speeches of famous people:
Mahatma Gandhi-Abraham Lincoln-Swami Vivekananda-John F. Kennedy

Reference book:

Author	**Title of the book**	**Edition / Year**	**Publisher**
Wren and Martin	English Grammar	2009	S.Chand& Company Ltd
Meenakshi Raman &Sangeetha Sharma	Technical Communication	Second Edition 2011	Oxford University Press
Sudhir Kumar Sharma	The World's Great Speeches	-	Galaxy Publishers

Course Code	Course Title	L	T	P	C
22111AEC12	**English-I**	**4**	**0**	**0**	**2**

Aim:

- To acquaint with learning English through literature

Objective:

- To improve English delightfully through simple poems, essays
- To throw light on fiction
- To read and comprehend literature

Outcome:

- Read and comprehend literature
- Appreciate the different types of poetry and prose

UNIT –I

Because I could not Stop for Death -Emily Dickinson
Stopping by Woods on a Snowy Evening -Robert Frost

UNIT – II

Enterprise -Nissim Ezekiel
Love poem for a wife -A.KRamanujam

UNIT –III

The Art of Reading - Lin Yutang
An Eco-Feminist Vision -ArunaGnanadason

UNIT –IV

The Merchant of Death -Nanda Kishore Mishra & John Kennet
She Spoke for all Nature -Young world 'The Hindu'

UNIT –V

Oliver Twist -Charles Dickens**Text book:**

Author	Title of the book	Edition / Year	Publisher
S.Murugesan/Dr.K.Chellappan	The Art of Reading/ Experiencing Poetry	Reprint 2004	Emerald Publishers

Course code	Course Title	L	T	P	C
20112AEC13	**Differential Calculus and Vector Calculus**	5	0	0	3

Objectives:

This course is designed to give students a secure base in elementary calculus and vector calculus to allow them to tackle the mathematics needed in other sciences. Students wishing to do more mathematics will be given a good foundation from which they can proceed to other courses.

UNIT I:

Successive differentiation — Leibnitz theorem with proof — Problems, Partial derivative of a function.

UNIT II:

Maxima & Minima for functions of two variables — Lagrange multiplier method.

UNIT III:

Curvature (Cartesian, Polar and Pedal form) — evolutes.

UNIT – IV

Vector differentiation – velocity & acceleration vectors- Gradient of a vector directional derivative - Init normal vector- tangent plane, Divergence- Curl – Solenoidal & Irrotational vector- Double operators – Properties connecting grad, div & curl of a vector.

Unit –V

Vector integration –Line integrals – Conservative force field – Scalar field- Scalar potential- Work done by d Force- Surface integrals – Volume integrals.

Text Books:

1.Differential calculus — T.K.M. Pillai

2.Vector calculus — T.K.M. Pillai.

Reference:

T.K. Manickavasagam Pillai, Analytical Geometry (3D) & Vector calculus, Neq Gamma Publishing House, 1991

Learning outcomes

By the end of this course, you should:

- ✓ be able to manipulate, and solve problems using, successive differentiation & vector operators;
- ✓ be able to calculate Maxima & Minima for functions of two variables and Lagrange multiplier method
- ✓ be able to solve curvature, evolutes, asymptotes and envelopes in simple cases.
- ✓ be able to calculate gradient, divergence and curl vectors.

Course code	Course Title	L	T	P	C
22112AEC14	Trigonometry, Analytical Geometry 3 D and Calculus	5	0	0	3

Objectives:

This course is designed here to get sufficient ideas about integral calculus, trigonometry and analytical geometry to tackle the mathematics needed in other sciences.

UNIT I:

Expansions of cos nθ, sin nθ, $\cos^n\theta$, $\sin^n\theta$(for positive integral values of n) — series for cosθ, sin θ**,** tan θ.

UNIT II:

Hyperbolic functions — Principal and general values of logarithms of complex numbers. Separation of real and imaginary parts — factorization.

UNIT III:

Summation of trigonometrical series — method of difference - sum of series of n angles in A.P, C+ is form, Gregory's series.

UNIT IV:

Analytical Geometry (3-D)

Spheres (Simple Properties only) general second degree equations to cone cylinder.

UNIT V:

Evaluation of double and Triple integral — Transformation of Variables, Change the order of Integration -- Transformation of Cartesian into Polar coordinates , Beta and Gamma integrals.

Text Books:

1. **Trigonometry** — T.K.M. Pillai
2. **Analytical Geometry (3D) And Integral Calculus** — T.K.M. Pillai

Learning outcomes

By the end of this course, you should:

- ✓ be able to manipulate the expansions of basic trigonometric functions
- ✓ be able to calculate summation of trigonometric series and Gregory's series
- ✓ understand the concept of analytical geometry and be able to use properties of spheres, cone and cylinder in real cases.
- ✓ be able to manipulate, and solve problems using, integral calculus

Allied- I- Paper -I PROGRAMMING IN C

Course code	Course Title	L	T	P	C
22120AEC15	Allied- I- Paper -I Programming In C	6	0	0	5

Objectives:

- To learn the concept of programming
- To understand input and output functions
- To study aboutStructures
- To learn Pointers in C Language

UNIT I :

Evolution and Applications of C - Structure of a C Program -Data Types - Declaration - Operators - Expressions - Type conversions -Built-in functions.

UNIT II :

Data Input and Output - Control statements: IF, ELSE-IF, GOTO, SWITCH, WHILE- DO, DO-WHILE, FOR, BREAK and CONTINUE.

UNIT III :

Functions:

Defining and accessing functions-passing parameters of functions -Arguments - Recursive functions -Storage classes.

Arrays:

Defining and processing Arrays -Multi dimensional arrays - passing arrays to functions -Arrays and strings String functions - String Manipulations.

UNIT IV :

Pointers

Pointers Declarations - Operators on pointers -pointers to functions - Pointer and Strings -pointers and arrays - array of pointers - Structures and pointers -unions.

UNIT V :

Data files -Opening, Closing, and processing files - Files with structures and unions Register variables - Bit wise Operations - Macros- Pre-processing

Reference:

"Programming in C" — E. Balagurusamy — Tata McGrawHill Publications

Reference:

1. " Programming with C" — ByronS.Gottfried — Schauni's outline series — Tata McGrawHill publications.
2. "Let us C "— Yeswantkanetkar — BPB Publications.

Learning Outcomes:

At the end of the course, the student should be able to:

- Design C Programs for problems.
- Write and execute C programs for simple applications

Allied- I Practical -I PROGRAMMING IN C LAB

Course code	Course Title	L	T	P	C
22120AEC16L	Allied -I -Paper -I Programming in C Lab	0	0	3	2

Objectives

Programming in C Lab provides the methodology for the planning and execution for any scientific enquiry, which has been accepted as a valid tool in this content. In this course Quadratic Equation, Sum of Series (Sine, Cosine, e^x**)**, Fibonacci Numbers using recursive functions, Sorting of given names in a1phabtical order, Matrix Operations (Addition, Subtraction, Multiplication — use functions) would be taught.

Students are able to the C program

1. Write a C program to find the roots of Quadratic Equation (all cases).
2. Write a C program to find the Sum of Series (Sine, Cosine, e^x**)**
3. Write aC program to reads an integer N and determine whether N is prime or not.
4. Write a C program to Finding factorials, generating Fibnoacci Numbers using recursive functions.
5. Write a C program to find the numbers in Ascending and Descending order (use it to find largest and smallest numbers).
6. Write a C program to find the sum of natural numbers using WHILE statement,
7. Write a C program for Sorting of given names in a1phabtical order.
8. Write a C program for Matrix Operations (Addition, Subtraction, Multiplication — use functions).
9. Write a C program for String Manipulation without using String functions (String length, String Comparison, String Copy, Palindrome checking, counting words and lines in strings — use function pointers).

Learning Outcomes:

At the end of the course, the student should be able to:

- Students learned program techniques
- Understand the concept of various functions and pointers
- A knowledge of writing C program
- Design/development of solutions

INDIAN CONSTITUTION

Course Code	Course Title	L	T	P	C
221ACLSICN	Indian Constitution	-	-	-	2

Objectives:
1. To make the students understand about the democratic rule and parliamentarian administration
2. To appreciate the salient features of the Indian constitution
3.To know the fundamental rights and constitutional remedies
4. To make familiar with powers and positions of the union executive ,union parliament and the supreme court
To exercise the adult franchise of voting and appreciate the electoral system of Indian democracy.

Unit I::The making of Indian constitution

The constitution assembly organization –character -work salient features of the constitution- written and detailed constitution -socialism –secularism-democracy and republic.

Unit II: Fundamental rights and fundamental duties of the citizens

Right of equality -right of freedom- right against exploitation -right to freedom of religion- cultural and educational rights -right to constitutional remedies -fundamental duties .

Unit III: Directive principles of state policy

Socialistic principles-Gandhi an principles-liberal and general principles -differences between fundamental rights and directive principles

Unit IV: The union executive, union parliament and Supreme Court

Powers and positions of the president -qualification _method of election of president and vice president -prime minister -Rajya Sabah -Lok Sabah .the supreme court -high court -functions and position of supreme court and high court

Unit V: State council -election system and parliamentary democracy in India

State council of ministers -chief minister -election system in India-main features election commission- features of Indian democracy.

References:

1) Palekar.s.a. Indian constitution government and politics, ABD publications, India
2) Aiyer, alladikrishnaswami, Constitution and fundamental rights 1955.
3) Markandan. k.c.directive Principles in the Indian constitution 1966.
4) Kashyap. Subash c, Our parliament ,National book trust , New Delhi 1989

UNIVERSAL HUMAN VALUES

Course Code	Course Title	L	T	P	C
221ACLSUHV	Universal Human Values	-	-	-	2

Course Objectives :

Thepresentcoursedealswithmeaning, purpose, andrelevanceofuniversalhumanvaluesandhow to inculcate and practice them consciously to be a good human being and realize one's potentials.

Course outcomes :

By the end of the course the learners will be able to:

1. Knowaboutuniversalhumanvaluesandunderstandtheimportanceofvaluesinindividual, social circles, career path, and national life.
2. Learnfromcasestudiesoflivesofgreatandsuccessfulpeoplewhofollowedandpractised human values and achievedself-actualization.
3. Become conscious practitioners of human values.
4. Realisetheirpotentialashumanbeingsandconductthemselvesproperlyinthewaysofthe world.

Unit I : Love & Compassion

- Introduction: What is love? Forms of love forself,parents,family,friend,spouse,community, nation, humanity and other beings, both for living and non-living
- Love and compassion and inter-relatedness
- Love, compassion, empathy, sympathy andnon-violence
- Individuals who are remembered in history for practicing compassion andlove.
- Narratives and anecdotes from history, literature including localfolklore
- Practicing love and compassion: What will learners learn gain if they practice love and compassion? What will learners lose if they don't practice love and compassion?
- Sharing learner's individual and/or groupexperience(s)
- SimulatedSituations
- Casestudies

Unit II: Truth

- Introduction: What is truth? Universal truth, truth as value, truth as fact(veracity, Sincerity, honesty among others)
- Individuals who are remembered in history for practicing this value
- Narratives and anecdotes from history, literature including localfolklore
- Practicing Truth: What will learners learn/gain if they practice truth? What will learners lose if they don't practice it?
- Learners' individual and/or group experience(s)
- Simulated situations
- Case studies

Unit III :Non-Violence

- Introduction: What is non violence?Itsneed.Love,compassion,empathysympathy for others as pre-requisites for non-violence
- Ahimsa as non-violence andnon-killing
- Individuals and organizations that are known for their commitment tonon-violence
- Narrativesandanecdotesaboutnon-violencefromhistory,andliteratureincluding local folklore
- Practicing on-violence: What will learners learn/gain if they practice non-violence? What will learners lose if they don't practice it?
- Sharing learner's individual and/or group experience(s) aboutnon-violence
- Simulatedsituations
- Case studies

Unit IV: Righteousness

- Introduction: What is righteousness?
- Righteousness and *dharma*, Righteousness and Propriety
- Individuals who are remembered in history for practicing righteousness
- Narratives and anecdotes from history, literature including local folklore
- Practicing righteousness: What will earnerslearn/gainiftheypracticerighteousness? What will learners lose if they don't practice it?
- Sharing learners' individual and/or group experience(s)

- Simulated situations
- Case studies

Unit V:Peace

- Introduction: What is peace? Its need, relation with harmony and balance
- Individuals and organizations that are known for their commitment to peace
- Narratives and Anecdotes about peace from history, and literature including localfolklore
- Practicing peace: What will learners learn/gain if they practice peace? What will learners lose if they don't practice it?
- Sharing learner's individual and/or group experience(s) about peace
- Simulated situations
- Case studies

Unit VI: Service

- Introduction: What is service? Forms of service, for self, parents, family, friend, spouse, community, nation, humanity and other beings—living and non-living, persons in distress or disaster.
- Individuals who are remembered in history for practicing this value.
- Narratives and anecdotes dealing with instances of service from history,literatureincluding local folklore
- Practicing service: What will earnerslearn/gain gainiftheypracticeservice?What will learners lose if they don't practice it?
- Sharing learners' individual and/or group experience(s) regarding service
- Simulated situations
- Case studies

Unit VII: Renunciation(Sacrifice)

- Introduction: What is renunciation? Renunciation and sacrifice. Self-restrain and Ways of overcoming greed. Renunciation with action as true renunciation
- Individuals who are remembered in history for practicing this value.
- Narrativesandanecdotesfromhistoryandliterature, includinglocalfolkloreabout individuals who are remembered for their sacrifice and renunciation.
- Practicing renunciation and sacrifice: What will learners learn/gain if they practice

Renunciation and sacrifice? What will learners lose if they don’t practice it?

- Sharing learners’ individual and/or group experience(s)
- Simulated situations
- Case studies

Course Code	Course Title	L	T	P	C
22110AEC12	Tamil -II	4	0	0	2

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Course Code	Course Title	L	T	P	C
22111AEC21	Advanced English-II	4	0	0	2

Aim:

- To improve the knowledge of English

Objective:

- To understand the format of e-mail, fax and memos
- To write itinerary, checklist, invitation, circular, instruction, recommendations
- To understand the impact of the biographies of famous people

Outcome:

- Develop technological skill
- Able to write in a variety of formats
- Read biographies and develop personality

UNIT –I

E-mail
Fax
Memos

UNIT – II

Itinerary
Checklist

UNIT – III

Invitation
Circular

UNIT – IV

Instruction
Recommendations

UNIT – V

Biographies of famous people:
Mother Teresa-Madam Curie-Charles Chaplin-Vikram Sarabhai

Text Book

Author	Title of the book	Edition / Year	Publisher
Meenakshi Raman &Sangeetha Sharma	Technical Communication	2011	Oxford University Press
Rajendra Pal &J.S.Korlahalli	Business Communication	2015	Sultan

Course Code	Course Title	L	T	P	C
22111AEC22	**English-II**	**4**	**0**	**0**	**2**

Aim:
- To acquaint learners with different trends of writing

Objective:
- To acquire language skills through literature
- To enable the students to appreciate literature
- To develop the conversational skills through one act plays

Outcome:
- Appreciate different forms of literature
- Acquire language skills through literature
- Broaden the horizon of knowledge

UNIT – I

Ecology -A.K. Ramanujan
Gift -Alice Walker
The First Meeting -Sujata Bhatt

UNIT –II

Fueled -Marcie Hans
Asleep -Ernst Jandl
Buying and selling -Khalil Gibran

UNIT –III

The End of living and The Beginning of Survival - Chief Seattle
My Wood - E.M.Forster
The Meeting of Races - Rabindranath Tagore

UNIT – IV

The Refugee -K.A. Abbas
I Have a Dream -Martin Luther king
Those People Next Door -A.G. Gardiner

UNIT – V

Marriage is a private Affair -Chinua Achebe
The Fortune Teller -Karel Capek
Proposal -Anton Chekov

Course code	Course Title	L	T	P	C
20112AEC23	Core -III Basic Mathematics III (Integrals and Differential Equations)	5	0	0	3

INTEGRALS AND DIFFERENTIAL EQUATIONS

UNIT I:

Properties of definite integrals and solve standard problems. Reduction formulae- $\int x^n e^{ax}$dx, $\int x^n$ cosaxdx, $\int \sin^n x$dx, $\int \cos^n x$dx, $\int \cos^m x$sinnxdxand problems based on above types working problems based on $\int \sin^m x \cos^n x$dx

UNIT II:

Second order differential equation with constant coefficients — $e^{ax}g(x)$,x sin x , x cos x, , x^2cos x types only and with Variable coefficients- Variation of parameters

UNIT III:

Partial differential equations. Formation of equation — General, particular and complete integrals of PDE — Lagrange's method four standard forms

UNIT IV:

Laplace Transforms: Laplace transform and its application for solving ordinary differential equations — convolution theorem for Laplace transform — problems.

UNIT V:

Fourier series: Periodic functions — Dirichlet conditions (Without Proof) Odd and Even functions- change of interval — Half range series.

Reference

Calculus -T.K.M.Pillai, Arumugam and S.Narayanan.
Differential equations - S.Narayanan

SEQUENCE AND SERIES

Course code	Course Title	L	T	P	C
22112SEC24	SEQUENCE AND SERIES	5	0	0	4

UNIT 1:

Sequence, Limits, Convergence-Cauchy's general principle of convergence-Cauchy's first theorem on Limits-Bounded sequences-Monotonic sequence always tends to a limit, finite or infinite - Limit superior and limit inferior.

UNIT 2:

Infinite series-Definition of convergence, Divergence and Oscillation-Necessary Condition for Convergence - Convergence of Σ **1 / n** ^{p} and Geometric series. Comparison test –Simple problems.

UNIT 3:

Cauchy's condensation test, Cauchy's root test and their simple problems Alternative series with simple problems.

UNIT 4:

D'Alembert's ratio test and Raabe's test – Simple Problems .General summation of series including successive difference and recurring series.

UNIT 5:

Inequalities - Geometric and Arithmetic means Weistrass inequalities- Cauchy's inequality.

TEXT BOOK:

Algebra Volume I & Volume II T.K.M.Pillai (Relavant problems only)
Unit I : Chapter 2 (4.7)
Unit II : Chapter 2 (8-14,16,18,19)
Unit III : Chapter 2 (15,17,21-24)
Unit IV : Chapter 5
Unit V : Chapter 4 (second volume)

General Reference

Sequence and series: Arumugam and Isaac

Course code	Course Title	L	T	P	C
22120AEC25	Allied -I-Paper-II Web Programming	5	1	0	5

Objectives

- give you a general understanding of how a computer works
- introduce you to assembly-level programming
- prepare you for future courses. .

UNIT-I:

Introduction to HTML- Head and body sections- Hyper text and Link in HTML documents.

UNIT-II:

Designing the body section- Managing images in HTML.

UNIT-III:

Ordered and Unordered Lists –Table Handling.

UNIT-IV:

DHTML and Style Sheet – Frames.

UNIT-V:

A Webpage design project – Forms.

REFERENCE BOOKS:

1. World Wide Web Design with HTML – c.Xavier –Tata McGraw-Hill-2000.
2. Principles of web design –Joel Sklar –Vikas Publishing House 2001.

Learning outcomes

By the end of this course, you should be able to:

- describe the fetch-execute cycle of a computer
- understand the different types of information which may be stored within a computer memory
- write a simple assembly language program

Allied- I Practical—II WEB PROGRAMMING LAB

Course code	Course Title	L	T	P	C
22122AEC26L	Allied-I Practical-II Web Programming Lab	0	0	3	2

Objectives

1. To create a fully functional website with mvc architecture
2. To develop an online book store
3. To provide an understanding of the language translation peculiarities by designing a complete translator for a mini language

1. Create a Web page for ABC INFOTECH LTD., with necessary images and marquee.
2. Create Web pages which displays the menu card of a hotel. The first page should contain the list of items available. After selection of one item, the corresponding details should be displayed on the next page.
3. Create a Web page which displays the balance sheets for the given list of companies (same as above problem).
4. Create a Web page for XYZ INFOTECH LTD., to display the company profile employee details balance sheet, receive resume, customer service using links.
5. Using frames create web pages *for* a travel agency
6. Create a Web page using forms for our college students admission process. (Use list box, push button, radio button, command button, rich text box, text box, etc where ever applicable)
7. Create a Web page which receives suggestions from customers for a software development & consultancy agency using necessary.

Learning outcomes

By the end of this course, you should be able to:

- Will create a fully functional website(online book store) using mvc architecture
- Will create a complete translator for a mini language
- Understand the basic terminology used in computer programming
- Use different data types in a computer program.
- Design programs involving decision structures, loops and functions.

Course code	Course Title	L	T	P	C
221ACLSCOS	Communication Skills	-	-	-	2

Course Objectives :

This course has been developed with the following objectives:

1. Identify common communication problems that may be holding learnersback
2. Identify what their non-verbal messages are communicating toothers
3. Understand role of communication in teaching-learningprocess
4. Learning to communicate through the digitalmedia
5. Understand the importance of empatheticlistening
6. Explore communication beyondlanguage.

Course Outcome :

By the end of this program participants should have a clear understanding of what good communication skills are and what they can do to improve their abilities.

Unit I :Listening

- Techniques of effective listening
- Listening and comprehension
- Probing questions
- Barriers to listening

Unit II: Speaking

- Pronunciation
- Enunciation
- Vocabulary
- Fluency
- Common Errors

Unit III :Reading

- Techniques of effective reading
- Gathering ideas and information from a given text
    - i. Identify the main claim of the text
    - ii. Identify the purpose of the text
    - iii. Identify the context of the text
    - iv. Identify the concepts mentioned
- Evaluating these ideas and information
    - i. Identify the arguments employed in the text
    - ii. Identify the theories employed or assumed in the text
- Interpret the text
    - i. To understand what a text says
    - ii. To understand what a text does

iii. To understand what a text means

Unit IV: Writing and different modes of writing

- Clearly state the claims
- Avoid ambiguity, vagueness, unwanted generalizations and oversimplification of issues
- Provide background information
- Effectively argue the claim
- Provide evidence for the claims
- Use examples to explain concepts
- Follow convention
- Be properly sequenced
- Use proper signposting techniques
- Be well structured
  - i. Well-knit logical sequence
  - ii. Narrative sequence
  - iii. Category groupings
- Different modesofWriting -
  - i. E-mails
  - ii. Proposal writing for Higher Studies
  - iii. Recording the proceedings of meetings
  - iv. Any other mode of writing relevant for learners

Unit V:Digital Literacy

- Role of Digital literacy in professional life
- Trends and opportunities in using digital technology in workplace
- InternetBasics
- Introduction to MS Office tools
  - i. Paint
  - ii. Office
  - iii. Excel
  - iv. PowerPoint

Unit VI: Effective use of Social Media

- Introduction to social media websites
- Advantages of social media
- Ethics and etiquettes of social media
- How to use Google search better
- Effective ways of using Social Media
- Introduction to Digital Marketing

Unit VII :Non-verbal communication

- Meaning of non-verbal communication
- Introduction to modes of non-verbal communication
- Breaking the misbelieves
- Open and Closed Body language
- Eye Contact and Facial Expression

- Hand Gestures
- Do's and Don’ts
- Learning from experts
- Activities-Based Learning

Reference Books

- SenMadhucchanda (2010), *An Introduction to Critical Thinking*, Pearson,Delhi
- Silvia P. J. (2007), *How to Read a Lot*, American Psychological Association, Washington DC

Course Code	Course Title	L	T	P	C
22110AEC13	Tamil -III	4	0	0	2

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Course Code	Course Title	L	T	P	C
22111AEC31	**Advanced English-III**	**4**	**0**	**0**	**2**

Aim:
- To improve the knowledge of English

Objective:
- To familiarize with the organs of speech and the description and classification of speech sounds
- To understand consonant cluster, syllable, word accent and intonation.
- To know how to interpret graphics
- To write slogans and advertisements

Outcome:
- Understand phonetics
- Develop writing skill
- Able to develop creative writing

UNIT –I
The organs of speech
Classification of speech sounds
Vowels and Diphthongs
UNIT –II
Consonants
Consonant cluster
UNIT – III
Syllable
Word accent
Intonation
UNIT – IV
Idiom
Interpretation of graphics
UNIT – V
Slogan writing
Writing advertisement
Reference books:

Author	Title of the book	Edition / Year	Publisher
T.B. Balasubramaniyan	A text book of Phonetics for Indian Students	Reprint 2008	Macmillian
Meenakshi Sharma &Sangeetha Sharma	Technical Communication	2011	Oxford University Press

Course Code	Course Title	L	T	P	C
22111AEC32	English-III	4	0	0	2

Aim:
- To acquaint with learning English through literature

Objective:
- To sensitize language use through prescribed text
- To develop the conversational skills through one act plays

Outcome:
- Appreciate different types of prose
- Develop the conversational skills through one act plays
- Enhance the skill of making grammatically correct sentences.

UNIT – 1

The Doctor's World - R.K. Narayan
The Postmaster - Rabindranath Tagore
Princess September - E.Somerest Maugham

UNIT – II

The Price of Flowers -Prabhat Kumar Mukhopadhyay
The Open Window -Saki
The Model Millionaire -Oscar Wilde

UNIT –III

My Brother My Brother - Norah Burke
Uneasy Home Coming - Will F. Jenkins
Resignation - Premchand

UNIT –IV

The Referee -W.H. Andrews & Geoffrey Dreamer
The Case of the Stolen Diamonds -Farrell Mitchell

UNIT – V

The Dear Departed -Stanley Houghton
The Princess and the Wood Cutter -Alan Alexander Milne

Text book:

Author	Title of the book	Edition / Year	Publisher
SteuartH.King	Nine Short Stories	Reprint 2001	Blackie Books
T.Prabhakar	One – Act Play		Emerald

Course code	Course Title	L	T	P	C
22112AEC33	Core – V Number Theory	4	0	0	3

bjectives:

The objective is for the students to obtain a foundational knowledge of elements of Number Theory through step-by-step proofs of classical theorems, as well as to sharpen their skills through problem-solving.

UNIT 1:

THE FUNDAMENTAL THEOREM OF AR1THMETIC:- Introduction - Divisibility — Greatest Common divisor — Prime numbers — The fundamental theorem of arithmetic — The series of reciprocals of the primes — The Euclidean algorithm — The greatest Common divisor of more than two numbers.

UNIT 2:

ARITHMETICAL FUNCTIONS AND D1RICHLET MULTIPLICATION:- The motions function μ(n) — The Euler totient function — A relation connecting ϕ and μ - A product formula for μ(n) — The Dirichlet product of arithmetical functions — Dirichlct inverses and the Mobius inversion formula — the Mangoldt function Λ (n) — Multiplicative functions — Multiplicative function and Dirichlet multiplication.

UNIT 3:

AVERAGES OF ARITHMETICAL FUNCTIONS:- The big oh notation Asymptotic equality of functions — Euler's summation formula — some elementary asymptotic formulas- the average order of d(n) — the average order of the divisor fraction ∂α*(n)* - the average order of ϕ(n).

UNIT 4:

SUM OF SQUARES: Sums of two squares-Sums of four squares. Elementary partition theory; Introduction-graphical representation-Euler's partition theorem-searching for partition identities.

UNIT V :

PARTITION GENERATING FUNCTIONS: Infinite products as generating functions-Identities between infinite series and products-partition identities: History and introduction-Euler's pentagonal number theorem-The Roger's Ramanujan identities-Series and Product identities.

Reference:

Introduction to Analytic Number Theory by Tom. M.Apostal

For Unit 1 - Chapter 1

For Unit 1 - Chapter 2

For Unit 1 - Chapter 3

For Unit 1 - Chapter 4 Section 4,1 to 4.9 only

For Unit 1 - Chapter 5

General Reference:

1. Number theory : George E.Andrews
2. Introduction to theory of Number : G.H.I-lardy and E.M.Wright.
3. Basic Number Theory :S.B.Malilk.
4. Elements of Number Theory :S.Kumaravelu and SusheelaKumaravelu.

Learning Outcomes:

On satisfying the requirements of this course, students will have the knowledge and skills to:

- ✓ Solve problems in elementary number theory
- ✓ Apply elementary number theory to cryptography
- ✓ Develop a deeper conceptual understanding of the theoretical basis of number theory and cryptography

- ✓ Define and interpret the concepts of divisibility, congruence, greatest common divisor, prime, and prime-factorization.

Core VI - NUMERICAL ANALYSIS

Course code	Course Title	L	T	P	C
22112AEC34	Core – VI Numerical Analysis	4	0	0	3

Objectives:

The roll of numerical analysis is to develop and analyze the numerical techniques. In this paper, different methods for finding the roots of algebraic and transcendental equations, solutions of simultaneous equations, solutions of ordinary differential equations

Solution of Linear systems ,Numerical differentiation and integration interpolation with equal & unequal intervals are concentrated.

UNIT 1:

Solutions of Algebraic and transcendental equation iterative method, Bisection method-Aitken's process Method of False Position-Newton-Raphson methods.

UNIT II:

Finite differences-Forward differences backward differences Central differences symbolic relations-Newton's formula for interpolation.

Interpolation with unevenly spaced points

Lagrange's interpolation formula-divided differences and their properties-Newton's General interpolation formula.

UNIT III: Numerical differentiation and integration

Numerical differentiation — integration — Trapezoidal rule and Simpson's rule.

UNIT IV: Solution of Linear systems

Gaussian Elimination method — Iterative methods Jacobi and Gauss seidal Methods.

UNIT V:

Numerical solution of Ordinary -Differential Equations. Solution by Taylor's series - Picard's method of successive approximations -Euler method Modifies Euler's method - RungeKutta methods -Predictor Corrector methods - Adams method and Mines method.

Text Book

Numerical Methods in Science And Engineering by M.K.Venkatraman

Reference:

Introductory methods of Numerical Analysis by S.S. Sastry- Prentice Hall of India Pvt. Limited.

Chapters:2. 2.1 to 2.5

3.3.1,3.3,3.6,3.9, 3.9.1,3.10,3.10.1

4. 4.2, 4.4, 4.4.1, 4.4.2

5. 5,4

6. 6.1 to 6.5 and 6.6.1 and 6.6.2

Learning Outcomes:

- Solving problems in algebraic and transcended equations
- Understand about finite differences
- Students develop and analyze numerical techniques
- Applying Various numerical methods to solve the ordinary differential equations

- Students gets the Research inquiry and analytical thinking abilities

Course code	Course Title	L	T	P	C
22118AEC35	Mathematical Statistics I	5	1	0	5

Objectives:
Statistics provides the methodology for the planning and execution for any scientific enquiry, which has been accepted as a valid tool in this content. In this course Basic Statistics, Probability, Baye'sTheorem,random variables, discrete distributions, continuous functions, Bivariate Distributions, Correlation and Regression would be taught.

UNIT I:
Statistical data — Primary and Secondary data. Formation of frequency distribution Various measures of Central tendency and their merits and demerits various measures of dispersion and their merits and demerits Concept of Skewness and Kurtosis.

UNIT II:
Axiomatic Probability and classical, probability addition, multiplication and Bayc's theorems, Simple problems.

UNIT III:
Concept of random variable—discrete and continuous distribution function, probability mass function, probability density function — their properties — mathematical expectation — moment generating function — Simple problems.

UNIT IV :
Bivariate distribution - discrete and continuous, marginal and conditional distribution Statistical independence, Conditional expectation.

UNIT V:
Correlation — Rank Correlation, Karl Pearson's Correlation coefficient and its properties Linear Regression and its properties — Concept of multiple and partial correlation for three variables only.

Text Book:
1. Fundamentals of Mathematical Statistics — S.C.Gupta and V.K.Kapoor, Sultan Chand & Sons, New Delhi.

Reference:
1. Fundamentals of Applied Statistics — S.C.Gupta and V.K.Kapoor. Sultan Chand & Sons.
2. Elementry Statistical Methods – S.P.Gupta, Sultan Chand & Sons, New Delhi.

Learning outcomes
By the end of this course, you should:
- Students gets the methodology for the planning and execution for any scientific enquiry
- Students learning statistical techniques and statistical data
- Understand the concept of random variables
- Understand the concept of Bivariate Distribution..
- A knowledge of constructions and uses correlation and regression.

Course code	Course Title	L	T	P	C
22118AEC36L	Mathematical Statistics – I lab	0	0	3	2

Objectives:

Statistics provides the methodology for the planning and execution for any scientificenquiry,which has been accepted as a valid tool in this content. In this course random variables, discrete distributions, continuous distributions would be taught.

List of Practical's

1. Measures of Central tendencies and measures of dispersion.
2. Moments.
3. Skewness and Kurtosis.
4. Fitting of binomial distribution.
5. Fitting of Poisson distribution.
6. Fitting of Normal distribution.
7. Correlation for Discrete Variables.
8. Correlation for Continuous Variables.
9. Rank Correlation.
10. Regression for Discrete Variables.
11. Regression for Continuous Variables.
12. Index Numbers.

Learning outcomes

By the end of this course, you should:

- Students learned statistical techniques and statistical data.
- Understand the concept of various distributions.
- Understand the concept of Correlation and Regression.
- Study of Index Numbers.

RESEARCH METHODOLOGY

Course code	Course Title	L	T	P	C
22112RMC37	Research Methodology	2	0	0	2

UNIT I

Research – Definition, Objectives, Motivation and purpose – types of research – Pure and applied, survey, case study experimental, exploratory – Concept of Research Design – Criteria of Good Research, Problems Encountered by Researchers in India. General guidelines for Good housekeeping & Lab-safety- Hygiene (Eye, foot, skin and hand protection) – Safety rules - Equipment protection – Respiratory protective equipment – safety equipment – Leaking, compressed gas cylinders – electrical safety. Fire – extinguishers.

UNIT II

Research Problem: Definition & need of research problem, Types & selection of proper research question and suitable research design with Examples, Literature types- compendia and tables of information, Reviews, General treatises, Monographs.

UNIT III

Methods of data collection – Primary and secondary data – observation – interview – Questionnaire – Tools for questionnaire; surveying & literature survey, spreadsheets, Technical writing, Construction of tools for data collection – testing validity – pilot study and pre-testing, Survey vs Experiment, Practical Exercises.

UNIT IV

Processing and analysis of data – editing – coding – transcription – tabulation –outline of statistical analysis – descriptive statistics – elements of processing through computer-packages for analysis (Excel).

UNIT V

Review of literature, Report writing – target audience – types of reports – contents of reports – styles and Conventions in reporting – steps in drafting a report. Technical Presentation

REFERENCE:

1. C.R. Kothari, Research Methodology-Methods & Techniques, 2nd Edition, New Age Int. (P) Ltd, 2004.
2. R. Gopalan, Thesis writing, Vijay Nicole Imprints Private Ltd., 2005.
3. S.P.Gupta, “Statistical Methods”, 7th Edition, S. Chand and Co. Ltd., 2004.
4. R.A Day and A.L. Underwood, Quantitative analysis, Prentice Hall, 1999.
5. Ajai.S.Gaur, SanjayaS.Gaur, Statistical Methods for Practice and Research, Response, 2009

OFFICE AUTOMATION

Course Code	Course Title	L	T	P	C
221ACLSOAN	OFFICE AUTOMATION	**-**	**-**	**-**	**2**

Course Objective:

To provide an in-depth training in use of office automation, internet and internet tools. The course also helps the candidates to get acquainted with IT.

Course Outcomes:

After completion of the course, students would be able to documents, spreadsheets, make small presentations and would be acquainted with internet.

Unit I

Knowing the basics of Computers

Unit II

Word Processing (MS word)

Unit III

Spread Sheet (MS XL)

Unit IV

Presentation (MS Power Point)

Unit V

Communicating with Internet

Reference Books:

1. Fundamentals of computers - V.Rajaraman - Prentice- Hall of india

2.Microsoft Office 2007 Bible - John Walkenbach,HerbTyson,FaitheWempen,caryN.Prague,MichaelR.groh,PeterG.Aitken, and Lisa a.Bucki -Wiley India pvt.ltd.

3. Introduction to Information Technology - Alexis Leon, Mathews Leon, and Leena Leon, Vijay Nicole Imprints Pvt. Ltd., 2013.

4. Computer Fundamentals - P. K. Sinha Publisher: BPB Publications

5. https://en.wikipedia.org

6. https://wiki.openoffice.org/wiki/Documentation

7. http://windows.microsoft.com/en-in/windows/windows-basics-all-topics

Course Code	Course Title	L	T	P	C
22110AEC41	Tamil -IV	4	0	0	2

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Course Code	Course Title	L	T	P	C

22111AEC41	**Advanced English-IV**	**4**	0	0	2

Aim:
- To improve the knowledge of English

Objective:
- To familiarize with the objectives and types of interview
- To know the types of questions and answering techniques
- To prepare reviews and proposals
- To learn the grammatical forms
- To understand the meaning of a poem and write the content
- To write for and against a topic
- To draw a flowchart
- To write definitions

Outcome:
- Develop writing skill
- Comprehend and describe poems
- Learn interviewing skills

UNIT –I
Interviews
Objectives, types, ten success factors, ten failure factors - Planning and preparation –Presentation– Type of questions – Answering techniques.

UNIT – II
Flowchart
Proposals

UNIT – III
Discourse markers
Review

UNIT IV
Grammatical forms
Paraphrasing

UNIT –V
Definition
Writing for and against a topic.

Reference books:

Author	**Title of the book**	**Edition / Year**	**Publisher**
Rajendra Pal & J.S Korlahalli	Essentials of Business Communication	2015	Sultan Chand & Sons
Meenakshi Raman &Sangeetha Sharma	Technical Communication	2011	Oxford University Press
Wren & Martin	English Grammar & Composition	2009	S.Chand

Course Code	**Course Title**	**L**	**T**	**P**	**C**

22111AEC42	English-IV	4	0	0	2

Aim:

- To learn English through literature

Objective:

- To explore learners to the standard literary texts
- To impart wisdom through morally sound poems and essays
- To introduce Shakespeare to non-literature students

Outcome:

- Improve their ability to read and understand them
- Know the genius of Shakespeare
- Express one's views in writing

UNIT –I

My Last Duchess -Robert Browning
The Toys -Coventry Patmore
I, too -Langston Hughes

UNIT –II

How to be a Doctor -Stephen Leacock
My Visions for India -A.P.J. Abdul Kalam
Woman, not the weaker sex -M.K. Gandhi

UNIT –III

The Best Investment I ever made-A.J.Cronin
The Verger -W.S Maugham
A Willing Slave -R.K.Narayan

UNIT –IV

Macbeth
As You Like It

UNIT –V

Henry IV
Tempest

Text book:

Author	**Title of the book**	**Edition / Year**	**Publisher**
Devaraj	English for Enrichment	2012	Emerald Publishers
Board of Editors	Selected Scenes from Shakespeare Book I & II	2012	Emerald Publishers

Core VIII- OPERATIONS RESEARCH

Course code	Course Title	L	T
22112SEC43	Core –VIII Operations Research	4	0

Objectives:

Optimization is an important tool of modern applied mathematics. This course gives an idea to the student to recognize potential linear programming problems, to humiliate such problems as linear programming models, to employ the proper computational techniques to solve these problems, and to understand the mathematical aspects that tie together these elements of linear programming. The objective of this paper is to highlight the theoretical, computational and applied aspects of linear programming problems.

UNIT 1:

Introduction to operations Research — Elementary treatment of linear programming simplex Method <,=,>,= constraints.

UNIT 2:

Application to Transportation problem - Transportation Algorithm - Degeneracy in Transportation problem, unbalanced transportation problem, Assignment problem - The assignment algorithm - unbalanced assignment problem.

UNIT 3:

PERT and CPM network — critical and sub critical jobs — Determining the critical path. Network calculation PERT networks probability aspect of PERT — PERT time — PERT cist (omitting Crashing)

UNIT 4:

Sequencing Problems – Introduction – Step-wise procedure for determing the optimal sequence for n jobs on 2 machines (Johnson's method) – Processing n jobs on three machines – Processing n jobs on m machines – Processing of two jobs on 'n ' machines.

UNIT 5:

Inventory Theory--Variables in an Inventory problem Techniques of Inventory Control with known demand.

1. Purchasing model with no shortage. 2. Purchasing model with shortages.

3. Manufacturing model with no shortages, 4. Manufacturing model with shortage.

5. Technique of Inventory Control with uncertain demand. 6.Buffer stock of safety stock model

[In all the units Application of the concept only. No book work]

Reference :

1. Operations Research by Kantiswarup, P.K. Gupta and Manmohan.
2. Resource Management Techniques (Operations Research) V.Sundaresan, K.S. Ganapathy Subramanian, K. Ganesan.
3. Operations Research Methods and Applications, P.Mariappan

Learning outcomes

By the end of this course,

- Students using OR techniques in business tools for decision making
- Students develop PERT and CPM networks and finding the shortest path
- Understand the concept of sequencing problems and game theory
- Students gets the knowledge about inventory theory

Core IX- IMAGE PROCESSING

Course code	Course Title	L	T	P	C
22112AEC44	Core – IX IMAGE PROCESSING	4	0	0	3

COURSE OBJECTIVES:

This course is concerned with the mathematical study of image processing. Its two main objectives are

To introduce basic concepts and engineering approaches applicable to image processing and develop a further study foundation.

To provode some mathematical techniques for studying several fundamental questions in image processing:;;su;ch as how to restore a degraded image and how to segment it into meaningful regions.

Unit I :Digital Image through Scanner, Digital Camera. Concept of Gray Levels. Gray Level to Binary Image Conversion. Sampling and Quantization. Relationship between Pixels. Imaging Geometry. 2D Transformations-DFT, DCT, KLT and SVD.

Unit II: Image Enhancement in Spatial Domain Point Processing, Histogram Processing, Spatial Filtering, Enhancement in Frequency Domain, Image Smoothing, Image Sharpening.

Unit III: Image Restoration Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration, Interactive Restoration

Unit IV: Image Segmentation Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region Oriented Segmentation

Unit V: Image Compression Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Source Encoder and Decoder, Error Free Compression, Lossy Compression.

TEXT BOOK:

1. Digital Image Processing: R.C. Gonzalez & R. E. Woods, Addison Wesley/ Pearson Education, 2nd Ed, 2004.

REFERENCES:

1. Fundamentals of Digital Image Processing: A. K. Jain , PHI.
2. Digital Image Processing using MAT LAB: Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins: Pearson Education India, 2004.
3. Digital Image Processing: William K. Pratt, John Wilely, 3rd Edition, 2004.

ENVIRONMENTAL STUDIES
(for under graduate students)

Course code	Course Title	L	T	P	C
221ENSTU45	Environmental Studies	2	0	0	2

Objectives:

- Creating the awareness about environmental problems among people.
- Imparting basic knowledge about the environment and its allied problems.
- Developing an attitude of concern for the environment.
- Motivating public to participate in environment protection and environment improvement.
- Acquiring skills to help the concerned individuals in identifying and solving environmental problems.
- Striving to attain harmony with Nature.

1. Nature of Environmental Studies

Definition, scope and importance.
Multidisciplinary nature of environmental studies
Need for public awareness.

2. Natural Resources and Associated Problems.

a) Forest resources: Use and over -exploitation, deforestation, dams and their effects on forests and tribal people.
b) Water resources: Use and over -utilization Of surface and ground water, floods, drought, conflicts over water, dams benefits and problems.
c) Mineral resources: Usage and exploitation. Environmental effects of extracting and using mineral resources.
d) Food resources: World food problem, changes caused by agriculture effect of modern agriculture, fertilizer -pesticide problems.
e) Energy resources: Growing energy needs, renewable and non -renewable energy resources, use of alternate energy sources. Solar energy, Biomass energy, Nuclear energy.
f) Land resources: Solar energy, Biomass energy, Nuclear energy, Land as a resource, land degradation, man induced landslides, soil erosion and desertification,

Role of an individuals in conservation of natural resources.

3. Ecosystems

Concept of an ecosystem.
Structure and function of an ecosystem.
Producers, consumers and decomposers.
Energy flow in the ecosystem.
Ecological succession.
Food chains, food webs and ecological pyramids.
Introduction, types, characteristics features, structure and function of the following ecosystem:
a) Forest ecosystem, b) Grassland ecosystem, c) Desert ecosystem,
d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

4. Biodiversity and its conservation

Introduction -Definition: genetic, species and ecosystem diversity.
Bio -geographical classification of India.
Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
India as a mega -diversity nation.
Western Ghat as a biodiversity region.
Hot— spot of biodiversity.
Threats to biodiversity habitat loss, poaching of wildlife, man -wildlife conflicts.
Endangered and endemic species of India.
Conservation of biodiversity: In -situ and Ex -situ conservation of biodiversity.

5. Environmental Pollution

Definition: Causes, effects and control measures of: Air pollution, Water pollution, soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards.
Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
Role of a individual in prevention of pollution.

6. Social Issues and the Environment

Disaster management: floods, earthquake, cyclone, tsunami and landslides.
Urban problems related to energy Water conservation, rain water harvesting, watershed management
Resettlement and rehabilitation of people; its problems and concerns.
Environmental ethics: Issue and possible solutions.
Global wanTling, acid rain, ozone layer depletion, nuclear accidents and holocaust.
Wasteland reclamation.
Consumerism and waste products.

7. Environmental Protection

From Unsustainable to Sustainable development.
Environmental Protection Act.
Air (Prevention and Control of Pollution) Act.
Water (Prevention and control of Pollution) Act.
Wildlife Protection Act.
Forest Conservation Act.
Population Growth and Human Health, Human Rights.

8. Field Work

Visit to a local area to document environmental assets — River / Forest / Grassland / Hill / Mountain.

or

Visit to a local polluted site — Urban / Rural *I* lad Listrial / Agricultural.

or

Study of common plants, insects, birds.

or

Study of simple ecosystems -— ponds, river, hill slopes, etc.

References:

1) Agarwal, K.C,200l, Environmental Biology, Nidi Pub. Ltd., Bikaner.
2) BharuchaErach, The l3iodiversity of India, Mapin Publishing Pvt, Ltd., Ahmedabad 380013, India, Email: rn4pin@icenet.net (R)
3) Brunner R.C., 1989, 1-lazardous Waste Incineration, McGraw Hill Inc. 480p
4) Clank R.S., Marine Pollution, Clanderson Press Oxford (TB)
5) Cunningham, W.P. Cooper, T.H. Gorhani, E. & Hepworth, M.T.2001, Environmental Encyclopedia, Jaico Pub. Mumbai, Il96p
6) De A.K., Environmental Chemistry, Wiley Wastern Ltd.
7) Down to Earth, Centre for Science and Environment, New Delhi. (R)
8) Gleick, H., 1993, Water in crisis, Pacific Institute for studies in Dcv., Environment & Security. Stockholm Env Institute. Oxford Univ. Press 473p
9) Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bompay (R)
10) Heywood, V.K. & Watson, R.T.1995, Global Biodiversity Assessment, Crnbridge Univ. Press 1140 p.
11) Jadhav, H. and Bhosale, VJvI. 1995, Environmental Protection and Laws, Himalaya Pub. House, Delhi 284p.
12) Mickinney, M.L. and School. R.M. 1196, Environmental Science Systems and Solutions, Web enhanced edition, 639p.
13) Miller T.G. Jr. Environmental Science. Wadsworth Publications Co. (TB).
14) Odum, E.P. 1971, Fundamentals of Ecology, W.B. Saunders Co. USA,574zp.
15) Rao M.N. and Dana, A.K. 1987, Waste Water Treatment, Wxford& IBH Publ. Co. Pvt. Ltd., 345p
16) Sharma B.K., 2001, Environmental Chemistry, GokelPubI. Hkouse, Meerut
17) Survey of the Environment, The Hindu (M)
18) Townsend C., Harper, J, and Michael Begon, Essentials of Ecology, Blackwell Science (TB)

19) Trivedi R.K. Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, vol. 1 and II, Environmental Media (R)
20) Trivedi R.K. and P.K. Goel, Introduction to air pollution, Techno— Science Publications (TB)
21)Wagner K.D., 1998, Environmental management, W.B. Saunders Co. Philadelphia, USA 499p,
22) Paryavaranshastra— Gholap T.N,
23) ParyavaranSahastra— Gharapure

(M) Magazine
(R) Reference
(TB) Textbook

Learning Outcomes:

Students who graduate with a major in environmental science will be able to:

1. Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale;
2. Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment;
3. Demonstrate ecology knowledge of a complex relationship between predators, prey, and the plant community;
4. Apply their ecological knowledge to illustrate and graph a problem and
5. describe the realities that managers face when dealing with complex issues; and
6. Understand how politics and management have ecological consequences.

Course code	Course Title	L	T	P	C
22118AEC46	Mathematical Statistics II	5	1	0	5

Objectives:
Statistics provides the methodology for the planning and execution for any scientific enquiry, which has been accepted as a valid tool in this content. In this course Central Limit Theorem, Discrete and Continuous Distributions, Small and Large Sampling would be taught.

UNIT I:
Tchebychev's inequality and weak law of large numbers — Simple form of central limit theorem for i.i.d random variables.

UNIT II:
Binomial, Poisson, Negative binomial, geometric distribution — Constants, moment generating function, Cumulant generating function.

UNIT III:
Continuous distribution — rectangular, exponential, beta, gamma distributions, Normal Distributions.

UNIT IV:
Test of Hypothesis—Null and alternative hypothesis(Concept only) One tail and two tail tests, tests of significance based on normal and t distribution for mean, simple correlation and properties.

UNIT V:
Test of significance based on chi square and F distributions for variance, test for goodness of fit and independence of attributes Analysis of variance — One way and two — way classifications with simple problems.

Text Book:

1. Fundamentals of Mathematical Statistics — S.C.Gupta and V.K.Kapoor, Sultan Chand & Sons, New Delhi.

Reference:

1. Fundamentals of Applied Statistics — S.C.Gupta and V.K.Kapoor. Sultan Chand & Sons.
2. Elementry Statistical Methods – S.P.Gupta, Sultan Chand & Sons, New Delhi.

Learning outcomes
By the end of this course, you should:

- Understand the concept of Tchebychev'sinequality and Applications of Central Limit Theorem.
- Understand the concept of Bivariate Distribution.
- A knowledge of test of significance based on parametric and non – parametric test.
- Understood the concept of sampling theory.
- Learned the concept of chi square, F-Test and ANOVA.

Course code	Course Title	L	T	P	C
22118AEC47L	Mathematical Statistics – II lab	0	0	3	2

Objectives:

Statistics provides the methodology for the planning and execution for anyscientificenquiry,which has been accepted as a valid tool in this content. In this course, chi-square distribution ,sampling distributions and analysis of variance would be taught.

List of Practical's

1.Goodness of fit. (Chi-square Test).
2. Attributes, Contingency table.
3. Large sample tests. Type I.
4. Large sample tests. Type II.
5.Large sample tests. Type III.
6.Large sample tests. Type IV.
7. t — tests.
8. Variance tests. (F-Test)
9. ANOVA.
10. Design of Experiments.

Learning outcomes

By the end of this course, you should:

- A knowledge of test of significance based on parametric and non – parametric test.
- Knowledge of Small and Large Sampling Tests.
- Design/development of solutions.

Course code	Course Title	L	T	P	C
221ACLSLMS	Leadership and Management Skills	-	-	-	2

Course Objectives :

The Module is designed to**:**

- Help students to develop essential skills to influence and motivateothers
- Inculcate emotional and social intelligence and integrative thinking for effective leadership
- Create and maintain an effective and motivated team to work for thesociety
- Nurture a creative and entrepreneurialmindset
- Make students understand the personal values and apply ethical principles inprofessionaland social contexts.

Course Outcomes :

Upon completion of the course students will be able to:

1. Examine various leadership models and understand/assess their skills, strengths and
   abilities that affect their own leadership style and can create their leadership vision
2. Learnanddemonstrateasetofpracticalskillssuchastimemanagement,selfmanagement,
   handling conflicts, team leadership, etc.
3. Understand the basics of entrepreneurship and develop business plans
4. Apply the design thinking approach for leadership
5. Appreciate the importance of ethics and moral values for making of a balanced personality.

Unit I-Leadership Skills

Understanding Leadership and its Importance

- What is leadership?
- Why Leadership required?
- Whom do you consider as an ideal leader?

b. Traits and Models of Leadership

- Are leaders born or made?
- Key characteristics of an effective leader
- Leadership styles
- Perspectives of different leaders

c. Basic Leadership Skills

- Motivation
- Teamwork
- Negotiation
- Networking

Unit II--Managerial Skills

a. **Basic Managerial Skills**

- Planning for effective management
- How to organize teams?
- Recruiting and retaining talent
- Delegation of tasks
- Learn to coordinate
- Conflict management

b. Self Management Skills

- Understanding self concept
- Developing self-awareness
- Self-examination
- Self-regulation
-

Unit III--Entrepreneurial Skills

a. **Basics of Entrepreneurship**

- Meaning of entrepreneurship
- Classification and types of entrepreneurship
- Traits and competencies of entrepreneur

b. Creating Business Plan

- Problem identification and idea generation
- Idea validation
- Pitch making

Unit IV - Innovative Leadership and Design Thinking

a. **Innovative Leadership**

- Concept of emotional and social intelligence
- Synthesis of human and artificial intelligence
- Why does culture matter for today's global leaders

b. Design Thinking

- What is design thinking?
- Key elements of design thinking:
  - Discovery
  - Interpretation
  - Ideation
  - Experimentation
  - Evolution.
- How to transform challenges into opportunities?
- How to develop human-centric solutions for creating social good?

Unit V- Ethics and Integrity

a. Learning through Biographies

- What makes an individual great?
- Understanding the persona of a leader for deriving holistic inspiration
- Drawing insights for leadership
- How leaders sail through difficult situations?

b. Ethics and Conduct

- Importance of ethics
- Ethical decision-making
- Personal and professional moral codes of conduct
- Creating a harmonious life

Reference Books:

- Ashokan, M. S. (2015). *Karmayogi: A Bbiography of E. Sreedharan*. Penguin,UK.
- Brown, T. (2012). *Change by Design.* HarperBusiness
- Elkington, J., &Hartigan, P. (2008). *The Power of Unreasonable People: How Social Entrepreneurs Create Markets that Change the World*. Harvard Business Press.
- GolemanD. (1995). *Emotional Intelligence*. Bloomsbury Publishing India PrivateLimited
- Kalam A. A. (2003). *Ignited Minds: Unleashing the Power within India*. Penguin BooksIndia
- Kelly T., Kelly D. (2014). *Creative Confidence: Unleashing the Creative Potential WithinUs All.*WilliamCollins
- KurienV.,& Salve G. (2012). *I Too Had a Dream*. Roli Books PrivateLimited

- Livermore D. A. (2010). *Leading with cultural intelligence: The New Secret to Success*. New York: American ManagementAssociation
- McCormackM.H.(1986).*WhatTheyDon'tTeachYouatHarvardBusinessSchool:NotesFromA Street-Smart Executive*. RHUS
- O'Toole J. (2019) *The Enlightened Capitalists: Cautionary Tales of Business Pioneers Who Tried to Do Well by Doing Good*.Harpercollins
- SinekS. (2009). *Start with Why: How Great Leaders Inspire Everyone to Take Action*.Penguin
- Sternberg R. J., Sternberg R. J., &BaltesP. B. (Eds.). (2004). *International Handbook of Intelligence*. Cambridge UniversityPress.

Course code	Course Title	L	T	P	C
22112AEC51	Core-X- Modern Algebra	5	0	0	4

SEMESTER – V

Core X. MODERN ALGEBRA

Objectives:

Algebraic structures like Groups, Rings, Vector spaces are studied. The existence of subgroups of given order and the number of such subgroups are studied. The properties of Euclidean rings are discussed. Vector spaces and its properties which will be useful in the study of Field Theory are exposed. Finally, Lattices and their types and finite Boolean algebras are introduced.

UNIT 1:

Permutation Groups - Sub Groups — Cosets and Lagrange's theorem

UNIT II:

Normal subgroups - Quotient groups. -Homeomorphisms –Isomorphism

UNIT III:

RING THEORY:

Definition and Examples of Rings — Some special Classes of Rings — Homomorphisms - Ideals and Quotient Rings — More ideals and Quotient Rings — Euclidean Rings.

UNIT IV:

VECTOR SPACE:

Elementary Basic concepts — Linear independence and Bases and spaces - Inner product Spaces – Orthoganallity, Orthogonal Complement.

UNIT V:

THEORY OF MATRICES:

Basic definitions – Elementary transformations, Rank of a matrix – Consistency -- Rouche's Theorem -- Eigen Values and Eigen Vectors of the matrix – Quadratic forms -- Canonical forms.

Text Books:

"TOPIC IN ALGEBRA" by Arumugam . S and Isaac. A.T (Second edition)

For UNIT 1 - .Chapter 3: Section 3.4 to 3.8
For UNIT 2 - Chapter 3: Section 3.9 to 3.11
For UNIT 3 - Chapter 4: Section 4.1 to 4.14
For UNIT 4 - Chapter 5: Section 5.0 to 5.6
For UNIT 5 - Chapter 5: Section 5.7 to 5.8 , Chapter 6 section 6.0 to 6.3

General References

1. Modern Algebra :A.R.Vasistha
2. Modern Algebra :Dr. S. Arumugam.

Learning outcomes

By the end of this course, you should:

- Knowledge and understand about Algebraic structures like Groups, Rings, Vector spaces
- Understood about Morphisms
- Skillness in Linear dep. , in- dep. and bases problems

Core XI - REAL ANALYSIS

Course code	Course Title	L	T	P	C
22112AEC52	Core –XI- Real Analysis	5	1	0	4

Objectives:

This paper is intended to cover all elementary topics in Real analysis such as sequence of real numbers, series of real numbers, continuous functions, connectedness, completeness and compactness. This paper is essential for studying Riemann integrals, fundamental theorem of calculus and improper integrals. This enhances the mathematical maturity of the students.

UNIT I: BASIC TOPOLOGY:-

Finite, countable and uncountable sets - Metric spaces - Compact spaces -Perfect sets - Connected sets.

UNIT II: NUMERICAL SEQUENCES AND SERIES:-

Convergent sequences - Subsequence's -Cauchy Sequences -Upper and Lower limits - some special sequences - Series -Series of Non negative Terms -The Number E - The Root and Ratio Tests-Power series -Summation by parts - Absolute convergence - Addition and Multiplication of series.

UNIT III: CONTINUITY:-

Limits of functions -continuous functions -Continuity and compactness - Continuity and connectedness-Discontinuity -Monotonic functions - Infinite limits and limits at infinity.

UNIT IV: DIFFERENTIATION:-

The derivative of a Real function - Mean value theorems - The continuity of Derivatives - L'Hospital's Rule -Derivatives of Higher order -Taylor's theorem.

UNIT V:

THE RIEMANN- INTEGRALS:- Definition and Existence of the Integral — Properties of the Integral — Integration and Differentiation.

Reference:

Principles of Mathematical Analysis by Walter Rudin, MC Graw Hill.

For UNIT I - Chapter-2

For UNIT II - Chapter-3 (section 3.1 to 3.50)

For UNIT III - Chapter-4

For UNIT IV - Chapter-5

For UNIT V - Chapter-6

General References:

1.Real Analysis : Bartle and Schuhest.

2. Real Analysis : Albert smith E.H.

Learning outcomes

By the end of this course, you should

- Knowledge about Connectedness, completeness and compactness
- Understanding the Riemann integrals, fundamental theorem of calculus
- Analyses the problem and finding the solution

Core XII - STATICS

Course code	Course Title	L	T	P	C
22112SEC53	Core – XII – Statics	5	1	0	4

Course Objectives:

Develop an understanding of the principles of statics, and the ability to analyze problems in a systematic and logical manner, including the ability to draw free-body diagrams.

UNIT-1
Forces and equilibrium –Forces-Resultant of two forces-Three forces related to a triangle –Equilibrium of a particle under three or more forces.
UNIT-II
Forces on a rigid body –Moment –Equivalent systems of forces-Parallel forces varigopn's theorem – Forces along a triangle-Couples –Equilibrium of a rigid body under three coplanar forces –Reduction of coplanar forces into a force and a couple.
UNIT –III
Friction –Laws of friction-Coefficient of fiction, angle and cone of Friction-Limiting equilibrium of a particle on a rough inclined plane, Tilting of a body Simple problems.
UNIT-IV
Virtual work-principle of virtual work-applied to a body or a system of bodies in equilibrium-Equation of virtual work-Simple problems.
UNIT-V
String –Equilibrium of string under gravity –common catenary-suspension bridge.
Reference:
(1)P.DURAIPANDIAN, Mechanics(vector treatment),S.chand&co.june 1997
UNIT-I chapter 2& chap 3 section 3.1
UNIT-II chapter 4 sec 4.1,4.3 to 4.9 & chap 5 sec 5.1
UNIT –III chap 2 sec 2.1,chap 3 sec 3.2,chap 5 sec 5.2
UNIT-IV chapter 8 ,UNIT-V chapter 9
Reference:
(1) M.K.Venkataraman, Statics, Agasthirpublication ,2002
(2)A.V.Dharmapadham, Statics, S.Viswanathan publishers Pvt Ltd.,1979
(3)S.L.Lony ,Elements of Statics and Dynamics, part-1,A.I.T.Publishers,1991

Course Outcomes:
Students who successfully complete the course will demonstrate the following outcomes by tests, homework, and written reports:

1. An ability to construct free-body diagrams and to calculate the reactions necessary to ensure static equilibrium.
2. An understanding of the analysis of couples and friction.

Core-XIII- PROGRAMMING in C++

Course code	Course Title	L	T	P	C
22112SEC54	Core-XIII- Programming in C++	5	0	0	3

Objectives

- Utilize Object Oriented techniques to design C++ programs.
- Use the standard C++ library.
- Exploit advanced C++ techniques

UNIT 1: Principles of OOP — Software evolution — OOP paradigm — basic Concepts of OOP's — Object oriented languages — applications of 00 P. (Chapter 1)

UNIT 2: Introduction of C++ - tokens, keywords, identifiers, variables, operators, manipulators, expression and control structures in C++ - main function in function prototyping — call by reference — return by reference — function overloading and virtual functions (Chapter 2,3 &4)

UNIT 3: Classes and objects - Constructors and destructors — operator overloading and type conversions, (Chapter 5, 6 &7)

UNIT 4: Inheritance — single inheritance — multilevel inheritance —multiple inheritances — hybrid inheritance. (Chapter 8)

UNIT 5: Pointer — virtual functions and polymorphism — managing console I/O operations (Chapter 9 & 10)

Reference

Object oriented programming with C++ by E. Balagurusamy, 2e, Tarn. McGraw Hill publishing Co. Ltd., New Delhi.

Reference

1. C++ The Complete Reference by HerbeitSchildt.
2. OOP's with C++ from the foundation by N.R. Parsa, Dream Tech Press India Pvt. Ltd., New Delhi.

Learning Outcomes:

At the end of the course, the students should be able to:

- Able to understand and design the solution to a problem using object-oriented programming concepts.
- Able to reuse the code with extensible Class types, User-defined operators and function Overloading
- Understand functions and parameter passing.
- Understand object-oriented design and programming
- Understand dynamic memory allocation and pointers

Elective 1- FUZZY ANALYSIS

Course code	Course Title	L	T	P	C
22112DSC55A	Elective Paper – I Fuzzy Analysis	5	0	0	3

Objectives

Humans have a remarkable capability to reason and make decisions in an environment of uncertainty, imprecision, incompleteness of information, and partiality of knowledge, truth and class membership. The principal objective of **fuzzy logic** is formalization/mechanization of this capability.

UNIT I:

Fuzzy sets-basic types-basic concepts- α cuts-additional properties of α cuts-extension principle for fuzzy sets,

UNIT II:

Operation on fuzzy sets-types of operations- fuzzy complements-
t-norms- fuzzy unions-combinations of operations.

UNIT III:

Fuzzy Arithmetic - Fuzzy numbers-Arithmetic operations on intervals
Arithmetic operations on fuzzy numbers.

UNIT IV:

Fuzzy relations-Binary fuzzy relation-fuzzy equivalence relation-fuzzy compatibility relation-fuzzy ordering relations-fuzzy morphism.

UNIT V:

Fuzzy relation equation-general discussion-problem partition ing-soluti on method-fuzzy relation equations based on sup-i compositions-fuzzy relation equations based on $w_i$compositions.

Reference

FUZZY SETS AND FUZZY LOGIC

J.KLIR AND BOYUAN.

PNI,NEWDELHI,2004.

Learning outcomes

By the end of this course, you should,

- Be able to get the knowledge and understand Classical Sets vs Fuzzy Sets (FS) – Types of FS – Operations on FS
- Be able to get the knowledge and understandZadeh's Extension Principle
- Be able to get the knowledge and understand Fuzzy Relations – Fuzzy Relational Equations – Possibility Theory :
- Be able to get the knowledge and understand Fuzzy Measures. Fuzzy relation equations based on sup-i compositions-fuzzy relation equations based on $w_i$compositions.

ELECTIVE - I - FORMAL LANGUAGES AND AUTOMATA THEORY

Course code	Course Title	L	T	P	C
22112DSC55B	Elective Paper-I-Formal Languages and Automata Theory	5	0	0	3

Objectives

1. The course aims to develop an appreciation of the theoretical foundations of computer science through study of mathematical and abstract models of computers and the theory of formal languages.
2. Theory of formal languages and use of various abstract machines as 'recognizers' and parsing will be studied for identifying the synthetic characteristics of programming languages.
3. To understand the fundamental models of computation that underlies modern computer hardware, software, and programming languages.
4. Explain computational thinking

Learn the foundations of automata theory, computability theory.

5. Discuss the applications of theory to other areas of computer science such as algorithms, programming languages, compilers, natural language translation, operating systems, and software verification.

UNIT I : The Theory of Automata — definition of an Automaton — Description of a finite Automaton — Transition system — properties of transition function — Acceptability of a string by a finite Automaton — Non deterministic finite state machine — the equivalence of DFA and NDFA — Mealy and Moore models — minimization of finite Automata.

UNIT II: Formal language — basic definition and examples — Chomsky classification of languages — language and their relation — recursive and recursively enumerable sets — operations on languages — languages and Automata.

UNIT III: Regular sets and regular grammars — regular expressions — finite Automaton and regular expressions — Pumping lemma for regular sets — application of pumping lemma.

UNIT IV: Context — free languages — context — free languages and derivation Trees — Ambiguity in context — free grammars — Simplification of context — free grammars — normal forms for context — free grammars.

UNIT V : Push Down Automata — basic definitions — Acceptance by PDA — Push Down Automata and context — free languages — parsing and Push down Automata.

Reference

K.L.P. Mishra and N. Chandrasekaran, "**Theory of Computer Science**", (Automata, languages and computation) — Prentice Hall of India private 2: limited — New Delhi, 3.

UNIT I : CHAPTER 2: (2.1 to2.9)
UNIT II : CHAPTER 3: (section 3.1 to 3.6)
UNIT III : CHAPTER 4 : (section 4.1 to 4.4)
UNIT IV : CHAPTER 5: (section 5.1 to 3.4)
UNIT V : CHAPTER 6 : (section 6.1 to 6.4)

Learning outcomes

By the end of this course you should be able ,

- Design deterministic and non-deterministic machines.
- Design the pushdown automata.
- Comprehend the hierarchy of problems arising in the computer sciences.

- The Student will get an idea for designing Compiler Design.
- The students will get knowledge about regular expressions and computability theory
- Acquire a fundamental understanding of the core concepts in automata theory and formal languages.
- An ability to design grammars and automata (recognizers) for different language classes.
- An ability to identify formal language classes and prove language membership properties.
- An ability to prove and disprove theorems establishing key properties of formal languages and automata.

PROFESSIONAL SKILLS

Course Code	Course Title	L	T	P	C
221ACLSPSL	Professional Skills	-	-	-	2

The Course Professional Skills is divided into two parts:

a) CareerSkills
b) Team Skills

A. CareerSkills

Course Objectives :

The Objectives of the course are to help students/candidates:

1. Acquire career skills and fully pursue to partake in a successful career path
2. Prepare good resume, prepare for interviews and group discussions
3. Explore desired career opportunities in the employment market in consideration of an individual SWOT.

Course Outcomes :

At the end of this course the students will be able to:

1. Preparetheirresumeinanappropriatetemplatewithoutgrammaticalandothererrorsand using proper syntax
2. Participate in a simulated interview
3. Actively participate in group discussions towards gainful employment
4. Capture a self - interview simulation video regarding the job role concerned
5. Enlist the common errors generally made by candidates in an interview
6. Perform appropriately and effectively in group discussions
7. Explore sources (online/offline) of career opportunities
8. Identify career opportunities in consideration of their own potential and aspirations
9. Usethenecessarycomponentsrequiredtopreparefora careerinanidentifiedoccupation (as a case study).

Unit I: Resume Skills

i. Resume Skills : Preparation and Presentation

- Introduction of resume and its importance
- Difference between a CV, Resume and Biodata
- Essential components of a good resume

ii. Resume skills : common errors

- Common errors people generally make in preparing their resume
- Prepare a good resume of her/his considering all essential components

Unit II: Interview Skills 5Hours

i. Interview Skills : Preparation and Presentation

- Meaning and types of interview (F2F, telephonic, video,etc.)
- Dress Code, Background Research, Do's and Don'ts
- Situation,Task,ApproachandResponse(STARApproach)forfacinganinterview
- Interview procedure (opening, listening skills, closure,etc.)
- Importantquestionsgenerallyaskedinajobinterview(openandclosedended questions)

ii. Interview Skills :Simulation

- Observation of exemplary interviews
- Comment critically on simulated interviews

iii. Interview Skills : Common Errors

- Discuss the common errors generally candidates make in interview
- Demonstrate an ideal interview

Unit III: Group Discussion Skills

- Meaning and methods of Group Discussion
- Procedure of Group Discussion
- Group Discussion-Simulation
- Group Discussion - Common Errors

Unit IV: Exploring Career Opportunities

- Knowing yourself – personal characteristics
- Knowledge about the world of work, requirements of jobs including self-employment.
- Sources of career information
- Preparing for a career based on their potentials and availability of opportunities

Reference

Please check IT-ITeS Sector Skills Council readiness programs namely

- Foundation Skills In IT (FSIT) -Refer the websites like https://www.sscnasscom.com/Ssc-projects/capacity-building-and-development/training/fsit/and
- GlobalBusinessFoundationSkills (GBFS)–Referwebsiteslikehttps://www.sscnasscom.Com/ssc-projects/capacity-building-and-development/training

B. TeamSkills

Course Objectives:

The objectives of the course are to make learners:

1. Understand the significance of Team Skills and help them in acquiring them
2. Tohelpthemdesign, developandadapttosituationsasanindividualandasateam.

Course Outcomes:

By the end of this course the learners/candidates will be able to:

1. Use common technology messaging tools that are used in enterprises for flow of informationandtransitionfromcommandandcontroltoinformalcommunicationduring an online/offline team session
2. Activelyuseandoperateonlineteamcommunicationtools:Webinar,Skype,Zoom,Google hangoutetc
3. Appreciate and demonstrate Team Skills
4. Participate in a digital lifestyle conversant with computers, applications, Internet and nuances of cyber security
5. Explore (online) and identify career opportunities in consideration of their own potential and aspirations.
6. Discuss and articulate the key requirements of an entrepreneurial exercise
7. Empathies and trust colleagues for improving interpersonal relations
8. Engage in effective communication by respecting diversity and embracing good listening skills
9. Distinguish the guiding principles for communication in a diverse, smaller internal world
10. Practiceinterpersonalskillsforbetterrelationswithseniors,juniors,peersandstakeholders
11. Projectagoodpersonalimageandsocialetiquettesoastohaveapositiveimpactonbuilding of one's chosen career
12. Generate, share and maximise new ideas with the concept of brainstorming and the documentationofkeycriticalideas/thoughtsarticulatedandactionpointstobeimplemented with timelines in a team discussion (as MOM) in identified applicabletemplates

SEMESTER –VI

Core XIV - COMPLEX ANALYSIS

Course code	Course Title	L	T	P	C
22112AEC61	Core – XIV-Complex Analysis	5	0	0	3

Objectives:

This paper is an introduction to the theory of analytic functions of one complex variable. Properties of analytic functions, results on linear transformations, problems on complex integration are discussed. Calculus of residues are also studied.

UNIT — I: Analytic Functions:

Functions of complex variables-Limits theorems on limits-continuous functions functions-Diffetentiability-C.R. Equations-Analytic Functions Harmonic functions (section 2. 1 to 2.8)

UNIT — 2: Bilinear Transformations:

Elementary transformations-Bilinear Transformations-cross ratio-fixed points of bilinear transformations-Some special bilinear transformations. (Section 3. 1 to 3.5)

UNIT —3: Complex Integration:

Definite Integral-Cauchy's Theorem-Cauchy's integral formula-Higlier derivations (Section 6.1 to 6.4)

UNIT — 4: Series Expansions:

Taylor's series-Laurent series-Zeros of analytic functions-Singularities (Section 7.1 to 7.4)

UNIT— 5: Calculus of residues:

Residues- Cauchy's Residue theorem — Evaluation of definite integrals (Section 8. 1 to 8.3)

Reference:

1. Complex Analysis by T.K. Manikavasakam Pillai & Others Ananda Book Depot. Madras.
2. Functions of Complex Variable by E.G. Philips.
3. Complex Varuable by Dr. P.P. Gupta KedarNath Ram Nath Meerut — Delhi.
4. Functions of Complex Variable by J.N. Sharma Krishna PrakashanMandir Meerut.

Learning outcomes

By the end of this course you should be able

- Represent complex numbers algebraically and geometrically,
- Define and analyze limits and continuity for complex functions as well as consequences of continuity,
- Apply the concept and consequences of analyticity and the Cauchy-Riemann equations and of results on harmonic and entire functions including the fundamental theorem of algebra,
- Analyze sequences and series of analytic functions and types of convergence,
- Evaluate complex contour integrals directly and by the fundamental theorem, apply the Cauchy integral theorem in its various versions, and the Cauchy integral formula, and
- Represent functions as Taylor, power and Laurent series, classify singularities and poles, find residues and evaluate complex integrals using the residue theorem.

Core XV - DYNAMICS

Course code	Course Title	L	T	P	C
22112SEC62	Core –XV Dynamics	5	1	0	3

Course Objectives:

Develop an understanding of the principles of dynamics, and the ability to analyze problems in a systematic and logical manner. Ability to analyze the dynamics of particles, systems of particles and rigid bodies.

UNIT-I:

Kinematics velocity-Relative velocity-Acceleration –coplanar motion components of velocity & acceleration-Newton's laws of motion.

UNIT-II:

Simple harmonic motion-Simple pendulum-Load suspended by an elastic string-projectile-Maximum height reached, range, time of flight-projectile.

UNIT-III:

Impulsive force-conversion of linear momentum-impact of a sphere & a plane-Direct & oblique impact of two smooth sphere –kinetic energy and impulsive.

UNIT-IV:

Central orbit –central force-Differential EQUATION TO A CENTRAL ORBIT IN polar & pedal coordinates-Given the central orbit, to find the law of force-Kepler's laws of planetary motion's.

UNIT-V:

Motion of a rigid body-Moment of inertia of simple bodies-Theorem of parallel & perpendicular axes-motion in two dimension-motion of a rigid body about a fixed axis.

TEXT BOOKS:

1. P.DURAIPANDIAN, VECTOR TREATMENT AS IN MECHANICS,

Unit-I-Chapter 1 & cha 2 sec 2.1, 2.1.1
Unit-II-Cha 12 sec 12.1 to 12.3 & cha 13
Unit-III-Cha 14
Unit –IV-cha 16
Unit-V-Cha 4 sec 4.2 cha 17 & cha 18

General References:

Dynamics – Dr.K.ViswanathNaik and Dr. M.S. Kasi.

Course Outcomes:

Students who successfully complete the course will demonstrate the following outcomes by tests, homework, and written reports:

1. A knowledge of internal forces and moments in members.
2. An ability to calculate centroids and moments of inertia.
3. A knowledge of kinematic and kinetic analyses and energy and momentum methods for particles and systems of particles.

4. A knowledge of kinematic and kinetic analyses and energy and momentum methods for rigid bodies.

Core XVI – **DISCRETE MATHEMATICS**

Course code	Course Title	L	T	P	C
22112AEC63	Core-XVI **Discrete Mathematics**	5	0	0	3

Objectives:

Discrete Mathematics is a bridge connecting various branches of Computer Science and Mathematics. In Discrete Mathematics, we essentially study various finite (discrete) structures of Mathematics which are essential to develop the various concepts of computer science.

UNIT 1 :

RELATIONS:

Cartesian Product of Two sets – Relations – Representation of Relation-Operations Relations-Equivalence Relation

FUNCTIONS:

Function and Operators- One-to-One , Onto Functions-Special Types of Functions-Invertible Functions- Compositions of Functions

UNIT 2:

LOGIC:

Introduction-TF –Statements-Connectives-Atomic and Compound Statements-Well Formed (Statements) Formulae-Truth Table of a Formula- Tautology-Tautological Implications and Equivalence of Formulae

UNIT 3:

LATTICES

Partial ordering – Lattices as Posets. Properties of Lattices – Lattices as Algebraic systems – Sublattices – Direct Product and Homomorphism – Some special lattices..

UNIT 4:

RECURRENCE RELATIONS AND GENERATING FUNCTIONS:

Recurrence an introduction – Polynomials and their Evaluations- Recurrence Relations-Solution of Finite Order Homogeneous (liner) Relations-Solution of Non- homogeneous Relations-Generating Functions-Some Common Recurrence Relations-Primitive Recursive Functions- Recursive and Partial Recursive Functions

UNIT 5:

AUTOMATA,LANUAGES AND COMPUTATIONS:

Introduction-Finite Automata- Definition of Finite Automaton –Representation of Finite Automaton-Acceptability of a string by a Finite Automaton-Languages accepted by a Finite Automaton-Non-deterministic Finite Automata- Acceptability of a String by Non-Deterministic Finite Automata –Equivalence of FA and NFA

Text Books: Dr.M.K. Venkataraman and N. Sridharan.N.Chandrasekaran

For UNIT 1 - .Chapter 2: Section 2.1 to 2.21& Chapter 3 Section 3.1 to 3.13

For UNIT 2 - Chapter 9: Section 9.1 to 9.30
For UNIT 3 - Chapter 10: Section 10.1 to 10.34
For UNIT 4 - Chapter 5: Section 5.1 to 5.33
For UNIT 5 - Chapter 12: Section 12.1 to 12.18

Learning outcomes

Students who successfully complete the course will demonstrate the following outcomes by tests, homework, and written reports:

1. A knowledge of Relations and functions
2. A knowledge of logical reasoning is used in mathematics to prove theorems, in computer science to verify the correctness of programs and to prove theorems in physical science to draw the conclusions..
3. An ability to find the solutions of Recurrence relations.
4. A knowledge of to study on ordering relations.

Elective II - GRAPH THEORY

Course code	Course Title	L	T	P	C
22112DSC64A	Elective Paper –II Graph Theory	5	0	0	3

Objectives:

Graph Theory is an integral part of Discrete Mathematics. It has applications to many fields, including computer science, physics, chemistry, psychology and sociology. In this course we teach basic topics in graph theory 20 such as Trees, Directed graphs, Connectivity, Euler tours, Hamilton cycles, Matchings, Colourings, Planar graphs

UNIT 1: Definitions of graph — finite and infinite graphs — incidence and degree isolated and pendent vertices — isomorphism — sub graphs — walks, puths and circuits — Connected and disconnected graphs — components — Euler graphs — Operations on graphs — more on Euler graphs — Harniltonian paths and circuits.

UNIT 2: Trees — Properties of trees — pendent vertices in a tree — distances and centers in a tree — Rooted and binary trees — Spanning trees — fundamental Circuits — Finding all spanning trees of a graph — Spanning trees in a weighted graph.

UNIT 3: Cut-sets — Properties of cut-set- All cut-sets in a graph — Fundamental circuits and cut-sets — connectivity and reparability.

UNIT 4: Planar graphs — Knratowski's two graphs — Representation of a planar graph — Detection of planarity — Geometrical dual — Combinational dual.

UNIT 5: Matrix representation of graphs — Incidence Matrix — circuit matrix Fundamental circuit and matrix and rank of the circuit matrix — cut-set matrix — Adjacency matrix. Chromatic number — Chromatic partitioning — Chromatic polynomial.

Treatment and content as in "Graph Theory with applications to engineering and computer science" by NarsingDeo, Prentice Hall of India, New Delhi.

References:

1. Invitation to graph Theory' by Dr.S. Arumugam and Dr. S. Ramachandran.
2. 'Graph Theory' — F. E-Haray, Narosa Publishing House, New Delhi — Madras - Bombay.
3. Graph Theory — S.A. Choudum, Macmillan India Limited —New Delhi — Madras.

Learning outcomes

By the end of this course, you should be able

- Knowledge in Graph Theory
- Understanding the properties of Graph Theory
- Understanding the concept of Kuratowski's graph
- Understanding Matrix representation of graphs

Elective II –QUANTITATIVE APTITUDE

Course code	Course Title	L	T	P	C
22112DSC64B	Elective Paper –II QUANTITATIVE APTITUDE	5	0	0	3

·To introduce students to *Quantitative Aptitude and Reasoning for competitive examinations.*

Objectives :

1. To lean the problems solving techniques for aptitude problems
2.To enable to students prepare themselves for various competitive Examinations
3.To introduce students to *Quantitative Aptitude and Reasoning for competitive examinations*

Unit I

Numbers – HCF – LCM – Problems on numbers- Decimal Fractions and Simplification.

Unit II

Chain Rule – Time and Work – Pipes and Cisterns- Time and Distance –Problems on Trains – Boats and Streams

Unit III

Surds and Indices – Percentage – Profit and Loss- Simple Interest – Compound Interest - Stocks and Shares.

Unit IV

Ratio and Proportion – Partnership – Allegation or Mixture- Clocks – Area – Volume and Surface Area.

Unit V

Average – Problems on Age - Permutations and Combinations.

Text Book:

Scope and treatment as in "Quantitative Aptitude" by R.S.Aggarwal, S.Chand& Company Ltd., Ram Nagar, New Delhi (2007)

Unit 1: (Chapters 1, 2 3,4& 7)
Unit 2: (Chapter 14, 15 & 16, 21, 22 & 29))
Unit 3: (Chapters 9, 10 & 11, 17, 18 & 19)
Unit 4: (Chapters 12, 13 & 20, 24, 25 & 28)
Unit 5: (Chapters 6 &8, 30 & 31))

Course Code	Course Title	L	T	P	C
221ACSSIST	Interview Skills Training and Mock Test	-	-	-	2

Unit I:Presentation Skills

- Types of presentations
- Internal and external presentation
- Knowing the purpose
- Knowing the audience
- Opening and closing apresentation
- Using presentation tools
- Handling questions
- Presentation to heterogenic group
- Ways to improve presentation skills overtime

Unit II: Trust and Collaboration

- Explain the importance of trust in creating a collaborative team
- AgreetoDisagreeandDisagreetoAgree–SpiritofTeamwork
- Understanding fear of being judged and strategies to overcomefear

Unit III: Listening as a Team Skill

- Advantages of EffectiveListening

Listening as a team member and team leader. Use of active listening strategies to encourage sharing of ideas (full and undivided attention, no interruptions, no pre- think, us**Credit Distribution**

- eempathy, listen to tone and voice modulation, recapitulate points,etc.).

Unit IV: Brainstorming

- Use of group and individual brainstorming techniques to promote ideageneration.
- Learning and showcasing the principles of documentation of team sessionoutcomes

Unit V: Social and Cultural Etiquette

- Need for etiquette (impression, image, earn respect, appreciation,etc)
- Aspects of social and cultural/corporate etiquette in promotingteamwork
- Importance of time, place, propriety and adaptability to diversecultures

Unit VI: Internal Communication

- Use of various channels of transmitting information including digital andphysical,
  to team members.

Reference:

PleasecheckIT-ITeSSectorSkillsCouncilreadinessprogramnamelyGlobalBusinessFoundation Skills (GBFS) in website (https://www.sscnasscom.com/ssc-projects/capacity-building-and-development/training/gbfs/),and Generic and the entrepreneurial

COMMUNITY ENGAGEMENT

Course Code	Course Title	L	T	P	C
221ACLSCET	**Community Engagement**	-	-	-	2

Course Objectives:

- To developanappreciationofruralculture,life-styleandwisdomamongststudents
- To learnaboutthestatusofvariousagriculturalandruraldevelopmentprogrammes
- Tounderstandcausesforruraldistressandpovertyandexploresolutionsforthesame
- To apply classroom knowledge of courses to field realities and therebyimprove quality of learning

Course Outcomes:

After completing this course, student will be able to

- Gain an understanding of rural life, culture and socialrealities
- Developasenseofempathyandbondsofmutualitywithlocalcommunity
- Appreciatesignificantcontributionsoflocalcommunitiestoindiansocietyand economy
- Learntovaluethelocalknowledgeandwisdomofthecommunity
- Identify opportunities for contributing to community's socio-economic

Unit I :Appreciationof Rural Society

Rural lifestyle, rural society, caste and gender relations, rural values with respect to community, nature and resources, elaboration of "soul of India lies in villages' (Gandhi), rural infrastructure

Unit II : Understanding rural economy & livelihood

Agriculture, farming, landownership, water management, animal husbandry, non-farm livelihoods and artisans, rural entrepreneurs, rural markets

Unit III : Rural Institutions

Traditional rural organizations, Self-help Groups, Panchayati raj institutions (Gram Sabha, Gram Panchayat, Standing Committees), local civil society, local administration

Unit IV : Rural Development Programmes

History of rural development in India, current national programmes: SarvaShikshaAbhiyan, BetiBachao, BetiPadhao, Ayushman Bharat, Swatchh Bharat, PM AwaasYojana, Skill India, Gram PanchayatDecentralised Planning, NRLM, MNREGA, etc.

Open Elective

Course Code	Course Title	L	T	P	C
221ENOEC	**Journalism**	**4**	**0**	**0**	**2**

Aim :

- To acquaint with the basic knowledge of journalism

Objective:

- To instil in the minds of students the different aspects of journalism
- To understand the different kinds of news
- To learn the qualities and duties of a reporter, editor and sub-editor
- To familiarize with the style and features of the different sections in a newspaper

Outcome:

- Become a journalist
- Explore the different kinds of news

UNIT- I

Journalism – Definition, Qualities of a journalist, Forms of journalism, Role and elements

UNIT- II

News – Definition, Kinds, Elements, Sources

UNIT- III

Reporters

UNIT- IV

The Editor and the Sub-editor

UNIT –V

Language of Journalism, Style
Qualities of a Writer
Writing a News story, Opinion Pieces, Reviews, Headlines, Editorials

Reference Book:-

Author	Title of the book	Edition / Year	Publisher
Susan	Journalism		
John Hogenberg	Professional Journalism	2012	
M.James Neal	News Writing and Reporting		Surjeet Publication
M.V Komath	The Journalist's Handbook		

Course code	Course Title	L	T	P	C
221MAOEC	Development of Mathematics Skills	4	0	0	2

Aim:

- To understand theconcepts from the five branches of mathematics

Objectives

- Knowledge and understanding are fundamental to study mathematics and form the base from which to explore concepts and develop problem-solving skills. Through knowledge and understanding students develop mathematical reasoning to make deductions and solve problems.
- To develop student's ability to apply both conventional and creative techniques to the solution of mathematical problems

Outcomes

- Know and demonstrate understanding of the concepts from the five branches of mathematics (Operations Research, Set Theory, Statistics, Matrices and Business mathematics)
- Use appropriate mathematical concepts and skills to solve problems in both familiar and unfamiliar situations including those in real-life contexts
- Select and apply general rules correctly to solve problems including those in real-life contexts.

Unit I

Simple interest and compound interest

Unit II

Sinking fund – discounting – trade discount – quantity discount – cash discount

Unit III

Set theory – Series

Unit IV

Matrices – Determinants

Unit V

Assignment problems

References

P.A.Navanitham, Business Mathematics & Statistics

KantiSwarup, P.K.Gupta and Manmohan, "Operations Research"

Course Code	Course Title	L	T	P	C
221PHGEC	Instrumentation	4	0	0	2

Aim:

Making and analyzing measurements is the primary task of the experimental physicist. This includes designing experiments. Most experimental work, whether in bench-top situations, or using complex instruments. To many physicists this can be as interesting and involving as the basic physics one is trying to do.

Objectives:

- To build the strong foundation in physics of students needed for the field of Instrumentation.
- To prepare student to apply reasoning informed by the contextual knowledge to practice.
- To provide opportunity for students to work as part of teams on multi-disciplinary projects.

UNIT – I: INTRODUCTION

Potentiometer - calibration of volt meter and ammeter, measurement of resistance, Principles of network theorems – Thevenin's and Norton's theorem – Bridges : AC bridges – Maxwell, Owen, Schering and deSauty's bridges – Wien bridges.

UNIT – II: ELECTRONIC INSTRUMENTS – I

Basic characteristics of instruments – resolution – sensitivity - Audio frequency oscillator, Conversion of galvanometer into voltmeter and ammeter – resistance meter - Amplified D.C. meter – Chopper stabilized amplifier – A.C. Voltmeter using rectifiers – Electronic multimeter – Differential voltmeter – Digital voltmeters – Component measuring instruments (quantitative studies)

UNIT – III: ELECTRONIC INSTRUMENTS – II

Signal conditioning systems – DC and AC carrier systems – Instrumentation amplifiers – Vibrating capacitor amplifier – Analog to digital data and sampling – A/D and D/A convertor (successive approximation, ladder and dual slope converseons).

Unit IV – Recording Devices

Recorders necessity – Recording requirements – Analog recorders – Graphic recorders – strip chart recorders – Galvanometer types recorders – Null type recorders.

Unit V – CRO

CRO – Construction and action – Beam transit time and frequency limitations – Measurement of potential, current, resistance, phase and frequency – Special purpose oscilloscopes – Sampling storage oscilloscope.

Books for Study

1. Electronic Instrumentation and Measurement techniques – W.D. Cooper and A.D. Helfrick – PHI – Third edn. – 1989

Learning Outcomes:

- Appreciate important practical aspects of theoretical knowledge: how important components work, when to impedance match, non-ideal behaviour of op-amps etc.
- Acquire a sound understanding of the role of noise in measurement systems and know how to apply noise reduction techniques.

Books for Reference:

1. A course in electrical and electronic measurements and Instrumentation – A.K. Sawhmey – DhanpatRai and Sons – 1990.

2. Electronic measurements and instrumentation – Oliver Cage – McGraw Hill – 1975.

Course Code	Course Title	L	T	P	C
221CEOEC	Food and Adulteration	4	0	0	2

Aim:

- To introduce students to food safety and standardization act and quality control of foods.

Objectives:

- To educate about common food adulterants and their detection.
- To impart knowledge in the legislatory aspects of adulteration.
- To educate about standards and composition of foods and role of consumer.

Outcomes:

- The students will have knowledge about different processing and preservation methods and principles involved.

Unit-I Introduction to Food Chemistry

Introduction to Food Chemistry- Water (Structure of water and ice, Physical constants of water, Types of water, Water activity) Composition of Food- Carbohydrates, Proteins, Lipids, Vitamins & Minerals.

Unit- II Food Pigments

Introduction- classification, types of food pigments- chlorophyll, carotenoids, anthocyanins, flavanoids.

Unit – III Food Preservation

Introduction - Importance, principle and Types.
High and low temperatures preservation - Pasteurization - Sterilization- Canning- Freezing- Refrigeration.

Unit – IV Food Additives

Introduction- antioxidants, sequestrants, preservatives, nutrient supplement, emulsifiers, stabilizers and thickening agents, bleaching and maturing agent, sweeteners, humectants and anti -caking agents, coloring and flavoring substance.

Unit-V Food Adulteration

Types of adulterants- intentional and incidental adulterants, methods of detection. Detection of common food adulterants in Spices , Grains, Coffee , Tea, Oil fats , Food colours and Milk. Health hazards and risks.

References:

1. The Food Safety and Standard ACT, 2006 – Seth &Capoor
2. Hand book of Food Adulteration and Safety Laws – Sumeet Malik
3. Food Science – B.Srilakshmi

Course Code	Course Title	L	T	P	C
221CSOEC	E Learning	4	0	0	2

COURSE OBJECTIVES

- Learn the basics of E-Learning concepts.
- Learn the content development techniques.

COURSE OUTCOMES

- Develop e – learning application on their own.
- Ability to develop contents for e-learning.
- To perform course management using tools.

UNIT I INTRODUCTION

Introduction – Training and Learning, Understanding elearning, components and models of e-learning, Advocacy of e-learning – benefits, learning styles, criteria for choosing, - Applications of E-learning.

UNIT II CONCEPTS and DESIGN

E-Learning Strategy, the essential elements of elearning strategy, Quality assuring e-learning, suppliers and resources, virtual learning environments, authoring tools, e-assessment, Learning Design Issues – purpose, general principles, designing live e-learning, designing self managed learning.

UNIT III APPLICATIONS

Moodle 2.0 E-Learning Course Development – Features, Architecture, Installation and Configuring Site.

UNIT IV COURSE MANAGEMENT

Creating – Categories, Courses, Adding Static Course Material – Links, Pages, Moodle HTML Editor, Media Files, Interacting with Lessons and Assignments – Evaluating Students – Quizzes and Feedback.

UNIT V ENHANCEMENT

Adding Social Activities - Chat, Forum, Ratings, Blocks – Types, Activities, Courses, HTML, Online Users – Features for Teachers.

REFERENCE BOOKS:

1. Delivering E-Learning: A complete Strategy for Design, Application and Assessment, Kenneth Fee, Kogan page, 2009.
2. Designing Successful e-Learning, Michael Allen, Pfeiffer Publication, 2007.
3. Moodle 2.0 E-learning Course Development, William Rice, PACKT, 2011.
4. Moodle 2.0 First Look, Mary Cooch, 2010.

Course Code	**Course Title**	L	T	P	C
221CAOEC	Web Technology	4	0	0	2

AIM

To equip the students with basic programming skill in Web Technology.

OBJECTIVE

- To understand the concepts and architecture of the Worldwide Web.
- To understand and practice mark up languages
- To learn Style Sheet and Frames

OUTCOMES:

- Acquire knowledge about functionalities of world wide web
- Explore markup languages features and create interactive web pages using them
- Learn and design Client side validation using scripting languages
- Acquire knowledge about Open source JavaScript libraries
- Able to design front end web page and connect to the back end databases.

UNIT I

Introduction to the Internet: networking- internet – email – Internet Technologies: modem internet addressing .

UNIT II

Internet browsers: Internet Explorer – Netscape navigator- Introduction to HTML: Html document – anchor tag – hyperlink.

UNIT III

Head and body sections: Header section – titles – links- colorful web page – sample html document – Designing the body section: paragraph – tab setting.

UNIT IV

Ordered and unordered lists: list – unordered list – heading in a list- order list- nested list.

UNIT V

Table handling: tables – table creation in html cell spanning multiple rows and columns- coloring cells- sample tables- frames frame set definition- nested frames set.

REFERENCE BOOKS

1.World Wide Web design with HTML – C. Xavier – Tata McGraw – Hill – 2000.
2. Principles of web design – Joel Sklar – Vikas publishing house 2001.

Course Code	Course Title	L	T	P	C
221CMOEC	Open Elective – Banking Service	4	0	0	2

AIM:

To Provide the Bank is financial institution which is involved in borrowing and lending money.

OBJECTIVE:

- To provide a lending money to firms, customers and home buyers.
- To provide keep money for customers
- To provide offering financial advice and related financial services, such as insurance.

UNIT – I

Commercial Banking – An Overview: Banking-Classification- Banking system- Universal Banking- Commercial Banking- functions – Role of Banks in Economic Development

UNIT – II

E-banking –An Overview: Meaning-Service-E-banking and Financial Services –Benefits-Internet Banking –Internet Banking Vs Traditional Banking –Mechanics of Internet Banking-Services

UNIT – III

Mobile Banking and Telephone Banking –An Overview: Meaning-Features- Registration-Services –Security Issues –Banking Facilities- Telephone Banking System – Drawbacks- Call Centers

Unit – IV

ATM and Electronic Money: Concept of ATM-Features-Functions-Strategic importance of ATM-Electronic Money – Categories –Merits – E-Money and Monetary Policy-Policy Issues for the RBI

Unit-V

EFT System and INFINET: Meaning- Steps in EFT- RBI Guidelines-EFT Systems Vs Traditional System - ECS-Features-Factors- Benefits –Handicaps -Applications

OUTCOME:

To help to gather knowledge on banking and financial system in India
To provide knowledge about commercial banks and its products
To create awareness about modern banking services like e-banking-banking and internet banking, ATM System
To introduce recent trends in banking system
To make the student understand the basic concept of banking and financial institutions and expose various types of risk based by banks

REFERENCES:

1. Banking theory law and Practice
2. Banking Theory law and practice -Santhanam
3. Banking Awareness - N.K.Gupta
4. Management of Banking and financial Services-Padmalathasuresh,Justinpaul .

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SCHOOL OF ARTS AND SCIENCE

Department of Mathematics

M.Sc. Mathematics Syllabus

[Regulation 2022]

EMPLOYABILITY
SKILL DEVLOPMENT

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THANJAVUR – 613 403 - TAMIL NADU

M.Sc., MATHEMATICS -CURRICULUM – REGULATION 2022

COURSE STRUCTURE

Course Code	Course Title	L	T	P	C
	SEMESTER I				
22212AEC11	Algebra	5	1	0	4
22212AEC12	Real Analysis	5	1	0	4
22212AEC13	Ordinary Differential Equations	5	1	0	4
22220SEC14	C++ Programming	5	1	0	4
22212DSC15_	Discipline Specific Elective – I	5	0	0	4
22212RLC16	Research Led seminar	-	-	-	1
	Total	**25**	**4**	**0**	**21**
	SEMESTER II				
22212AEC21	Complex Analysis	5	1	0	4
22212AEC22	Measure Theory and Integration	5	0	0	4
22212SEC23	Mathematical Methods	5	1	0	4
22212AEC24	Graph Theory	5	0	0	4
22212DSC25_	Discipline Specific Elective – II	5	0	0	4
22212RMC26	Research Methodology	3	0	0	2
22212BRC27	Participation in Bounded Research	-	-	-	2
	Total	**28**	**2**	**0**	**24**
	SEMESTER III				
22212AEC31	Topology	5	1	0	5
22212SEC32	Stochastic Process	5	2	0	5
22212AEC33	Advanced Numerical Analysis	5	2	0	5
22212DSC34_	Discipline Specific Elective – III	5	0	0	4
222__OEC	Open Elective	4	0	0	3
22212SRC36	Participation in Scaffold Research (Societal Project)	-	-	-	2
	Total	**24**	**5**	**0**	**24**
	SEMESTER IV				
22212AEC41	Functional Analysis	5	1	0	5
22212SEC42	Visual Programming	5	2	0	5

22212AEC43	Number Theory	5	1	0	5
22212DSC44_	Discipline Specific Elective – IV	5	0	0	4
22212PRW45	Project Work	0	0	0	6
22212PEE	Programme for Exit Examination	0	0	0	2
	Total	**20**	**4**	**0**	**27**
	Total Credits for the Programme				**96**

Discipline Specific Electives

Semester	Discipline Specific Elective Courses
I	a)22212DSC15A- Classical Dynamics b)22212DSC15B- Fluid Dynamics
II	a)22212DSC25A- Mathematical Probability b)22212DSC25B- Mathematical Modelling
III	a) 22212DSC34A- Cryptography b) 22212DSC34B- Algebraic Coding Theory
IV	a) 22212DSC44A- Combinatorial Mathematics b) 22212DSC44B- Design And Analysis of Algorithm

Open Electives

Semester	Open Elective Courses
III	a) 22211OEC-Writing For the Media b) 22213OEC-Bio-medical Instrumentation c) 22214OEC-Green Chemistry d) 22215OEC-Herbal Medicines e) 22220OEC-M-Marketing f) 22261OEC- Financial Service

Credit Distribution:

Sem	AEC	SEC	DSC	OEC	Research	Others	Total
I	12	04	04	-	01	-	21
II	12	04	04	-	04	-	24
III	10	05	04	03	02	-	24
IV	10	05	04	-	06	02	27
Total	**44**	**18**	**16**	**03**	**13**	**02**	**96**

M.Sc., MATHEMATICS
SYLLABUS

SEMESTER – I
Core I: ALGEBRA

Course Code	Course Title	L	T	P	C
22212AEC11	Core –I - Algebra	5	1	0	4

Objectives:

1. Group Theory is the fundamental building blocks for the Abstract Algebra.
2. To study the algebraic aspects of Real and Complex numbers.
3. Module is a third algebraic Model - Applicable to geometry and physics.

UNIT I:

Group theory: Sylow's theorem — direct products — finite abelian groups.

UNIT II:

Ring theory: Polynomial rings — polynomials over the rational field polynomial ring over commutative rings — modules.

UNIT III:

Field: Extension fields — roots of polynomials — more about roots

UNIT IV:

Field: the elements of Galois theory — Finite fields

UNIT V:

Linear transformations — the algebra of linear transformations, Hermition, Unitary and normal transformations.

Reference

1. Topics in Algebra — 1.N. Herstein

Learning Outcomes:

1. Understand the concept of Group Theory, Ring Theory.
2. A knowledge of Linear Transformations.
3. An understanding of the analysis of Fields.
4. Research inquiry and analytical thinking abilities

Course Code	Course Title	L	T	P	C
22212AEC12	Core –II Real Analysis	5	1	0	4

Objectives:

1. To introduce the motion of Reimann – stieltjes integral.
2. To study the infinite series and infinite sequences of functions.
3. To study the multivariate differential calculus.

UNIT I:

Riemann — Stielties — integral

UNIT II:

Infinite series and infinite products

UNIT III:

Sequences of functions

UNIT IV:

Multivariable Differential Calculus

UNIT V:

Implicit functions and Extremum problems

Reference:

Mathematical Analysis Tom. M.Apostol. 2nd Edition Narosa Publishing House— 1985

Unit I Chapter— 7(7.1—7.25)

Unit II Chapter — 8(8.1 — 8.18)

Unit III Chapter — 9(9.1 — 9.6, 9.8-9.13)

Unit IV Chapter— 12(12.1—12.5, 12.7— 12.14)

Unit V Chapter— 13(13.1 — 13.6)

Learning Outcomes:

Students will be able to

1. Know the motion of the Riemann-Stieltjes integral, prove elementary properties of the Riemann integral and the Fundamental Theorem of Calculus.
2. Describe the Infinite series and Infinite Products, Sequences of Functions.
3. An understanding of Multivariable Differential Calculus and Implict Functions and Extremum problem.

Course Code	Course Title	L	T	P	C
22212AEC13	Ordinary Differential Equations	5	1	0	4

Objectives:

1. Teaching the theory and applications to students preparing for advanced training in applied sciences and social sciences.
2. Presenting in easy and lucid language the results of oscillations, boundry valued problems (BVP) and elements of control theory.
3. Justifying the inclusion of qualitative theory to students who that it is out of place.
4. Emphasing the importance of the study of Boundary problems, both in Mathematics and applied sciences.
5. Studying about the stability of stationary solutions.

UNIT I:

Systems of linear diffrentia1 equations — Chapter 4

UNIT II:

Existence and uniqueness of solutions Chapter 5

UNIT III:

Boundary value problems — Chapter — 7

UNIT IV:

Oscillations of second order equations — Chapter 8

UNIT V:

Stability of linear and nonlinear system — Chapter 9

Reference

Ordinary differential Equations and Stability Theory — S.G.GEO. V.Ragavendra, V.Lakshmikanthan

Learning Outcomes :

Upon completing this course students should be able to:

1. Solve first order equations, systems of periodic coefficients and use these methods to solve applied problems.
2. A knowledge of Sturm-Liouville Problem.
3. Understanding about the stability of stationary solutions.

Course Code	Course Title	L	T	P	C
22220SEC14	C++ Programming	5	1	0	4

Objectives

- Utilize Object Oriented techniques to design C++ programs.
- Use the standard C++ library.
- Exploit advanced C++ techniques

UNIT 1:

Beginning with C++ - what is C++ - applications — simple program — structure of C program — creating the source file — compiling and linking — tokens, expressions and control structures — user defined data types — derived data types — declarations of variables — reference — variables

UNIT II:

Operations in C++ - Manipulators — types cast operator — expressions and implicit conversions — operator over loading — operator precedence — control structures — Functions in C — the main function — functions prototyping. call by reference — return by reference — function overloading

UNIT III:

Class and object — introduction — C structures revisited — C++ program with class — arrays with in class — static member function — arrays of objects — returning objects — returning objects — constant member functions — pointers to members.

UNIT IV:

Constructors and destructors — introduction — constructors — parameterized constructors — multiple constructors in a class — copy constructor — dynamic constructor — two dimensional Arrays — destructors — operators over loading and type conversions — defining operator loading — manipulation strings using operations — type conversions.

UNIT V:

Inheritance: extending classes — introduction — defining derived classes — single in heritance — multiple inheritance — virtual base classes — abstract classes — nesting classes.

Reference:

Object Oriented Programming with C++ - E.Balagurusamy.

Learning Outcomes:

At the end of the course, the student should be able to:

- Able to understand and design the solution to a problem using object-oriented programming concepts.

- Able to reuse the code with extensible Class types, User-defined operators and function Overloading
- Understand functions and parameter passing.
- Understand object-oriented design and programming
- Understand dynamic memory allocation and pointers

Elective - CLASSICAL DYNAMICS

Course Code	Course Title	L	T	P	C
22212DSC15 A	Elective- Classical Dynamics	5	0	0	4

Objectives.

1. Classical mechanics afford the student an opportunity to master many of mathematics techniques.
2. It is certainly true that classical mechanics today is far from being a closed subject.
3. Alternative means exist in the curriculum for acquiring the mathematics needed in other branches.

UNIT I:

Introductory Concepts—Chapter 1(1.1 — 1.5)

UNIT II:

Lagrange's equations — Chapter 2

UNIT III:

Special applications of Lagrange's equations — Chapter 3

UNIT IV:

Hamilton equations — Chapter 4

UNIT V:

Euler's equation of motions – Bernoulli's equation – worked examples.

Reference:

CLASSICAL DYNAMICS — Donald T.Greenwood, PHI, India.

Learning Outcomes:

Students who successfully complete the course will demonstrate the following outcomes by tests, homework, and written reports:

A knowledge of mechanical systems , virtual work Energy and Momentum.

1. Understanding the concept and Applications Lagrange's Equation.
2. A knowledge of Hamilton's Principal function.

Course Code	Course Title	L	T	P	C
22212DSC15B	Elective- Fluid Dynamics	5	0	0	4

Objectives:

1. To introduce the behavior of fluid in motion.
2. To study the application of complex analysis in the analysis of flow of fluids.

UNIT I

Introductory concepts – the mechanical systems – Generalized Coordinates – Constraints – Virtual work – Energy and momentum – Lagrange’s equation – Integrals of the motion – Small oscillation.

UNIT II

Some flows involving axial symmetry — some special two — Dimensional flow — impulsive Motion. Some three — dimensional flows: Introductions — sources, skins and doublets — images in a rigid infinite plane — Axis-symmetric flows: stokes stream functions.

UNIT III

Some two — Dimensional Flows: meaning of a two — Dimensional flow — Use of cylindrical polar coordinates — The steam function — The complex potential for two Dimensional, irrotational, incompressible flow - The Milne- Thomson circle theorem and applications

UNIT IV

The use of conformal transformation and Hydrodynamical Aspects — stress components in real fluids — relations between Cartesian components of stress — Translational motion of fluid element—Relations between stress and rate of strain — The coefficient of viscous fluids

UNIT V

Some solvable problems in viscous flow — steady viscous flow in tubes of uniform cross section — Diffusion of vorticity — Energy. Dissipation due to viscosity — steady flow past a fixed sphere — Dimensional Analysis; Reynolds Number — prandtl’s Boundary layer.

Reference:

Fluids dynamics by F. Chorlton (CBS Publisher & Distributors, Delhi- 110032) 1985.

Unit I : Chapter 2.Sec 2.1 to 2.9 and Chapter 3.Sec 3.1 to 3.6

Unit II : Chapter 3.Sec 3.9 to 3.11 and Chapter 4.Sec 4.1,4.2, 4.3, 4.5

Unit III : Chapter 5.Sec 5.1 to 5.9 except 5.7

Unit IV : Chapter 5.Sec 5.10 and Chapter 8:Sec 8.1 to 8.9

Unit V : Chapter 8.Sec 8.lO to 8.l6

General References

Fluids Dynams shanty swarup, Krishna prakasan mandir Meerut 1984.

Learning Outcomes:

Students who successfully complete the course will demonstrate the following outcomes by tests, homework, and written reports:

1. A knowledge of behaviour of fluid in motion.
2. A knowledge of Two Dimensional and conformal mappring.
3. A knowledge of solving problems in viscous flow-steady viscous flow

SEMESTER – II

Course Code	Course Title	L	T	P	C
22212AEC21	Complex Analysis	5	1	0	4

Objectives:

1. To introduce the students to the fascinating world of complex analysis which is different from analysis of real variable.
2. To introduce the concepts of harmonic functions , elliptic functions and periodic functions.

UNIT I:

Harmonic functions — power series expansions partial fraction and factorization — entire functions.

UNIT II:

The Riemann zeta function — normal families.

UNIT III:

The Riemann mapping theorem — conformal mapping of polygons — Chapter 6(6.1, 6.2)

UNIT IV:

A closer look at harmonic functions — the Dirichiet's problem Harmonic measures — Chapter 6 sec 3.4 and 5(5.1 only)

UNIT V:

Simple periodic functions — double periodic functions — the weierstrass theory Chapter 7 sec 1,2,3(3.1. 3.2, 3.3)

Reference

Complex Analysis L.V. Ahlfors 3rd edition McGraw Hill

Learning Outcomes:

On completion of this unit successful students will be able to:

1. Understand the significance of harmonic functions, Reimann zeta function.
2. A knowledge of periodic functions, the weierstrass
3. Research inquiry and analytical thinking abilities
4. Abilities in conformal mapping

Course Code	Course Title	L	T	P	C
22212AEC22	Measure Theory and Integration	5	0	0	4

Objectives:

To gain understanding of the abstract measure theory and definition and main properties of the integral. To construct Lebesgue's measure on the real line and measurability in product space. To explain the basic advanced directions of the theory.

UNIT I

Measure on Real line — Lebesgue outer measure — Measurable sets — Regularity — Measurable function — Borel and Lebesgue measurability.

UNIT II

Integration of non-negative functions — The General integral — Integration of series — Riemann and Lebesgue integrals.

UNIT III

Abstract Measure spaces — Measures and outer measures — Completion of a measure — Measure spaces — Integration with respect to a measure.

UNIT IV

Convergence in Measure — Almost uniform convergence — Signed Measures and Hahn Decomposition — The Jordan Decornpostion.

UNIT V

Measurability in a Product space — The product Measure and Fubini’s Theorem.

Reference:

[I] G.De Barra, Measure Theory and Integration, New age international (p) Limited.

UNIT — I : Chapter II: Sections 2.1 to 2.5

UNIT—Il : Chapter III: Sections 3.1 to 3.4

UNIT — Ill : Chapter V: Sections 5.1 to 5.6

UNIT— IV : Chapter VII: Sections 7.1 to 7.2, Chapter VIII: Sections 8.1 and 8.2

UNIT —VI : Chapter X: Sections 10.1 to 10.2

Reference(s)

1. Measure and Integration. Second Edition by M.E.Munroe Addison — Wesley publishing company, 1971.
2. P.K.Jain, V.P.Gupta, Lebesgue Measure and integration, New Age International Pvt Limited Publishers, New Delhi, 1986. (Reprint 2000)
3. Richard L. Wheeden and Antoni Zygmund, Measure and Integral: An Introduction to Real Analysis, Marcel Dekker Inc. 1977.
4. Inder, K.Rana, An Introduction to Measure and Integration, Narosa Publishing House, New Delhi,1997.

Learning Outcomes:
To introduce the concepts of *measure* and *integral with respect to a measure*,
To show their basic properties,
To provide a basis for further studies in Analysis, Probability, and Dynamical Systems.
Knowledge in measure spaces

Course Code	Course Title	L	T	P	C
22212AEC23	Mathematical Methods	5	1	0	4

Objectives:

To introduce the concept of Calculus of variations, Fourier Transforms, Hankel Transform, Linear Integral Equations, Method of successive approximations.

UNIT I

Calculus of variations — Maxima and Minima — the simplest case — Natural boundary and transition conditions variational notation — more general case — constraints and Lagrange's multipliers — variable end points — Sturm - Liouville problems.

UNIT II

Fourier transform — Fourier sine and cosine transform — Properties Convolution — Solving integral equations — Finite Fourier transform — Finite Fourier sine and cosine transforms — Fourier integral theorem Parseval's identity.

UNIT III

Hankel Transform: Definition - Inverse formula — Some important results for Bessel function — Linearity property — Hankel Transform of the derivatives of the function — Hankel Transform of differential operators — Parsavaj's Theorem.

UNIT IV

Linear Integral Equations — Definition, Regularity conditions — special kind of kernels — eigen values and eigen functions — convolution integral — the inner and scalar product of two functions — Notation — reduction to a system of' Algebraic equations — examples — Fredholm alternative — examples — an approximate method.

UNIT V

Method of successive approximations: Iterative scheme — examples — Volterra Integral equation examples — some results about the resolvent kernel. Classical Fredholm Theory: the method of solution of Fredholm — Fredholm's first theorem — second theorem — third theorem.

References

1. Ram.P.Kanwal — Linear Integral Equations Theory and Practise, Academic Press 1971.
2. F.B.Hildebrand. Methods of Applied Mathematics II ed. PHI, ND 1972.
3. A.R.Vasishtha. R.K.Gupta, Integral Transforms, Krishna Prakashan Media Pvt Ltd. India, 2002.

UNIT — I : Chapter 2:Sections 2.1 to 2.9 of [2]
UNIT — II : Chapter 7 of [3]
UNIT — III : Chapter 9 of [3]
UNIT— IV : Chapter 1 and 2 of [1]
UNIT—V : Chapter 3 and4 of [1]

Learning Outcomes:
On completion of this unit successful students will be able to:

1. Understand the significance of Caluculus of Variations, Fourier Transforms and Hankel Transform.
2. A knowledge of linear integral equations and Method of successive approximations.
3. Skillness in transformation form one function into another function
4. Applications

Course Code	Course Title	L	T	P	C
22212AEC24	Graph Theory	5	0	0	4

Objectives

1. To give a rigorous study of the basic concepts of Graph Theory.
2. To study the applications of Graph Theory in other disciplines.

UNIT I

Basic Results Basic Concepts – Sub graphs - Degrees of Vertices - Paths and Connectedness Operations on Graphs - Directed Graphs:

UNIT II

Connectivity Vertex Cuts and Edge Cuts - Connectivity and Edge - Connectivity, **Trees**: Definitions, Characterization and Simple Properties - Counting the Number of Spanning Trees - Cayley's Formula.

UNIT III

Independent Sets and Matchings Vertex Independent Sets and Vertex Coverings - Edge Independent Sets -Matchings and Factors - Eulerian Graphs - Hamiltonian Graphs.

UNIT IV

Graph Colourings Vertex Colouring - Critical Graphs - Triangle - Free Graphs - Edge Colourings of Graphs - Chromatic Polynomials.

UNIT V

Planarity Planar and Nonplanar Graphs - Euler Formula and its Consequences - K5 and K3,3 are Nonplanar Graphs - Dual of a Plane Graph - The Four-Colour Theorem and the Heawood Five-Colour Theorem-Kuratowski's Theorem.

Textbook

1. R. Balakrishnan, K. Ranganathan, A Textbook of Graph Theory, Springer International Edition, New Delhi, 2008.

UNIT I :Chapter I & II: 1.1 to 1.4, 1.7, 2.1, 2.2
UNIT II :Chapter III & IV: 3.1, 3.2, 4.1, 4.3 to 4.4
UNIT III :Chapter V & VI: 5.1 to 5.4, 6.1, 6.2
UNIT IV :Chapter VII: 7.1 to 7.4, 7.7
UNIT V :Chapter VIII: 8.1 to 8.6

References

1. J.A. Bondy, U.S.R. Murty, Graph Theory with Applications, Mac Milan Press Ltd., 1976.
2. Gary Chartrand, Linda Lesniak, Ping Zhang, Graphs and Digraph,CRC press,2010.
3. F.Harary, Graph Theory, Addison - Wesley, Reading, Mass., 1969.

Course Code	Course Title	L	T	P	C
22212DSC25A	Elective -Mathematical Probability	5	0	0	4

Objectives:

The goal of the subject is to extend and master students' knowledge of probability and statistical and to provide theoretical background for studying and applying advanced statistical methods. Students are introduced to probability theory and mathematical statistics. They learn to understand important distributions, present statistical data, and fundamental statistical concepts. Emphasis is placed on evaluation the processes encountered in the real reality and on formulation of problems that are investigated by sampling.

UNIT I

Measure theory — Classes of sets. Singular distributions Probability measures and their distribution functions.

UNIT II

Random Variables — Expectation — Independence — General Definitions — Properties of mathematical expectation — Independence.

UNIT III

Convergence concept — Various modes of convergence — Almost sure convergence — Borel — Cantelli lemma — Vague convergence — continuation — Uniform integrability — convergence of moments.

UNIT IV

Law of large numbers and random series — simple limits theorem's — weak law of large numbers — convergence of series — strong law of large numbers.

UNIT V

Markov Processes and Markov chains--- Classification – Stationary Process – Markov process – Markov Chains – Transition probabilities – Limiting distribution .

Reference

A course in Probability Theory — Second Edition — by Kai Lai Chung, Academic Press, New York

Unit I	:	Chapter 2
Unit II	:	Chapter 3
Unit III	:	Chapter 4
Unit IV	:	Chapter 5 (Sec.5.l to 5.4 Only)
Unit V	:	Chapter 6 (Sec.6.l to 6.3 Only)

GENERAL REGERENCE

Modern Probability theory — BR.Bhat, Willy Eastern Limited 0989).

Learning Outcomes:

Knowledge and understanding understand the place of probability theory knowledge in cognitive process, describe the basic probability theory and mathematical statistics concepts; Special abilities and skills.

1. Calculate the probabilities of events with an appropriate choice of the method of calculation;
2. Be familiar with the types of random variables, be able write them, calculate their numerical characteristics;
3. Evaluate numerical characteristics of the sample and interpret the meanings of the parameters of population.
4. Formulate and test hypotheses, draw the appropriate conclusions.
5. Understand impotent distribution

Course Code	Course Title	L	T	P	C
22212DSC25B	Elective- Mathematical Modelling	5	0	0	4

Objectives:

Mathematical modelling can be used for a number of different reasons. How well any particular objective is achieved depends on both the state of knowledge about a system and how well the modelling is done.

1. Developing scientific understanding - through quantitative expression of current knowledge of a system.
2. Test the effect of changes in a system;
3. Aid decision making, including (i) tactical decisions by managers; (ii) strategic decisions by planners.

UNIT I

Microbial population models, single-species, non — age — structured population models.

UNIT II

Age — structured population models.

UNIT III

Epidemic models.

UNIT IV

Mathematical Model using Fourier Series

UNIT V

Mathematical models using Partial Differential Equations.

Reference:

Mathematical models in Biology and Medicine By J.N.Kapur, Affiliated East — West Press Pvt. Ltd., New Delhi

Unit I : Chapter 2,3
Unit II : Chapoter 4
Unit III : Chapter 8
Unit IV : Chapter 9
Unit V : Chapter 10

General References

1. Mathematical Modelling - J N Kapur ,Wiley Eastern Ltd., New Delhi.

2. Theory of Ordinary Differential Equations with Equations with applications in biology and Engineering Ahmad & Mohana Rao Affiliated East — West Pvt Ltd New Delhi, (1999).

Learning Outcomes:
Having successfully completed this module, you will be able to demonstrate knowledge and understanding of:

1) The concept of mathematical modelling.
2) The mathematical descriptions of some real systems.
3) Correct methodology when developing mathematical models.
4) Skill in applications.
5) Designing the solutions

Course Code	Course Title	L	T	P	C
22212RMC26	**Research Methodology**	3	0	0	2

AIM:

To give an exposure to development of research questions and the various statistical methods suitable to address them through available literature, with basic computational operators.

OBJECTIVES:

- To understand the approaches towards and constraints in good research.
- To identify various statistical tools used in research methodology
- To appreciate and compose the manuscript for publication
- To train in MATLAB platform for basic computational programming and analysis

OUTCOME:

Ability to develop research questions and the various research strategies, and compile research results in terms of journal manuscripts.

PREREQUISITES:

Research Methodology course in UG level or equivalent knowledge.

UNIT I: Introduction to Research Methodology

Objectives of research – Types of research – Significance of research. Research methods versus methodology – Research and scientific method – Criteria of good research – Problems encountered by researchers in India.

UNIT II: Database and Literature Survey

Articles – Thesis – Journals – Patents – Primary sources of journals and patents – Secondary sources – Listing of titles – Abstracts – Chemical Abstract Service – Reviews – Monographs – Literature search.

UNIT III: Data Analysis :

Precision and accuracy – Reliability – Determinate and random errors – Distribution of random errors – Normal distribution curve – Statistical treatment of finite samples – t test and F test (ANOVA) co -variance (ANCOVA) correlation and multiple regression.

UNIT IV: Thesis and Paper writing:

Conventions in writing – General format – Page and chapter format – Use of quotations and footnotes – Preparations of tables and figures – References – Appendices.

UNIT V: Application of MATLAB:

Numerical Integration - Numerical integration, ordinary differential equations, partial differential equations, boundary value problems

Fourier Analysis - Fourier transforms, convolution.

References:

1. C. R. Kothari, Research Methodology, New Age International Publishers. New Delhi, 2004.
2. R.A Day and A.L. Underwood, Quantitative analysis, Prentice Hall, 1999.
3. R. Gopalan, Thesis writing, Vijay Nicole Imprints Private Ltd., 2005.
4. A Guide to MATLAB: For Beginners and Experienced Users by Brian R. Hunt (Editor), Ronald L. Lipsman, J. Rosenberg
5. Introduction to MATLAB for Engineers by by William J. Palm III

SEMESTER – III

Course Code	Course Title	L	T	P	C
22212AEC31	Core IX- Topology	5	1	0	5

Objectives:

1) The subject of topology is of interest in its our right and it also serves to lay the foundations for future study in analysis, in Geometry and in Algebraic Topology.
2) To develop the students' abilities through hard thinking.
3) To train the students to develop analytical thinking.

UNIT I

TOPOLOGICAL SPACES: Topological spaces' — Basis for a topology- The order topology — The product topology on X x Y — The subspace topology — Closed sets and limit points.

UNIT II

CONTINUOUS FUNCTIONS: Continuous functions — the product topology — The metric topology.

UNIT III

CONNECTEDNESS: Connected spaces — connected subspaces of the Real line — Components and local connectedness.

UNIT IV

COMPACTNESS: Compact spaces — compact subspaces of the Real line — Limit Point Compactness — Local Compactness.

UNIT V:

COUNTABILITY AND SEPERATION AXIOMS: The Countability Axioms — The separation Axioms — Normal spaces — The Urysohn Lemma — The Urysohn metrization Theorem — The Tietz extension theorem.'

Reference:

James R.Munkres, Topology(2nd Edition) Pearson Education Pvt. Ltd., New Delhi — 2002 (Third Indian Reprint)

UNIT — I Chapter 2: Sections 12 to 17
UNIT — II Chapter 2: Sections 1 8to 2l(Ornit Section 22)
UNIT — III Chapter 3: Sections 23 to 25
UNIT — IV Chapter 3: Sections 26 to 29
UNIT — V Chapter 4: Sections 30 to 35.

Reference(s)

1. J.Dugundji, Topology, Prentice Hall of India, New Delhi, 1975.
2. George F.Sinmons, Introduction to Topology and Modern Analysis, McGraw Hill Book Co., 1963.
3. .J.L.Kelly, General Topology, Van Nostrand, Reinhold Co., New York.
4. L.Steen and J.Seeback, Counter examples in Topology, HoIt, Rinehart and Winston, New York, 1970
5. S.Willard, General Topology, Addison — Wesley, Mass., 1970.

Learning Outcomes:

Upon successful completion of this course, the student will be able to: (Knowledge based) distinguish among open and closed sets on different topological spaces;

1) know the two fundamental topologies: discrete and indiscrete topologies.
2) Identify precisely when a collection of subsets of a given set equipped with a topology forms a topological space;
3) Understand when two topological spaces are homeomorphic;
4) Identify the concepts of distance between two sets; connectedness, denseness, compactness and separation axiom.

Course Code	Course Title	L	T	P	C
22212AEC32	Core X – Stochastic Process	5	2	0	5

Objectives

The objective of this course is to provide the fundamentals and advanced concepts of random process to support graduate coursework and research in engineering. The required mathematical foundations will be studied at fairly rigorous level and the applications of the probability theory and random processes to engineering problems will be emphasized. The simulation techniques will also be studied and MATLAB will be used as a software tool for bridging the probability theory and engineering applications.

UNIT I

Elements of Stochastic Processes — Two simple examples of Stochastic processes — Classification of general Stochastic processes — Defining a Stochastic Processes — Markov chains — Definitions — Examples of Markov Chain — Transition probability matrices of a Markov chain — classification of states of a Markov chain — Recurrence — more on Recurrence.

UNIT II

The basic limit theorem of Markov chains and applications — Discrete renewal equation — proof of theorem — Absortion probabilities — criteria for recurrence — Random walk.

UNIT III

Classical Examples of continuous time Markov chains — General pure birth processes and Poisson processes — more about Poisson processes — A counter model — birth and death processes — Differential equations of birth and death processes — Examples of birth and death processes.

UNIT IV

Renewal processes — Definition of Renewal process and related concepts — Some examples of Renewal Processes — More on some special Renewal processes — Renewal equations and elementary Renewal theorem — The Renewal Theorem — Applications of Renewal theorem.

UNIT V

Martingales — Preliminary definitions and examples — Super martingales and Sub martingales — The optional sampling theorem.

Reference

A First course in Stochastic Processes — second Edition by Samuel Karlin and M . Taylor, Academic Press New York.

Unit I : Chapter l(l.2,l.3,l.4Only) , Chapter 2 (2.1 to 2.5 and 2.7 Only)

Unit II : Chapter 3 (3.1 to 3.4 and 3.7 Only)

Unit III : Chapter 4 (4.1 to 4.6 Only)
Unit IV : Chapter 5 (5.1 to 5.6)
Unit V : Chapter6(6.1,6.2,6.3 Only)

General references

1. "Stochastic Processes" S.K Srinivasan and K.M. Mehata, Tata Mcgraw — Hill Publishing Company Ltd., New Delhi.
2. "Stochastic Processes" JMedhi, Second Edition Wiley Eastern Ltd., New Del/it

Learning Outcomes

1.On successful completion of the course, students should be able to:
2. Explain fundamentals of probability theory, random variables and random processes.
3. Understand the mathematical concepts related to probability theory and random processes
4, Understand the characterization of random processes and their properties.
5. Formulate and solve the engineering problems involving random processes.
6. Analyze the given probabilistic model of the problem.
7. Make precise statements about random processes.
8. Use computational techniques to generate simulation results.

Course Code	Course Title	L	T	P	C
22212AEC33	Advanced Numerical Analysis	5	2	0	5

Objectives:

1) Derive appropriate numerical methods to solve algebraic and transcendental equations.
2) Develop appropriate numerical methods to solve a differential equation.
3) Derive appropriate numerical methods to evaluate a derivative at a value.
4) Derive appropriate numerical methods to solve a linear system of equations.
5) Derive appropriate numerical methods to calculate a definite integral.

Unit – I

Transcendental polynomials equation: Introduction, Methods based on first and second degree equation: secant method - Newton Raphson method - Muller method - Chebyshev method - Rate of convergence. Polynomials Equations: Birge-Vieta method - Bairstow method -Graeffe's root squaring method.

Unit – II

System of linear algebraic equation and Eigen values problems: Jacobi iteration method, Gauss-Seidal iteration method successive over relaxation method. Eigen values and vectors.

Unit – III

Interpolation and approximation – Hermite Interpolation – Bivariate interpolation – Lagrange bivariate interpolation- Newton's bivariate Interpolation for equispaced points – approximations – Gram-Schemidt orthoganalizing process – Chebyshev polynomials.

Unit – IV

Numerical Integration: Methods based on interpolation-Newton-Cotes methods-trapezoidal rule-Simpson's rule-Methods based on undetermined coefficients-Gauss-Legendre integration methods-Labotto integration method-Radau Integration Method and Gauss-Chebystew Integration methods.

Unit – V

Ordinary Differential Equations: Numerical methods – Euler method – Backward Euler method – Mid point method – Taylor series method – Runge Kutta methods – Implicit Runge – Kutta method.

TEXT BOOK:

Numerical methods for scientific and Engineering Computation by M.K.Jain, S.R.K.Iyengar, R.K. Jain III – Edition.

Unit: I – Chapter-2 Sec 2.3, 2.4, 2.5, 2.8
Unit: II – Chapter-3 Sec 3.4, 3.5, 3.6
Unit: III – Chapter-4 Sec 4.5, 4.7, 4.8
Unit: IV – Chapter-5 Sec 5.6, 5.7, 5.8

Unit: V – Chapter-6 Sec 6.2, 6.3, 6

Learning Outcomes

Students will be able to

1) Solve an algebraic or transcendental equation using an appropriate numerical method.
2) Solve a differential equation using an appropriate numerical method.
3) Evaluate a derivative at a value using an appropriate numerical method.
4) Solve a linear system of equations using an appropriate numerical method.
5) Calculate a definite integral using an appropriate numerical method.
6) Skill in finding the roots of the given equation

Course Code	Course Title	L	T	P	C
22212DSC34A	Elective- Cryptography	5	0	0	4

Objectives:

1) Understand the basic concept of Cryptography and Network Security their mathematical models.
2) Understand mathematical foundation required for various cryuptographic Algorithms.

UNIT I:

Simple cryptosystem — enciphering matrices.

UNIT II:

Idea of public key cryptography — RSA — discrete log.

UNIT III:

Knap sack pseudo primes — Rho method .

UNIT IV:

Fermat factorization and factor bases — continued fraction method.

UNIT V:

Basic facts — elliptic curve cryptosystems — elliptic curve factorization.

Reference:

A course in Number Theory and Cryptography — N.Koblitz, Springer — verlog, New York 1987.

Learning Outcomes

1) Analyze key agreement algorithms to identify their weaknesses.
2) Describe the ethical issues related to the misuse of computer security.
3) Develop code to implement a cryptographic algorithm or write an analysis report on any existing security product.

Course Code	Course Title	L	T	P	C
22212DSC34B	Elective- Algebraic Coding Theory	5	0	0	4

Objective:

- To equip students with the basic understanding of the fundamental concept of Coding Theory as they are used in communications.
- To enhance knowledge of codes. Error, Tree Codes, cyclic codes.
- To guide the student through the implications and consequences of fundamental theories and laws of coding theory with reference to the application in modern communication and computer systems

UNIT I

The communication channel. The coding problem. Types of codes. Block codes. Error — detecting and Error — Correcting codes. Linear codes. The hamming metric. Description of linear block codes by matrices.

UNIT II:

Error — Correction capabilities of linear codes. Bounds on minimum Distance for block codes. Plotkin bound. Hamming sphere packing bound.. Bounds for Burst — Error detecting and correcting codes. Important linear block codes. Hamming codes. Golay codes. Perfect codes.

UNIT III:

Tree codes. Convolutional codes. Description of linear tree and convolutional codes by matrices. Standard Array. Bounds on minimum distance for convolutional codes. V. G. S bound. Bounds for Burst — error detecting and correcting convolutional codes.

UNIT IV:

Matrix description of cyclic codes. Hamming and Golay codes as cyclic codes. Error detection with cyclic codes. Error — connection procedure for short — ended cyclic codes. Pseudo cyclic codes.

UNIT V:

Majority — Logic decodable codes. Majority — Logic Decoding. Singleton bound. The Griesmer bound, Maximum — distance separable (MDS) codes. Generator and Parity — check matrices of MDS codes. Weight distribution of MDS code.

References

1. Raymond Hill,' A First Course in Coding Theory "Oxford University Press. 1986.
2. Man Young Rhee, Error Correcting Coding Theory " MacGraw Hill Inc., 1989.
3. W.W. Peterson and E.J. Weldon, Jr., Error — Correcting Codes. M.I.T. Press. Combridge, Massachusetts, 1972.
4. E.R. Beriekamp. Algebraic Coding Theory, MacGraw Hill Inc., 1968.
5. F.J. Macwilliams and N.J.A. Sloane, Theory of Error Correcting Codes" North — Roland Publishing Company, 1977.

Learning Outcomes

Upon completion of this course, students should be able to:

Define channel capacities and properties using Shannon's Theorems.

Construct efficient codes for data on imperfect communication channels.

Generalize the discrete concepts to continuous signals on continuous channels.

SEMESTER – IV

Course Code	Course Title	L	T	P	C
22212AEC41	**FUNCTIONAL ANALYSIS**	5	1	0	5

UNIT I : Banach Spaces :

The definition and some examples - Continuous linear transformations-The Hahn - Banach theorem.

UNIT II: Banach Space & Hilbert Spaces

The natural imbedding of N in N** - The open mapping theorem- The conjugate of a operator.

Hilbert Spaces: The definition and some simple properties

UNIT III: Hilbert Spaces

Orthogonal complements - Orthonormal sets -The conjugate space H* - The adjoint of an operator

UNIT IV: Operators on Hilbert Spaces

Self-adjoint operators -Normal and unitary operators - Projections.

UNIT V: Banach Algebras

Banach Algebra- General Preliminaries on Banach Algebras: The definition and some examples -Regular and simple elements -Topological divisors of zero -The spectrum - The formula for the spectral radius -The radical and semi- simplicity

Text Book:

Author Name	Title of the book	Edition/year	Publisher
G.F. Simmons	Introduction to Topology and Modern Analysis	1963	McGraw-Hill International

UNIT-I : ***Chapter-9:Sec46-48***

UNIT-lI : ***Chapter-9: Sec 49-51 & Chapter-10: Sec 52***

UNIT-III : ***Chapter-10: Sec 53-56***

UNIT-IV : ***Chapter-10: Sec 57-59***

UNIT-V : ***Chapter-12: Sec 64-69***

References :

1.Walter Rudin, Functional Analysis, TMH Edition, 1974.

2. B.V.Limaye, Functional Analysis, Wiley Eastern Limited, Print, 1985.

3. D.Somasundaram, Functional Analysis.

Course Code	Course Title	L	T	P	C
22212AEC42	Core XIII – Visual Programming	5	2	0	5

Objectives

Learn to design and develop Windows-based business applications using Visual Basic.NET programs that meet commercial programming standards.

- To learn the basic principles of visual programming
- To study the necessary skills to create software solutions using visual programming
- Understood the Open Data Base Connectivity using Visual programming.
- To inculcate knowledge on Programming and Project Development using Visual Basic.

UNIT I

Introduction to Visual Basic — Integrated Development Environment (IDE) features — VB Editor — Customizing the IDE — Anatomy of a form — Working with form properties — setting form's properties — Introducing form events and form methods.

UNIT II

Variables in Visual Basic: Declaring variables — Data types — Null value. Error value — Empty value - The scope of a variable Module level variables — Constants — Creating your own constants — Scope of a constant — Converting data types — Arrays — Declaring arrays — Fixed size arrays — Dynamic arrays — Preserve Keyword - ReDim — Writing code in Visual Basic — The anatomy of a procedure — Subroutine and functions — Language constructs — For .... Next, The While loop, Select case - End select, Exit statement. With structure.

UNIT III

Selecting and Using controls — Introduction to standard controls -- Command buttons - Text boxes — labels — Option buttons — Check boxes — Frame controls — List boxes — Combo boxes — Image objects — Picture boxes — Timer — Scroll bars - File system Controls (Drive, DirList, File List boxes)

UNIT IV

Introduction to Built — in ActiveX Control — Tool bar — The Tree view control — The List view control — The Image list control — Common Dialog Control — Status bar control Rich textbox control — Menu editor.

UNIT V

DDE Properties — DDE Methods — OLE properties — Active Control Creation and Usage and ActiveX DLL creation and usage - Database access — Data Control — field control — Data grid record set using SQL to manipulate data — Open Data Base Connectivity.

Reference:

1. Mohammed Azam, Programming with Visual Basic 6.0 — Vikas Publishing House Pvt, Ltd — 2002
2. Content Development Group, Visual Basic 6.0 — Tata McGraw Hill Publishing Company Limited — 2002.

Learning Outcomes

Upon completion of this course, the student will be able to:

- Design, create, build, and debug Visual Basic applications.
- Explore Visual Basic's Integrated Development Environment (IDE).
- Implement syntax rules in Visual Basic programs.
- Write Windows applications using forms, controls, and events
- Write and apply decision structures for determining different operations.
- Write and apply loop structures to perform repetitive tasks.
- Students are able to design a IDE enabled software solution to representative problems.
- Students can use DDE data I/O components to read and write raster and vector data files.
- Students can use OLE map components to develop a custom Windows Forms based application with a map and legend.

Course Code	Course Title	L	T	P	C
22212AEC43	Number Theory	5	1	0	5

Objectives:

The objective is for the students to obtain a foundational knowledge of elements of number Theory through step-by-step proofs of classical theorems, as well as to sharpen their skills through problem-solving.

UNIT I :

Fundamentals of Congruence's : Basic properties of Congruence's – Residue-Riffling. Solving Congruence's: Linear Congruence's-the theorems of Fermat and Wilson Revisited-the Chinese remainder Theorem-polynomial congruence's.

UNIT II :

Arithmetic functions: Combinatorial study of φ (n) – Formulae for d(n) and $\sigma(n)$- Multiplicative arithmetic functions. The Mobius inversion formula. Primitive roots: properties of reduced systems-primitive roots modulo P.

UNIT III :

Quadratic Residues: Euler's Criterion-the Legendre symbol-the quadratic Reciprocity law-Applications of the Quadratic reciprocity law, Distribution of quadratic residues: Consecutive residues and non residues-consecutive triples and Quadratic residues.

UNIT IV:

Sum of squares: Sums of two squares-Sums of four squares. Elementary partition theory; Introduction-graphical representation-Euler's partition theorem-searching for partition identities.

UNIT V :

Partition generating functions: Infinite products as generating functions-Identities between infinite series and products-partition identities: History and introduction-Euler's pentagonal number theorem-The Roger's Ramanujan identities-Series and Product identities.

TEXT BOOK: Scope and treatment as in "Number Theory" by George E.Anderews, Hindustan Publishing Corporation (India) Delhi-110 007 (1989).

Unit I	:	Chapters IV and V
Unit II	:	Chapters VI and VII
Unit III	:	Chapters IX and X
Unit IV	:	Chapters XI and XII
Unit V	:	Chapters XIII and XIV

Learning Outcomes:

On satisfying the requirements of this course, students will have the knowledge and skills to:

1. Solve problems in elementary number theory
2. Apply elementary number theory to cryptography
3. Develop a deeper conceptual understanding of the theoretical basis of number theory and cryptography
4. Research inquiry and analytical thinking abilities

Course Code	Course Title	L	T	P	C
22212DSC44A	Elective –Combinatorial Mathematics	5	0	0	4

Objectives:

The main objective is to learn how rigorous mathematical tools can be made for the purpose of doing mathematics with help of computers.

UNIT I

Basic combinational numbers.

UNIT II

Generating functions and Recurrence relations symmetric functions.

UNIT III

Multinomials — Inclusion and exclusion principles — permutations with forbidden positions.

UNIT IV

Necklace problem and Burnsides' Lemma — Cycle Index of a permutations group.

UNIT V

Schur Functions – Robinson-schensted-knuth correspondence, Combinatorics of the schur function.

Reference

Combinatorics theory and applications by V. Krishnamurthy.

Unit I : Chapter I (Pages 1 — 15)
Unit II : Chapter I (Pages 26— 61)
Unit III : Chapter I (Pages 66 — 98)
Unit IV : Chapter 11 (Pages 99— 121)
Unit V : Chapter III (Pages 191 – 238)

General Reference

Introductory Combinatorics — Kenneth P.Bogart — Pitman Publishing mc, MashJIeld, Mass achusetts.

Learning Outcomes

Upon successful completion of Math 315 - Combinatorics, a student will be able to:

- Apply diverse counting strategies to solve varied problems involving strings, combinations, distributions, and partitions,

- Write and analyze combinatorial, algebraic, inductive, and formal proofs of combinatory identities,
- Recognize properties of graphs such as distinctive circuits or trees.

- will become familiar with fundamental combinatorial structures that naturally appear in various other fields of mathematics and computer science.
- They will learn how to use these structures to represent mathematical and applied questions, and they will become comfortable with the combinatorial tools commonly used to analyze such structures.

Course Code	Course Title	L	T	P	C
22212DSC44B	Elective- Algebraic Coding Theory	5	0	0	4

Objective:

- To equip students with the basic understanding of the fundamental concept of Coding Theory as they are used in communications.
- To enhance knowledge of codes. Error, Tree Codes,cyclic codes.
- To guide the student through the implications and consequences of fundamental theories and laws of coding theory with reference to the application in modern communication and computer systems

UNIT I

The communication channel. The coding problem. Types of codes. Block codes. Error — detecting and Error — Correcting codes. Linear codes. The hamming metric. Description of linear block codes by matrices.

UNIT II:

Error — Correction capabilities of linear codes. Bounds on minimum Distance for block codes. Plotkin bound. Hamming sphere packing bound. Bounds for Burst — Error detecting and correcting codes. Important linear block codes. Hamming codes. Golay codes. Perfect codes. Quasi — perfect codes. Reed — Muller codes. Codes derived from Hadmard matrices.

UNIT III:

Tree codes. Convolutional codes. Description of linear tree and convolutional codes by matrices. Standard Array. Bounds on minimum distance for convolutional codes. V. G. S bound. Bounds for Burst — error detecting and correcting convolutional codes. The Lee metric, packing bound for Hamming code w.r.t. Lee metric.

UNIT IV:

Matrix description of cyclic codes. Hamming and Golay codes as cyclic codes. Error detection with cyclic codes. Error — connection procedure for short — ended cyclic codes. Pseudo cyclic codes. Code symmetry. Invariance of codes under transitive group of permutations.

UNIT V:

Majority — Logic decodable codes. Majority — Logic Decoding. Singleton bound. The Griesmer bound, Maximum — distance separable (MDS) codes. Generator and Parity — check matrices of MDS codes. Weight distribution of MDS code. Necessary and sufficient conditions for a linear code to be an MDS code. MDS codes from RS codes.

References

1. Raymond Hill,' A First Course in Coding Theory "Oxford University Press. 1986.
2. Man Young Rhee, Error Correcting Coding Theory " MacGraw Hill Inc., 1989.
3. W.W. Peterson and E.J. Weldon, Jr., Error — Correcting Codes. M.I.T. Press. Combridge,

Massachusetts, 1972.

4. E.R. Beriekamp. Algebraic Coding Theory, MacGraw Hill Inc., 1968.
5. F.J. Macwilliams and N.J.A. Sloane, Theory of Error Correcting Codes” North — Roland Publishing Company, 1977.

Learning Outcomes

Upon completion of this course, students should be able to:

Define channel capacities and properties using Shannon's Theorems.

Construct efficient codes for data on imperfect communication channels.

Generalize the discrete concepts to continuous signals on continuous channels.

Course Code	Course Title	L	T	P	C
22211OEC	**Open Elective -Writing for the Media**	4	0	0	3

Aim:

- To equip students to enter into the realm of mass media.

Objective:

- To comprehend the intricacies of mass media
- To know about the barriers to mass communication
- To understand the function of mass media
- To learn the different kinds of news
- To enhance the different kinds of writing for media

Outcome:

- Understand the intricacies of mass media
- Learn to write for the media

UNIT-I

Mass communication- Barriers to mass communication and mass culture- Function of mass media - Media effects, Qualities of media men.

UNIT-II

News- Hard and soft news- Expected and unexpected news- Box news- Follow up news- Scoop- Filters- Human interest stories- Recognizing and evaluation news.

UNIT-III

News and views- News analysis, Editorial, Columns, Article, Middle reviews, Letters- Features.

UNIT-IV

Reporting- Crime, Court, Election, Legislature, Sports, Development Investigative, Interpretative depth.

UNIT-V

Writing for Media-Inverted pyramid style-Feature style-TV/Broadcast, New style writing TV/Radio Documentaries- Writing Advertisements-Practical

ReferenceBook:-

Author	**Title of the book**	**Edition / Year**	**Publisher**
Susan	Journalism		
John Hogenberg	Professional Journalism	2012	
M.James Neal	News Writing and Reporting		Surjeet Publication
M.V Komath	The Journalist’s Handbook		
D.S Mehta	Mass Communication		

	&Journalism		

Course Code	Course Title	L	T	P	C
Open Elective	Applicable Mathematical Techniques	4	0	0	3

Objectives:

1) Understand the basic concept of Interpolation.
2) To enhance the knowledge about Assignment Problems, Replacement Problems, Decision Analysis and Game Theory.

UNIT I

Interpolation with unequal intervals: Newton's, Lagrange's, and inverse interpolation

UNIT II

Assignment Problems

UNIT III

Replacement Problems

UNIT IV

Decision Analysis

UNIT V

Game Theory

References

1. For unit I, "Numerical Methods in Science and Engineering" M.K.Venkatraman
2. For units II to V, "Operations Research",Kantiswarup, P.K. Gupta and Manmohan

Learning outcomes

By the end of this course,

- Students using OR techniques in business tools for decision making
- Students develop Assignment problem and Replacement problems
- Understand the concept of decision analysis and game theory
- Students gets the knowledge about interpolation

Course Code	Course Title	L	T	P	C
22213OEC	**BIO-MEDICAL INSTRUMENTATION**	4	0	0	3

Aim:

- To understand the concepts and application of electronic Instrumentation in the Medical field.

Objective:

- Understanding basic principles and phenomena in the area of medical diagnostic instrumentation,
- Theoretical and practical preparation enabling students to maintain medical instrumentation

UNIT – I: BIO ELECTRIC SINGNALS AND ELECTRODES

Fundamentals of medical instrumentation – Sources of biomedical signals – basic medical instrumentation – Intelligent medical instrumentation system – Origin of Bio electric signals – Recording Electrodes – Silver – Silver chloride electrodes – Electrodes for ECG – Electrodes for EEG – Electrodes for EMG.

UNIT – II: RECORDING SYSTEM AND RECORDERS

Basic recording system – General consideration for signal conditions – Preamplifiers – Biomedical signal analysis technique – main amplifier and driver stage – Writing systems – direct writing recorders – the ink jet recorders – Electrocardiograph, Electroencephalograph – Electromyography and other Biomedical recorders.

UNIT – III: MEASUREMENT AND ANALYSIS TECHNIQUES

Electro cardiography – measurements of Blood pressure - measurements of Blood flow and cardiac output, Respiratory therapy Equipment – Origin of EEG – Action Potentials of the brain – evoked potentials – Placement of electrodes – Recording set up – Analysis of EEG.

UNIT – IV: MAGNETIC RESONANCE AND ULTRASONIC IMAGILG SYSTEMS

Principles of NMR Imaging system – Image reconstruction Techniques – Basic NMR components – Biological efforts of NMR Imaging – Advantages of NMR Imaging System – Diagnostic ultra Sound – Physics of ultrasonic waves – metical ultra sound – basic pulse – echo apparatus, A – Scan – echocardiograph(M mode).

UNIT – V: ADVANCED BIO MEDICAL SYSTEMS

Pacemakers – Need for Cardiac pacemaker – External Pace makes – Implantable Pace makers – recent development in Implantable Pacemakers – Pacing system Analyzer – Defibrillator – Pacer – Cardioverter – Physiotherapy and electro therapy equipment – High frequency heat therapy – short wave diathermy – microwave and ultrasonic therapy – pain relief through electrical simulation.

OUTCOMES:

- Define basic medical terms and physical values that can be handled by medical instrumentation,
- Describe methods and implementation of electrical and nonelectrical medical parameters diagnostic,
- demonstrate measuring of basic medical parameters,
- Calculate basic parameters of the equipment for using in electro diagnostic and electro therapy,
- Apply safety standards and select disposal method and procedures for electrical diagnostic equipment.

Books for Study

1. R.S Khandpur, Handbook of Biomedical instrumentation, Tata McGraw Hill publishing company Limited. New Delhi,(2003). (Unit I,II,IV & V)
2. Lestlie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, Bio medical instrumentation and measurements, PHI, New Delhi.(Unit-III)

Book for Reference

1. M.Arumugam, Biomedical Instrumentation, Anuradha Agencies, Kumbakonam (2000).

Course Code	Course Title	L	T	P	C
22220OEC	**M-Marketing**	4	0	0	3

OBJECTIVES

- Understand Mobile Business strategies.
- To understand Mobile marketing tools and techniques.
- To know Mobile technologies.

UNIT I Introduction

Mobile Marketing Campaign, Fortune 500 and Mobile Marketing, consumers engagement with mobile, Terminologies.

UNIT II Businesses Vs mobile marketing

classic mistakes in mobile marketing, laying foundation for successful mobile marketing campaign, understanding technology behind mobile marketing – Android, iOS, Windows Phone.

UNIT III

Strategic thinking about Mobile marketing campaign, Mobile Marketing Tools – setting up mobile website for different firms, using SMS, MMS and apps to drive customers to business and other ways to attract customers.

UNIT IV Location Based Marketing

LBS, NFC, Bluetooth and LBA, 2D codes, Tablet, Other Mobile Applications, Business Firms connecting to customers using Mobile – case study, Mobile Marketing for B2B companies, Mobile E-commerce to Drive Revenue.

UNIT V Mobile Payments

Present and Future Mobile Technology, Mobile Application Development.

OUTCOMES

- Upon Completion of the course, the students should be able to:
- Analyze various mobile marketing strategies.
- Market Mobile based Applications.
- Apply various tools in mobile marketing.

REFERENCE BOOKS:

1. Go Mobile: Location Based Marketing, Apps, Mobile Optimized Ad Campaigns, 2D codes and other Mobile Strategies to Grow your Business, Jeanne Hopkins, Jamie Turner, John Wiley&Sons Inc., 2012.

2. M- Commerce, Paul Skeldon, Crimson Publishing, 2012.
3. M-Commerce Technologies, Services and Business Models, Norman Sadeh , Wiley 2002.
4. Mobile Commerce, Opportunities, Applications and Technologies of Wireless Business, Paul Mary, Tom Jell, Cambridge University Press, 2001.

Course Code	Course Title	L	T	P	C
22214OEC	Open Elective-Green Chemistry	4	0	0	3

Aim:

- To reduce the soil and water pollution in environment.

Objectives:

- To learn about the environmental status, public awareness in evolution, principles involved in green chemistry, bio-catalytic reactions, global warming and its control measures, availability of green analytical methods.

Outcomes:

- To understand the environmental status and evolution.
  - To know about the Pollution and its prevention measures.
  - To familiarize the green chemistry.
  - To learn about the bio-catalytic reactions.
  - To understand about the vitamins and antiobiotics.

Unit I - Introduction

Introduction-Current status of chemistry and the Environment-Evolution of the Environmental movement: Public awareness - Dilution is the solution to pollution-Pollution prevention.

Unit II - Principles

Green Chemistry – Definition – Principles of Green Chemistry - Why is this new area of Chemistry getting to much attention - Why should chemist pursue the Goals of Green Chemistry - The roots of innovation – Limitations.

Unit III - Bio Catalytic Reactions

Green Chemistry Using Bio Catalytic Reactions – Introduction - Fermentation and Bio transformations - Production of Bulk and fine chemicals by microbial fermentation Antibiotics – Vitamins - Bio catalyses synthesis of industrial chemicals by bacterial constructs - Future Tends.

Unit IV - Green House Effect

Green house effect and Global Warming – Introduction - How the green house effect is produced - Major sources of green house gases - Emissions of CO2 - Impact of green house effect on global climate - Control and remedial measures of green house effect - Global warming a serious threat - Important points.

Unit V - Green Analytical Methods

Future trends in Green Chemistry - Green analytical methods, Redox reagents, Green catalysts; Green nano-synthesis, Green polymer chemistry, Exploring nature, Biomimetic, Proliferation of solvent-less reactions; Non-covalent derivatization, Biomass conversion, emission control

References:

1. Introduction to Green Chemistry – M.Rayan and M.Tinnes
2. New Trends in Green Chemistry – V.K.Ahluwalia and M.Kidwai

Course Code	Course Title	L	T	P	C
22215OEC	**Open Elective -**Herbal Medicine	4	0	0	3

Aim:

- Be able to advise and educate effectively to create a comprehensive wellness plan incorporating herbal, dietary and lifestyle recommendations integrating self-awareness and lessons of nature

Objective

- Possess knowledge of traditional herbal systems as well as an understanding of the principles and practices of modern Western herbalism
- Demonstrate the ability to critically analyze herbal research and contribute to the current body of herbal literature
- Know how to integrate knowledge of raw materials, formulation, and herbal pharmacy for product development purposes
- Know how to effectively educate individuals and groups about herbs
- Be able to demonstrate basic skills in herb identification, harvesting, and preparation
- Be able to address potential safety concerns including herb-drug interactions

Outcomes

- Accurately gather information regarding past and current health status while differentiating between phenomena and the client's interpretation of phenomena
- Synthesize the above information to create a comprehensive assessment of health inputs and processes
- Work with clients to develop individualized goals and a plan for health and wellness

Unit I

Tribal medicine – methods of disease diagnosis and treatment – Plants in folk religion – Aegle marmelos, Ficus benghalensis, Curcuma domestica, Cyanodon dactylon and Sesamum indicum.

Unit II

Traditional knowledge and utility of some medicinal plants in Tamilnadu – Solanum trilobatum, Cardiospermum halicacabum, Vitex negundo, Adathoda vasica, Azadirachta indica, Gloriosa superba, Eclipta alba, Aristolochia indica and Phyllanthus fraternus.

Unit III

Plants in day today life – Ocimum sanctum, Centella asiatica, Cassia auriculata, Aloe vera. Nutritive and medicinal value of some fruits (Guava, Sapota, Orange, Mango, Banana, Lemon, Pomegranate) and vegetables - Greens (Moringa, Solanum nigrum Cabbage).

Unit IV

Allergens – types – sources – active principles – Chemical nature – Cell modifiers – Lectins – mutagens, teratogens – Allergic reactions with known examples.

Unit V

Cardiovascular diseases – blood pressure – cardiac drugs of plant origins – alkaloids, anticoagulants – basic mechanism of action. Pulmonary / respiratory disorders – asthma – bronchitis – common cold – allergy – Remedy from plants.

References

1. Tribal medicine – D.C. Pal & S.K. Jain Naya Prakash, 206, Bidhan Sarani, Calcutta , 1998
2. Contribution to Indian ethnobotany – S.K. Jain, 3rd edition, Scientific publishers, B.No. 91, Jodhpur, India. 2001
3. A Manual of Ethnobotany – S.K.Jain, 2nd edition, 1995.
4. Kumar, N.C., An Introduction to Medical botany and Pharmacognosy. Emkay Publications, New Delhi. 1993.
5. Rao, A.P. Herbs that heal. Diamond Pocket Books (P) Ltd., New Delhi, 1999

Course Code	Course Title	L	T	P	C
22261OEC	**Open Elective -** FINANCIAL SERVICES	4	0	0	3

AIM

To analyze the various financial institutions and their services.

OBJECTIVES

I. To gain knowledge on financial services.
II. To understand importance of various services including banking, insurance, mutual funds.

UNIT – I

Financial system-An Overview: Indian Financial System-Global Financial System-Financial Services Environment- Credit Rating –Factoring and Forfeiting –Leasing

UNIT – II

Financial Markets –An Overview: Definition-Role-Functions-Constituents-Financial Instruments-Capital Market instruments-Indian money and Capital Market-Global Financial Markets.

UNIT – III

Money Market –An Overview: Definition-Characterstistics-Objectives-Imporatance-Functions-Segment-Financial Institutions-Indian Money Market-Global Money Market

Unit – IV

Capital Market: Money Market-Characteristics-Functions-New financial Instruments-measures of Investor Protection-Indian Capital Market-Major Issues

Unit-V

Stock Exchange: History of Stock Exchange-Functions-Indian Stock Exchanges-Organization structure-Regulations of Stock Exchange –Recent Developments

OUTCOME

To introduces meaning and functions of Financial Intermediaries
To understand the role of merchant bank and its services
To provide information regarding management of mutual funds and Regulations
To understand the role and functions of financial services Marketing
To know the structure and types of debt Instruments
To realize Foreign Exchange Market

REFERENCE BOOKS

1. Gordon ,Natarajan – Financial Market and Services.
2. Dr. S. Gurusamy – Financial services and Market.
3. Kucchol S.C. – Financial Management
4. Pandey I.M. – Financial Management.

Course Code	Course Title	L	T	P	C
22280OEC	**Open Elective** **Counseling and Psychology**	4	0	0	3

Aim:

- To acquaint with counselling and its process

Objectives:

- To learn the fundamental concepts of counselling.
- To know the nature of different determinates.
- To familiarize with the approaches of counselling

Out Come:

- Learn counselling and its process

UNIT I

Definition of Counselling
Counselling as a Solution to Human Problems
Counselling-Expectations & Goals

UNIT II

Personality Determinates, Intellectual Determinates, Emotional Determinates
Social Determinates

UNIT III

Approaches to Counselling
Counselling Process

UNIT IV

Psychological Testing
Diagnosis

UNIT V

Educational Counselling
Family Counselling

References Book:

1. Hanson, J.C. Stevic, R.R., Warner, R.W., Jr. Counselling Theory & Process (2nd Edition) Boston
2. Hurlock Elizabeth B.(2oo7), Human Development, New York, Grawhill Book Company
3. John W, Santrock (1999), Life Span Development, 7th Edition, New Delhi; Mcgrowhill Company
4.blum And Bolimsky, B. Counselling & Psychology; Bomboy; Asia Publishing House, 1961
5. Bordin, E.S. Psychology Of Counselling New York; Application Century Crafts, 1968
6. Lewis E. C., The Psychology Of Counselling New York Holt, Rinchart And Winston Inc. 1970.

COMPUTER SCIENCE

1.1.3	**colour**
EMPLOYABILITY	
SKILL DEVELOPMENT	
ENTREPRENEURSHIP	
EMPLOYABILITY,/ENTREPRENEURSHIP,/SKILL DEVELOPMENT	
EMPLOYABILITY,/SKILL DEVELOPMENT	
EMPLOYABILITY,/ENTREPRENEURSHIP	

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SCHOOL OF ARTS AND SCIENCE

DEPARTMENT OF COMPUTER SCIENCE
B.Sc., COMPUTER SCIENCE- REGULATION 2022

B.Sc C.S. Graduate Attributes :

- Information Literacy
- Problem Analysis
- Design/development of solutions
- Modern tool usage
- Professional and Ethical understanding

B.Sc C.S. Programme Objectives-PEO

- POE1- To study about I/O management, storage management
- POE2- To know the methods of connecting them to the peripheral devices.
- POE3- To learn Software design and Implementation
- POE4- To learn the basic principles of database and database design
- POE5- To understand computational development of graphics with mathematics

B.Sc C.S. Programme Outcomes -PO

- PO1- Understand dynamic memory allocation and pointers.
- PO2- Trace the flow of information from one node to another node in the network.
- PO3- Understand the format and use of objects.
- PO4- Able to Measure the product and process performance using various metrics
- PO5- Design Secure applications.
- PO6- Apply the various optimization techniques.

B.Sc C.S. Courses -C

- **C1-** Programming in C with C++
- **C2-** Internet and Java Programming
- **C3-** Visual Programming
- **C4-** Active Server Programming
- **C5-** E-Business Technology
- **C6-** Operating System
- **C7-** Microprocessor and its Applications
- **C8-** .NET Programming
- **C9-** Relational Data Base Management System

B.Sc C.S. Curriculum Mapping

Programme Educational Objectives-PEO vs Programme Outcome-PO

Programme Outcome-PO Programme Educational Objectives-PEO	PO1	PO2	PO3	PO4	PO5	PO6
PEO1		✓			✓	
PEO2	✓					
PEO3			✓			✓
PEO4				•		✓
PEO5			✓		✓	

B.Sc C.S. Curriculum Mapping

Programme Outcome-PO VS Course Outcome-CO

Programme Outcome-PO Course Outcome-CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓					
CO2	✓		✓			
CO3	✓		✓		✓	
CO4			✓			✓
CO5		✓				
CO6				✓		✓
CO7						✓
CO8			✓			✓
CO9					✓	✓

DEPARTMENT OF COMPUTER SCIENCE

B.Sc., COMPUTER SCIENCE- REGULATION 2022

COURSE STRUCTURE

SEMESTER – I

Course Code	Course Title	L	T	P	C
THEORY					
22110AEC11/ 22111AEC11/ 22132AEC11/ 22135AEC11	Tamil – I/Advanced English-I/Hindi-I/ French – I	4	0	0	2
22111AEC12	English-I	4	0	0	2
22120SEC13	Visual Programming				
22112AEC14B	Classical algebra	4	1	0	3
22112AEC15B	Numerical and statistical Methods	4	1	0	4
PRACTICAL					
22120SEC16L	Visual Programming Lab				
	Total	**21**	**3**	**3**	**17**
AUDIT COURSE					
221LSCIC	Indian Constitution	-	-	-	**2**
221LSCUV	Universal Human Values	-	-	-	**2**

SEMESTER – II

Course Code	Course Title	L	T	P	C
THEORY					
22110AEC21/ 22111AEC21/ 22132AEC21/ 22135AEC21	Tamil – II/ Advanced English-II/Hindi-II/ French – II	4	0	0	2
22111AEC22	English-II	4	0	0	2
22120SEC23	Internet and Java Programming	5	1	0	4
22112AEC24B	Discrete Mathematics	4	1	0	4
22112AEC25B	Operations Research	4	1	0	3
PRACTICAL					
22120SEC26L	Internet and Java Programming Lab	0	0	3	2
RESEARCH SKILL BASED COURSE					
22120RLC27	Research Led Seminar	-	-	-	1
	Total	**21**	**3**	**3**	**18**
AUDIT COURSES					
221LSCCS	Communication Skills	-	-	-	**2**
221SSCBE	Basic Behavioral Etiquette	-	-	-	**2**

SEMESTER – III

Course Code	Course Title	L	T	P	C
THEORY					
22110AEC31/ 22132AEC31/ 22111AEC31/ 22135AEC31	Tamil – III/Hindi-III/Advanced English-III/ French – III	4	0	0	2
22111AEC32	English-III	4	0	0	2
22120SEC33	Problem Solving using Python				
22113AEC34A	Applied Physics –I	4	1	0	5
PRACTICAL					
22120SEC35L	Problem Solving using Python Lab				
22113AEC36AL	Applied physics Lab – I	0	0	3	2
RESEARCH SKILL BASED COURSE					
22120RMC37	Research Methodology	2	0	0	2
	Total	**18**	**2**	**6**	**19**
AUDIT COURSE					
221LSCOAN	Office Automation	-	-	-	**2**

SEMESTER – IV

Course Code	Course Title	L	T	P	C
THEORY					
22110AEC41/ 22111AEC41/ 22132AEC41/ 19135AEC41	Tamil-IV/Advanced English-IV /Hindi-IV/ French – IV	4	0	0	2
22111AEC42	English-IV	4	0	0	2
22120SEC43	Active Server Programming	4	1	0	4
22120SEC43	Java and Data structures				
22113AEC44A	Applied Physics –II	5	1	0	5
221EVNSTU	Environmental Studies	2	0	0	2
PRACTICAL					
22120SEC45L	Java and Data structures Lab				
22120SEC46L	Active Server Programming Lab	0	0	3	2
22113AEC47AL	Applied Physics Lab –II	0	0	3	2
	Total	**19**	**2**	**6**	**19**
AUDIT COURSE					
221LSCLS	Leadership and Management Skills	-	-	-	**2**
221SSCAQ	General Aptitude and Quantitative Ability				**2**

SEMESTER – V

Course Code	Course Title	L	T	P	C
	THEORY				
22120SEC51	Data Communication and Networking	4	1	0	4
22120SEC52	Operating System	4	1	0	3
22120SEC53	Microprocessor and its Applications	4	1	0	4
22120DSC54_	Discipline Specific Elective -I	4	1	0	3
	PRACTICAL				
22120SEC55L	Microprocessor Lab	0	0	3	2
22120SEC56L	Operating System Lab	0	0	3	2
	RESEARCH SKILL BASED COURSE				
22120BRC57	Participation in Bounded Research	-	-	-	1
	Total	**16**	**4**	**6**	**19**
	AUDIT COURSE				
221ACLSPSL	Professional Skills	-	-	-	**2**

SEMESTER – VI

Course Code	Course Title	L	T	P	C
THEORY					
22120SEC61	.NET Programming	4	1	0	4
22120SEC61	Advanced Web Technology				
22120SEC62	Relational Data Base Management System	4	1	0	5
22120DSC63 A	Discipline Specific Elective –II	4	1	0	3
221_ _OEC(2 Digit Course Name)	Open Elective	4	0	0	2
PRACTICAL					
22120SEC64L	.NET Programming Lab	0	0	3	2
22120SEC65L	Oracle Lab	0	0	3	2
22120PRW66	Project Work	-	-	-	4
22120PROEE	Program Exit Examination	-	-	-	1
	Total	**16**	**3**	**6**	**23**
AUDIT COURSE					
221SSCIM	Interview Skills Training and Mock Test	-	-	-	**2**
221LSCCE	Community Engagement	-	-	-	**1**
Total Credits –Programme					**115**
Total Credits - Audit Courses					**19**

Discipline Specific Electives

Semester	Discipline Specific Elective Courses
V	a)22120DSC54A- Cloud Computing b)22120DSC54B- Middleware Technology c)22120DSC54C- Enterprise Resource Planning d) 22120DSC54D-Semantic Web
VI	a) 22120DSC63A- Data Mining b) 22120DSC63B-Artificial Intelligence and Expert System c)22120DSC63C-Ethical Hacking

Open Electives

Semester	Open Elective Courses
VI	a) 221TAOEC-Tamil IlakkiyaVaralaru b) 221MAOEC-Development of Mathematical Skills c) 221PHOEC-Instrumentation d) 221CHOEC-Food and Adulteration e) 221MBOEC-Wildlife Conservation f) 221CSOEC-Web Technology g) 221CMOEC-Banking Service

Course Code	Course Title	L	T	P	C
22110AEC11	Tamil-I	4	0	0	2

முதல் பருவம் - தாள் - I

இக்கால இலக்கியம், செய்யுள், சிறுகதை, இலக்கணம், இலக்கிய வரலாறு மனப்பாடப்பகுதி

அலகு – I

பாரதியார் தேசபக்திப் பாடல்கள்

சுதந்திரப் பெருமை

சுதந்திரப் பயிர்

சுதந்திர தேவியின் துதி

தொண்டு செய்யும் அடிமை

பாரதிதாசன்

வீரத்தாய்

அலகு – II

சுரதா – நல்ல தீர்ப்பு

கண்ணதாசன் - கந்தல் துணியின் கதை

பட்டுக்கோட்டை கல்யாணசுந்தரம் - நன்டு செய்த தொண்டு – காலம் சரியில்லே

மு.மேத்தா – வாழையடி வாழை

வாலி – தாய்

அலகு – III

சிறுகதை - இளவேனிற் குறிப்புகள் - திருவையாறு பாலகுமார்

அலகு – IV

இலக்கணம்

எழுத்து

மனப்பாடப்பகுதி

அலகு – V

இலக்கிய வரலாறு

சிறுகதை, புதினம், நாடகம், உரைநடை, கவிதைபுதுக்கவிதை

தாள் - I

ஒப்படைவு – மதிப்பெண் 40

பாடத்தொடர்புடைய கட்டுரை – 20 மதிப்பெண்

ஆத்திச்சூடி – 20 மதிப்பெண்

அறம் செய விரும்பு, ஆறுவது சினம், இயல்வது கரவேல், ஈவது விலக்கேல், உடையது விளம்பேல், ஊக்கமது கைவிடேல், எண் எழுத்து இகழேல்,ஏற்பது இகழ்ச்சி, ஐயம் இட்டு உண், ஒப்புரவு ஒழுகு, ஓதுவது ஒழியேல்,ஔவியம் பேசேல், கண்டு ஒன்று சொல்லேல், ஞயம்பட உரை, இடம்பட வீடு எடேல், இணக்கம் அறிந்து இணங்கு, தந்தை தாய்பேன்நன்றி மறவேல்,பருவத்தே பயிர்செய், இயல்பு அலாதன செயேல்,வஞ்சகம் பேசேல்,இளமையில் கல்,அனந்தல்ஆடேல்,கடிவது மற,கீழ்மை

அகற்று,குணமது கைவிடேல்,கெடுப்பது ஒழி, கேள்வி முயல்,சான்றோர் இனத்து இரு, சோம்பித்திரியேல்.

(மேற்கண்ட தலைப்புகளில் ஏதேனும் ஒன்றனுக்கு கவிதை(மரபு அல்லது புதுக்கவிதை) கதை,கட்டுரை,நாடகம் எழுதி வரச் செய்து சரிப்பார்த்து மதிப்பெண் வழங்கிடவும்)

OURSE CODE	COURSE TITLE	L	T	P	C
22111AEC11	Advanced English-I	4	0	0	2

Aim:

- To improve the knowledge of English

Objective:

- To familiarize with the glossary terms, figures of speech
- To improve vocabulary
- To learn how to edit and proof read
- To know the comparison and contrast and cause and effect forms
- To understand the impact of the speeches of famous people

Outcome:

- Develop vocabulary
- Read and comprehend literature

UNIT –I

Glossary of grammar terms

Figures of speech

UNIT – II

Foreign words and phrases

British and American Vocabulary

UNIT – III

Speeches of famous people:

Mahatma Gandhi-Abraham Lincoln-Swami Vivekananda-John F. Kennedy

UNIT – IV

Editing

Proof reading

UNIT – V

Comparison and contrast
Cause and effect

References:

English Grammar	-Wren and Martin
English Grammar and Composition	-Radhakrishna Pillai
Essentials of Business Communication	-Rajendra Pal &J.S Korlahalli Sultan Chand & Sons
English for writers and translators	-Robin Macpherson
Technical Communication	-Meenakshi Sharma & Sangeetha Sharma
The World's Great Speeches	- Sudhir Kumar Sharma Galaxy Publishers
English Work Book-I&II	-Jewelcy Jawahar

Course Code	Course Title	L	T	P	C
22111AEC12	English-I	4	0	0	2

AIM:

- To acquaint students with learning English through literature

OBJECTIVE:

- To improve English delightfully through simple poems, essays
- To throw light on fiction
- To read and comprehend literature

UNIT –I

The Art of Reading - Lin Yutang

An Eco-Feminist Vision -Aruna Gnanadason

UNIT – II

The Merchant of Death -Nanda Kishore Mishra & John Kennet

She Spoke for all Nature -Young world 'The Hindu'

UNIT –III

Because I could not Stop for Death -Emily Dickinson

Stopping by Woods on a Snowy Evening -Robert Frost

UNIT –IV

Enterprise -Nissim Ezekiel

Love poem for a wife -A.K Ramanujam

UNIT –V

Oliver Twist -Charles Dickens

OUTCOME:

- Read and comprehend literature

REFERENCES:-

The Art of Reading/ Experiencing Poetry. -S.Murugesan and Dr.K.Chellappan

Emerald Publishers

Course Code	Course Title	L	T	P	C
22120SEC13	**Visual Programming**	**4**	**1**	**0**	**4**

AIM:

To equip the students with principles of various visual programming environment

OBJECTIVE:

- To learn the basic principles of visual programming
- To study the necessary skills to create software solutions using visual programming
- Understood the Open Data Base Connectivity using Visual programming.
- To inculcate knowledge on Programming and Project Development using Visual Basic.

UNIT I

Visual Basic – Integrated Development Environment (IDE) features – VB editor – customizing the IDE – anatomy of a form working with form properties – setting form's properties – introducing form events and formmethods.

UNIT II

Variables in Visual Basic : Declaring variables – Data types – Null values, Error value – empty value – the scope of a variable – Module level variable – Constants – Creating your own constants – Scope of a constant – Converting data types – arrays – Declaring arrays – Fixed size arrays – Dynamic arrays – Preserve keywords – ReDim. Writing code in Visual Basic – The anatomy of a procedure – Subroutine and Functions – Language constructs – For…Next, The While loop, Select case…End select, Exit statement, with structure.

UNIT III

Selecting and Using controls – Introduction to standard controls: command buttons – Text boxes – labels – frames – option buttons – Check boxes – Scroll Bars – Timer – working with Common Dialog Control.

UNIT IV

The Image list control – the List view control – slider control – status bar control – Tool bar control – The Tree view control – Menu editor. –File System Controls (Drive, Dirlist, File List boxes).

UNIT V

OLE properties – OLE automation – building COM/OLE DLL servers – Data control – design time(for access – style databases) –programming with the data control– Database access – set using SQL –transaction control – testing the control – Open Database Connectivity.

OUTCOMES:

Upon completion of this course, the student will be able to:

- Design, create, build, and debug Visual Basic applications.
- Explore Visual Basic's Integrated Development Environment (IDE).
- Implement syntax rules in Visual Basic programs.
- Write Windows applications using forms, controls, and events
- Write and apply decision structures for determining different operations.
- Write and apply loop structures to perform repetitive tasks.

REFERENCE BOOKS:

1. Mohammed Azam, Programming with Visual Basic 6.0 – Vikas Publishing House Pvt Ltd – 2202(unit-I, unit-II)
2. Content Development Group, Visual Basic 6.0 – Tata McGraw Hill Publishing Company Limited – 2202(unit-III, unit-IV, unit-V)

Course code	Course Title	L	T	P	C
22112AEC14B	Classical Algebra	4	1	0	3

OBJECTIVES

To learn about the expansion of a Binomial Theorem for a rational index using vandermonde's theorem. Further we aim at learning problems to be solved using the different types in Binomial series .Understanding the relation between roots and coefficients of polynomial equations-symmetric functions-sum of r th power of the roots-two methods And Reciprocal equations-Descartes' rule of signs-simple problems.

UNIT-I

Binomial, exponential and logarithmic series (formulae only)- Summations.

UNIT-II

Non singular, symmetric, skew symmetric orthogonal, Hermition, skew Hermition and unitary matrices-characteristic equation, Eigen values, Eigen vector-Cayley Hamilton's theorem(proof not needed)-simple applications.

UNIT-III

Relation between roots and coefficients of polynomial equations-symmetric functions-sum of rth power of the roots-two methods.

UNIT-IV

Finding number and position of the real roots – Finding the nature and position of the roots (Cardans&Ferrar's method not included).

UNIT-V

Sum of the powers of the roots of the equation-Transformation of equation by given quantity,-formation of equations whose roots are diminished by h- formation of equations whose roots are equal in magnitude and opposite in sign.

Learning outcomes

By the end of this course, you should:

- Understand the theory of, and be able to solve problems in Cayley Hamilton Theorem, and finding the Eigen values & Eigen vectors
- be able to manipulate relation between root and coefficients, symmetric functions of the roots in terms of the coefficients and transformation of equation .
- be able to calculate summation related to Binomial, Exponential and Logarithmic series

REFERENCE BOOKS:

Algebra-T.K.M.Pillai, Vol1&2.

Course code	Course Title	L	T	P	C
22112AEC15B	Numerical And Statistical Methods	4	1	0	4

OBJECTIVES:

The roll of numerical analysis is to develop and analyze the numerical techniques. In this paper, different methods for finding the roots of algebraic and transcendental equations, solutions of simultaneous equations, solutions of ordinary differential equations Solution of Linear systems ,Numerical differentiation and integration interpolation with equql & unequal intervals are concentrated. Correlation coefficient and its properties Linear Regression and its properties, Test of significance would also be taught.

UNIT-I

Algebraic and transcendental equations-the iteration method –the Newton Raphson method-False Position method-the bisection method

UNIT-II

Interpolation-Finite difference –Newton's formulae for interpolation-Lagrange's formulae for interpolation-Gaussian elimination method –Gauss-Seidal method.

UNIT-III

Numerical different ion and integration-Maximum and minimum values of a tabulated functions-Trapezoidal rule-Simpson's rule –Numerical solution of ordinary differential equations-Euler's method –Runge Kutta methods-Predictor corrector method-Boundary value problems.

UNIT-IV .

INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS:

Single step methods – Taylor's series method – Euler's method – Modified Euler's method – Runge-Kutta method for solving (first, second , Third and 4th) order equations – Multi step methods

UNIT-V

Correlation Analysis:

Meaning and significance. Correlation and Causation, Types of correlation, Methods of studying simple correlation - Scatter diagram, Karl Pearson's coefficient of correlation, Spearman's Rank correlation coefficient.

REFERENCE BOOKS:

1. Introductory methods of numerical analysis S.S.Sastry, PHI
2. Fundamentals of mathematical statistics-S.C.Gupta & V.K.Kapoor.

Learning outcomes

By the end of this course, you should:

- be able to calculate the solution of algebraic and transcendental equations, Solutions of simultaneous equations,
- be able to calculate the area of the given curve

Course Code	Course Title	L	T	P	C
22120SEC16L	Visual Programming Lab	0	0	3	2

1. Simple exercises using standard controls.

2. Write a program to design a calendar of any year.

3. Write a program to expand and shrinking an object – while program is running.

4. Write a code to design and implement a scientific calculator.

5. Write a program to create animation by using move method and timer Object.

6. Write a program for preparing students mark list.

7. Write a program to populate the label entities using data bound control.

8. Write a program to expand and shrink Objects using timer control and move method

Course Outcomes:

- Design,create,build and debug visual basic applications.
- Apply arithmetic operations for displaying numeric output.
- Apply decision structures for determining different operations.
- Write windows applications using forms,controls and events.
- Create one and two dimensional arrays for sorting,calculating and displaying of data.

Write Visual Basic programs using object-oriented programming techniques including classes, objects, methods, instance variables, composition, and inheritance, and

Course Code	Course Title	L	T	P	C
221ACLSICN	Indian Constitution	-	-	-	2

OBJECTIVES:

- To make the students understand about the Democratic Rule and Parliamentarian administration.
- To appreciate the salient features of the Indian Constitution.
- To know the fundamental Rights and Constitutional Remedies.
- To make familiar with powers and positions of the Union Executive, Union Parliament and the Supreme Court.
- To exercise the adult franchise of voting and appreciate the Electoral system of Indian Democracy.

UNIT I:

The Making of Indian Constitution

The Constituent Assembly Organization Character – Work – Salient features of the constitution – Written and Detailed Constitution – Socialism – Secularism – Democracy and Republic.

UNIT II:

Fundamental Rights and Fundamental Duties of the Citizens

Right of Equality – Right of Freedom – Right against Exploitation – Right to Freedom of Religion – Cultural and Educational Rights – Right to Constitutional Remedies – Fundamental Duties .

UNIT III:

Directive Principles of State Policy

Socialism Principles – Gandhian Principles – Liberal and General Principles – Differences between Fundamental Rights and Directive principles.

UNIT IV:

The Union Executive, Union parliament and Supreme Court

Powers and positions of the President – Qualification Method of Election of President and vice president – Prime Minister RajyaSabha- LokSabha – The Supreme Court – High Court – Functions and position of Supreme court and High Court.

UNIT V:

State Council – Election System and Parliamentary Democracy in India

State council of Ministers – Chief Minister – Election system in India- Main features – Election Commission - Features of Indian Democracy.

OUTCOMES

- Democratic values and citizenship Training are gained.
- Awareness on Fundamental Rights are established.
- The functions of union Government and State Governments are learnt.
- The power and functions of the Judiciary learnt thoroughly.
- Appreciation of Democratic parliamentary Rule is learnt.

REFERENCE BOOKS:

1. Palekar S.A. Indian Constitution Government and polities, ABD Publications, India.
2. Aiyer Alladi, Krishnaswami, Constitution and fundamental rights 1955.
3. Markandan K.C. Directive Principles in the Indian Constitution 1966.
4. Kashyap Subash C Our Parliament, National Book, Trust New Delhi 1989.

Course Code	Course Title	L	T	P	C
221ACLSUHV	**Universal Human Values**	-	-	-	2

Aim:

This course aims at making learners conscious about universal human values in an integralmanner, without ignoring other aspects that are needed for learner's personality development.

Course Objectives :

The present course deals with meaning, purpose and relevance of universal human values and how to inculcate and practice them consciously to be a good human being and realiseone's potentials.

Course Outcomes :

By the end of the course the learners will be able to:

1. Know about universal human values and understand the importance of values in individual, social circles, career path, and national life.
2. Learn from case studies of lives of great and successful people who followed and practised human values and achieved self-actualisation.
3. Become conscious practitioners of human values.
4. Realise their potential as human beings and conduct themselves properly in the ways of the world.

Unit I

- Introduction:What is love? Formsoflove—forself, parents, family, friend, spouse, community, nation, humanity and other beings, both for living and non-living
- Love and compassion and inter-relatedness
- Love, compassion, empathy, sympathy and non-violence
- Individuals who are remembered in history for practicing compassion and love.
- Narratives and anecdotes from history, literature including local folklore
- Practicing love and compassion: What will learners learn gain if they practice love and compassion? What will learners lose if they don't practice love and compassion?
- Sharing learner's individual and/or group experience(s)
- Simulated Situations
- Casestudies

Unit II

- Introduction: What is truth? Universal truth, truth as value, truth as fact (veracity, sincerity, honesty among others)
- Individuals who are remembered in history for practicing thisvalue
- Narratives and anecdotes from history, literature including localfolklore
- Practicing Truth: What will learners learn/gain if they practice truth? What will learners lose if they don't practiceit?
- Learners' individual and/or group experience(s)

- Simulated situations
- Casestudies

Unit III

- Introduction: What is non-violence? Its need. Love, compassion, empathy sympathy for others as pre-requisites for non-violence
- Ahimsa as non-violence and non-killing
- Individuals and organisations that are known for their commitment to non-violence
- Narratives and anecdotesaboutnon-violence from history,and literature including local folklore
- Practicingnon-violence: What will learners learn/gain if they practice non- violence? What will learners lose if they don't practice it?
- Sharing learner's individual and/or group experience(s) about non-violence
- Simulated situations
- Casestudies

Unit IV

- Introduction: What is righteousness?
- Righteousness and *dharma*, Righteousness and Propriety
- Individuals who are remembered in history for practicing righteousness
- Narratives and anecdotes from history, literature including local folklore
- Practicing righteousness: What will learners learn/gain if they practice righteousness? What will learners lose if they don't practice it?
- Sharing learners' individual and/or group experience(s)
- Simulated situations
- Casestudies

Unit V

- Introduction: What is peace? Its need, relation with harmony and balance
- Individuals and organisations that are known for their commitment to peace
- Narratives and Anecdotes about peace from history, and literature including local folklore
- Practicing peace: What will learners learn/gain if they practice peace? What will learners lose if they don't practice it?
- Sharing learner's individual and/or group experience(s) about peace
- Simulatedsituations
- Casestudies

Unit VI

- Introduction: What is service? Forms of service for self, parents, family, friend, spouse, community, nation, humanity and other beings—living and non-living, persons in distress ordisaster.
- Individuals who are remembered in history for practicing this value.
- Narratives and anecdotes dealing with instances of service from history, literature including local folklore
- Practicingservice: What will learners learn/gain gain if they practice service? What will

learners lose if they don’t practice it?

- Sharing learners’ individual and/or group experience(s) regarding service
- Simulated situations
- Casestudies

Unit VII

- Introduction: What is renunciation? Renunciation and sacrifice. Self-restrainand Ways of overcoming greed. Renunciation with action as true renunciation

- Individuals who are remembered in history for practicing this value.
- Narratives and anecdotes from history and literature,including local folklore about individuals who are remembered for their sacrifice and renunciation.
- Practicing renunciation and sacrifice: What will learners learn/gain if they practice Renunciation and sacrifice? What will learners lose if they don’t practiceit?
- Sharing learners’ individual and/or group experience(s)
- Simulated situations
- Casestudies

Course Code	Course Title	L	T	P	C
22110AEC21	Tamil-II	4	0	0	2

தாள் - II

செய்யுள் - பக்தி இலக்கியம், சிற்றிலக்கியம், இலக்கணம், இலக்கிய வரலாறுமனப்பாடப்பகுதி

அலகு-I

திருஞானசம்பந்தர் தேவாரம் -இடரினும் தளரினும் - பதிகம்

திருநாவுக்கரசர் தேவாரம் - அன்னம் பாலிக்கும் தில்லை – பதிகம்

திருவாசகம் - கோயிற் திருப்பதிகம்

திருமந்திரம் - 25, 85, 139,238,250,252,270,724,2104,2716

திருஅருட்பா – தெய்வமணி மாலை 1,8,9

அலகு-II

நம்மாழ்வார் - 1 பாசுரம்- திருவாய்மொழி –எம்பெருமானுக்கு ஆட்படுதல் இன்பமே

பெரியாழ்வார் - 1 பாசுரம் - திருப்பல்லாண்டு – தாலப்பருவம்

நாச்சியார் திருமொழி -10 பாடல்கள்- ஆறாம் திருமொழி

அலகு-III

சிற்றிலக்கியம் , முக்கூடற்பள்ளு- வளமை, செழுமை

மதுரை மீனாட்சியம்மை பிள்ளைத்தமிழ் தாலப்பருவம்-ஐந்துபாடல்கள்

அலகு-IV

இலக்கணம்

சொல்

மனப்பாடப்பகுதி

அலகு-V

இலக்கிய வரலாறு

சைவ, வைணவ இலக்கியங்கள்

சிற்றிலக்கியம்.பள்ளு

பிள்ளைத்தமிழ்

பரணி

தாள் II

ஒப்படைவு – மதிப்பெண் 40 பாடத்தொடர்புடைய கட்டுரை 20 மதிப்பெண் கொன்றை வேந்தன்

20 **மதிப்பெண்**

அன்னையும் பிதாவும் முன்னறி தெய்வம், இல்லறம் அல்லது நல்லறம் அன்று, ஊருடன் பகைக்கின் வேருடன் கெடும்,ஏவா மக்கள் மூவா மருந்து,ஔவியம் பேசுதல் ஆக்கத்திற்கு அழிவு, அஃகமும் காசும் சிக்கனத்தோடு,கற்பெனப்படுவது சொல்திறம்பாமை,கிட்டாதாயின் வெட்டென மற,கீழோர் ஆயினும் தாழ உரை,குற்றம் பார்க்கின் சுற்றம் இல்லை, கூர் அம்பு ஆயினும் வீரியம் பேசேல், கெடுவது செய்யின் விடுவது கருமம், கைப்பொருள் தன்னின்,மெய்ப்பொருள் கல்வி,சீரைத்தேடின் ஏரைத்தேடு, சுற்றத்திற்கு அழகு சூழ இருத்தல்,சூதும் வாதும் வேதனை செய்யும்,சேமம்புகினும் யாமத்து உறங்கு, சோம்பர் என்பவர் தேம்பித்திரிவர், தந்தை சொல்மிக்க மந்திரம் இல்லை, தாயிற் சிறந்தது ஒரு கோவிலும் இல்லை, திரைகடல் ஓடியும் திரவியம் தேடு, தீராக் கோபம் போராய் முடியும், தோழனோடும் ஏழமை பேசேல்,நாடெங்கும் வாழக் கேடொன்றும் இல்லை,நீரகம் பொருந்திய ஊரகத்து இரு, பாலோடு ஆயினும் காலம் அறிந்து உண், பையச் சென்றால் வையம் தாங்கும், மருந்தே ஆயினும் விருந்தோடு உண், முற்பகல் செய்யின் பிற்பகல் விளையும், மேழிச் செல்வம் கோழைபடாது.(மேற்கண்ட தலைப்புகளில் ஏதேனும் ஒன்றனுக்கு கவிதை(மரபு அல்லது புதுக்கவிதை) கதை,கட்டுரை,நாடகம் எழுதி வரச் செய்து சரிப்பார்த்து மதிப்பெண் வழங்கிடவும்)

COURSE CODE	COURSE TITLE	L	T	P	C
22111AEC21	Advanced English-II	4	0	0	2

Aim:

- To improve the knowledge of English

Objective:

- To understand the format of e-mail, fax and memos
- To write itinerary, checklist, invitation, circular, instruction, recommendations
- To understand the impact of the biographies of famous people

Outcome:

- Develop writing skill
- Read and comprehend literature

UNIT –I

E-mail, Fax, Memos

UNIT – II

Itinerary, Checklist

UNIT – III

Invitation, Circular

UNIT – IV

Instruction, Recommendations

UNIT – V

Biographies of famous people:

Mother Teresa-Madam Curie-Charles Chaplin-Vikram Sarabhai

References:

English Grammar -Wren and Martin

English Grammar and Composition -Radhakrishna Pillai

Technical Communication -Meenakshi Sharma & Sangeetha Sharma

Inspiring Lives -Maruthi Publishers

English Work Book-I&II -Jewelcy Jawahar

Course Code	Course Title	L	T	P	C
22111AEC22	English-II	4	0	0	2

AIM:

- To acquaint learners with different trends of writing

OBJECTIVE:

- To empower students to acquire language skills through literature
- To enable the students to appreciate literature
- To develop the conversational skills through one act plays

UNIT – I

Ecology -A.K. Ramanujan

Gift -Alice Walker

The First Meeting -Sujata Bhatt

UNIT –II

Fueled -Marcie Hans

Asleep -Ernst Jandl

Buying and selling -Khalil Gibran

UNIT –III

The End of living and The Beginning of Survival - Chief Seattle

My Wood - E.M.Forster

The Meeting of Races - Rabindranath Tagore

UNIT – IV

The Refugee -K.A. Abbas

I Have a Dream -Martin Luther king

Those People Next Door -A.G. Gardiner

UNIT – V

Marriage is a private Affair -Chinua Achebe

The Fortune Teller -Karel Capek

Proposal -Anton Chekov

OUTCOME:

- Read and comprehend literature

REFERENCES:-

Gathered Wisdom -Gowri Sivaraman Emerald Publishers

Course Code	Course Title	L	T	P	C
22120SEC23	Internet and Java Programming	5	1	0	4

AIM

To equip the students with basic programming skill in Java

OBJECTIVE

- To understand the core principles of the Java Language
- To study about Graphics programming using java Language
- To learn visual tools to produce well designed, effective applications and applets.

UNIT-I

Introduction to the Internet - Internet Technologies - Internet Browsers

UNIT-II

Decision making and looping statements -Classes, Objects and Methods

UNIT-III

Arrays, strings and vectors- Interfaces: Multiple Inheritance – Packages: Putting classes together - Multithreaded Programming

UNIT-IV

Managing Errors and Exceptions - Applet programming- Graphics programming

UNIT-V

Managing Input/Output files in Java

OUTCOMES:

- Understand the format and use of objects.
- Understand basic input/output methods and their use.
- Understand object inheritance and its use.
- Understand development of JAVA applets vs. JAVA applications.
- Understand the use of various system libraries.

REFERENCE BOOKS:

1. "World Wide Web Design with HTML", C.Xavier, Tata McGraw-Hill Publishing Company Limited for Unit-1.

2. "Programming with Java", E.Balagurusamy, Tata McGraw-Hill Publishing Company Limited for Unit-2, 3, 4, 5.

Course code	Course Title	L	T	P	C
22112AEC24B	Discrete Mathematics	4	1	0	4

OBJECTIVES:

Algebraic structures like Groups ,cosets , different types of morphisms of groups fundamental thm of homomorphism are concentrated. Graph Theory is an integral part of Discrete Mathematics. It has applications to many fields, including computer science, physics, chemistry, psychology and sociology. In this course we teach basic topics in graph theory 22 such as Trees, Directed graphs, Connectivity, Euler tours are also concentrated

UNIT I

Groups- Types – Propertices Of Groups- Semi Groups-Monoids – Problem In Groups- Cyclic Groups And Subgroups .

UNIT-II

cosets & lagrange's thm-Normal groups and quotient groups- Different types of morphisms of groups fundamental thm of homomorphism.

UNIT III

Graph theory - Basic concepts- Finite and infinite graph – Incidence and degree ideas on vertices-Isomorphism-sub graphs – Walks – Paths and circuits.

Unit IV

Group theory: Groups, subgroups, generators and evaluation of powers, cosets and Lagrange's theorem, permutation groups and Burnside's theorem, isomorphism, automorphisms, homomorphism and normal subgroups, rings, integral domains and fields.

Unit V

Lattice theory: Lattices and algebras systems, principles of duality, basic properties of algebraic systems defined by lattices, distributive and complimented lattices, Boolean lattices and Boolean algebras, uniqueness of finite Boolean expressions, prepositional calculus. Coding theory: Coding of binary information and error detection, decoding and error correction.

REFERENCE BOOKS

1. **Algebra - Arumugan Issac**
2. **Graph theory – Narasingh deo**

Learning outcomes

By the end of this course, you should be able

- Understood the concept of Algebraic structures like Groups ,cosets , different types of morphisms of groups fundamental theorem of homomorphism

- Knowledge in Graph Theory
- Understood the properties of Graph Theory
- Understood the concept of Euler theorem and its applications.

Course Code	Course Title	L	T	P	C
22112AEC25B	Operations Research	4	1	0	3

OBJECTIVES:

Optimization is an important tool of modern applied mathematics. This course gives an idea to the student to recognize potential linear programming problems, to humiliate such problems as linear programming models, to employ the proper computational techniques to solve these problems, and to understand the mathematical aspects that tie together these elements of linear programming. The objective of this paper is to highlight the theoretical, computational and applied aspects of linear programming problems.

UNIT — I

Basic of operations research (OR) characteristics of OR - Necessity of OR in industry, OR and decision making - role of computers in OR Linear Programming: Formulations and graphical solution of (2 variable) canonical and standard terms of linear programming problem.

UNIT — II

Algibric Solution: Simplex methods — Charnes method of penality - Two phase simplex method.

UNIT — III

Transportation Model: Definition — Formulation and solution of transportation models the row — Minima,column minima, Matrix minima and Vogel's approximation method.

Assignment Model: Definition of assignment model— comparison with transportation model - Formulation and solution of assignment model

UNIT IV:

Transportation Problems Meaning –(Initial Basic Feasible Solution)Assumptions -Degenerate Solution -North -West Corner Method- Least Cost Method - -Assignment ProblemsFeatures - Transportation Problem Vs Assignment Problem -Hungarian Method (Simple Problems Only)

UNIT V: Game Theory Meaning- Types of Games- Basic Assumptions- Finding Value of Game for Pure Strategy - Mixed Strategy -Indeterminate Matrix and Average Method -Graphical Method -Pure Strategy- Saddle Point Payoff Matrix Value of Game (Simple Problems Only)

REFERENCES BOOK

1. Hamdy A. Taha: Operation Research - An Introduction 5th Edition, PHI, New Delhi 1996
2.Ackoff, R Land Sasieni, M.N: Fundamental of Operation research, John Wiley and sons, New york 1968.

Learning outcomes

By the end of this course,

- Students using OR techniques in business tools for decision making
- Students develop PERT and CPM networks and finding the shortest path
- Understand the concept of sequencing problems and game theory

Course Code	Course Title	L	T	P	C
22120SEC26L	Internet and Java Programming Lab	0	0	3	2

1. Simple programming using for, while, do-while, ternary and switch.
2. String handling using string and string buffer.
3. Inheritance.
4. Polymorphism
5. Interfaces and Packages
6. Data files(creation, processing)
7. Vector manipulation
8. Simple programs using Applets
9. Exercises using predefined and user defined exceptions
10. Graphics programs for drawing lines, rectangle, oval, string using Applets.

Course Outcome:

*To solve computational problems using basic constructs like if-else, control structures, array and strings.
*To implement relationships between classes and Usage in Data Structures.
*To evaluate user requirements for software functionality required to decide whether the Java programming language can meet user requirements.
*To develop software applications using Java programming language.
*Write modular, multithreading and event driven programming.
*Implement interfaces, inheritance, polymorphism, exception handling, file IO and multithreading as programming techniques for application development.

Course Code	Course Title	L	T	P	C
221ACLSCOS	Communication Skills	-	-	-	2

Aim:

Course Objectives :

This course has been developed with the following objectives:

1. Identify common communication problems that may be holding learnersback
2. Identify what their non-verbal messages are communicating toothers
3. Understand role of communication in teaching-learningprocess
4. Learning to communicate through the digitalmedia
5. Understand the importance of empatheticlistening
6. Explore communication beyondlanguage.

Course Outcome :

By the end of this program participants should have a clear understanding of what good communication skills are and what they can do to improve their abilities.

Unit I

- Techniques of effectivelistening
- Listening andcomprehension
- Probing questions
- Barriers tolistening

Unit II

- Pronunciation
- Enunciation
- Vocabulary
- Fluency
- CommonErrors

Unit III

- Techniques of effective reading
- Gathering ideas and information from a giventext

i. Identify the main claim of thetext
ii. Identify the purpose of thetext
iii. Identify the context of thetext
iv. Identify the conceptsmentioned

- Evaluating these ideas andinformation

i. Identify the arguments employed in thetext
ii. Identify the theories employed or assumed in thetext

- Interpret thetext

i. To understand what a textsays
ii. To understand what a textdoes

iii. To understand what a textmeans

Unit IV

- Clearly state theclaims
- Avoid ambiguity, vagueness, unwanted generalisations and over simplification of issues

- Provide backgroundinformation
- Effectively argue theclaim
- Provide evidence for theclaims
- Use examples to explainconcepts
- Followconvention
- Be properlysequenced
- Use proper signpostingtechniques
- Be well structured

i. Well-knit logicalsequence
ii. Narrativesequence
iii. Categorygroupings

- Different modesofWriting -

i. E-mails
ii. Proposal writing for HigherStudies
iii. Recording the proceedings ofmeetings
iv. Any other mode of writing relevant forlearners

Unit V

- Role of Digital literacy in professionallife
- Trends and opportunities in using digital technology inworkplace
- InternetBasics
- Introduction to MS Officetools

i. Paint
ii. Office
iii. Excel
iv. Powerpoint

Unit VI

- Introduction to social mediawebsites
- Advantages of socialmedia
- Ethics and etiquettes of socialmedia
- How to use Google searchbetter
- Effective ways of using SocialMedia
- Introduction to DigitalMarketing

Unit VII

- Meaning of non-verbalcommunication
- Introduction to modes of non-verbalcommunication
- Breaking the misbeliefs
- Open and Closed Bodylanguage
- Eye Contact and FacialExpression
- HandGestures
- Do's andDon'ts

- Learning fromexperts
- Activities-BasedLearning

Reference:

1. SenMadhucchanda (2210), *An Introduction to Critical Thinking*, Pearson,Delhi
2. Silvia P. J. (2207), *How to Read a Lot*, American Psychological Association, Washington DC

Course Code	Course Title	L	T	P	C
22110AEC31	Tamil-III	4	0	0	2

தாள் - III

செய்யுள் - காப்பியங்கள், இலக்கணம்இலக்கிய வரலாறு, மனப்பாடப்பகுதி

அலகு-I

சிலப்பதிகாரம்-வழக்குரை காதை **மணிமேகலை**-ஆதிரை பிச்சையிட்ட காதை

சீவகசிந்தாமணி-நாட்டுவளம் 10 பாடல்கள்

அலகு-II

பெரியபுராணம்- மெய்ப்பொருள் நாயனார் புராணம். கம்பராமாயணம்-வாலி வதைப்படலம்

அலகு-III

சீறாப்புராணம் - கரம் பொருத்து படலம். **இயேசுகாவியம்** - மழைப்பொழிவு

அலகு-IV

இலக்கணம்

யாப்பு

மனப்பாடப்பகுதி

அலகு-V

இலக்கிய வரலாறு

காப்பியங்கள்

ஐஞ்சிறுகாப்பியங்கள்

புராணங்கள், இதிகாசங்கள்

தாள் - III

ஓப்படைவு – மதிப்பெண் 40

பாடத்தொடர்புடையக் கட்டுரை 20 மதிப்பெண்

வெற்றி வேற்கை 20 மதிப்பெண்

எழுத்து அறிவித்தவன் இறைவன் ஆகும், கவ்விக்கு அழகு கசடற மொழிதல், செல்வர்க்கு அழகு செழுங்கிளை தாங்குதல், மன்னவர்க்கு அழகு செங்கோல் முறைமை, வைசியர்க்கு அழகு வளர் பொருள் ஈட்டல், உழவர்க்கு அழகு உழுது ஊண் விரும்பல், மந்திரிக்கு அழகு வரும் பொருள் உரைத்தல், தந்திரிக்கு அழகு தறுகண் ஆண்மை, உண்டிக்கு அழகு விருந்தோடு உண்டல், பெண்டிர்க்கு அழகு எதிர் பேசாதிருத்தல்,அறிஞர்க்கு அழகு கற்றுணர்ந்து அடங்கல், வறிஞர்க்கு அழகு வறுமையில் செம்மை, பெரியோர் எல்லாம் பெரியோரும் அல்லர்.சிறியோர் எல்லாம் சிறியரும் அல்லர்,அடினும் ஆவின் பால் தன் சுவை குன்றாது, சுடினும் செம்பொன் தன்னொளி கெடாது, அறைக்கினும் சந்தனம் தன் மனம் மாறாது பெருமையும் சிறுமையும் தான் தர வருமே, அறிவுடை ஒருவனை அரசும் விரும்பு, யானைக்கு இல்லை தானமும், தருமமும்,பூனைக்கு இல்லை தவமும் தயையும், ஞானிக்கு இல்லை இன்பமும் துன்பமும் , அச்சமும் நாணமும் அறிவிலோருக்கு இல்லை, நாளும் கிழமையும் நலிந்தோருக்கு இல்லை, கேளும் கிளையும் கெட்டோருக்கு இல்லை,உடைமையும் வறுமையும் ஒரு வழி நில்லா,இரந்தோர்க்கு ஈவதும் உடையோர் கடனே,பழியா வருவது மொழியாது ஒழிவது, சுழியா வருபுனல் இழியாது ஒழிவது, துணையோடு அல்லது நெடுவழி போகேல்.

(மேற்கண்ட தலைப்புகளில் ஏதேனும் ஒன்றனுக்கு கவிதை(மரபு அல்லது புதுக்கவிதை) கதை,கட்டுரை,நாடகம் எழுதி வரச் செய்து சரிப்பார்த்து மதிப்பெண் வழங்கிடவும்)

COURSE CODE	COURSE TITLE	L	T	P	C
22111AEC31	Advanced English-III	4	0	0	2

Aim:

- To improve the knowledge of English

Objective:

- To familiarize with the organs of speech and the description and classification of speech sounds
- To understand consonant cluster, syllable, word accent and intonation.
- To know how to interpret graphics
- To write slogans and advertisements

Outcome:

- Understand Phonetics
- Develop writing skill

UNIT –I

The organs of speech, Classification of speech sounds , Vowels and Diphthongs

UNIT –II

Consonants, Consonant cluster

UNIT – III

Syllable, Word accent, Intonation

UNIT – IV

Idiom, Interpretation of graphics

UNIT – V

Slogan writing, Writing advertisement

References:

English Grammar -Wren and Martin
English Grammar and Composition -Radhakrishna Pillai
Technical Communication -Meenakshi Sharma & Sangeetha Sharma
A text book of Phonetics for Indian Students -T.B. Balasubramaniyan

Course Code	Course Title	L	T	P	C
22111AEC32	English-III	4	0	0	2

AIM:
- To acquaint students with learning English through literature

OBJECTIVE:
- To sensitize students to language use through prescribed text
- To develop the conversational skills through one act plays

OUTCOME:
- Read and comprehend literature

UNIT – 1
The Doctor's World - R.K. Narayan
The Postmaster - Rabindranath Tagore
Princess September - E.Somerest Maugham

UNIT – II
The Price of Flowers -Prabhat Kumar Mukhopadhyay
The Open Window -Saki
The Model Millionaire -Oscar Wilde

UNIT –III
My Brother My Brother - Norah Burke
Uneasy Home Coming - Will F. Jenkins
Resignation - Premchand

UNIT –IV
The Referee -W.H. Andrews & Geoffrey Dreamer
The Case of the Stolen Diamonds -Farrell Mitchell

UNIT – V
The Dear Departed -Stanley Houghton
The Princess and the Wood Cutter -Alan Alexander Milne

REFERENCES:-
Nine Short Stories -Steuart H.King Blackie Books
One-Act plays of Today -T.Prabhakar Emerald Publishers

Course Code	Course Title	L	T	P	C
22120SEC33	**PROBLEM SOLVING USING PYTHON**	0	0	3	4

OBJECTIVES:

- Describe the core syntax and semantics of Python programming language.
- Discover the need for working with the strings and functions.
- Illustrate the process of structuring the data using lists, dictionaries, tuples and sets.
- Understand the usage of packages and Dictionaries.

OUTCOMES:

- To understand the principles of Python and acquire skills in programming in python
- To develop the emerging applications of relevant field using Python
- Interpret the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements.
- Able to develop simple turtle graphics programs in Python

UNIT – I

Introduction: The essence of computational problem solving – Limits of computational problem solving-Computer algorithms-The process of computational problem solving-Python programming language - Literals - Variables and Identifiers - Operators - Expressions and Data types.

UNIT - II

Control Structures: Boolean Expressions - Selection Control - If Statement- Indentation in Python- Multi-Way Selection -- Iterative Control- While Statement- Infinite loops- Definite vs. Indefinite Loops- Boolean Flags and Indefinite Loops. Lists: List Structures - Lists in Python - Iterating over lists in Python.

UNIT - III

Functions: Program Routines- Defining Functions- More on Functions: Calling Value-Returning Functions- Calling Non-Value-Returning Functions- Parameter Passing - Keyword Arguments in Python – **UNIT - V**

Objects and their use: Software Objects - Turtle Graphics – Turtle attributes-Modular Design: Modules - Top-Down Design - Python Modules.

UNIT - V

Dictionaries and Sets: Dictionary type in Python - Set Data type. Object Oriented Programming using Python: Encapsulation - Inheritance – Polymorphism.

TEXT BOOKS

1. Charles Dierbach, "Introduction to Computer Science using Python - A computational Problem solving Focus", Wiley India Edition, 2215.

REFERENCE BOOKS:

1. Mark Lutz, "*Learning Python Powerful Object Oriented Programming*", O'reilly Media 2218, 5th Edition.
2. Timothy A. Budd, "*Exploring Python*", Tata MCGraw Hill Education Private Limited 2211, 1st Edition.
3. Allen Downey, Jeffrey Elkner, Chris Meyers, "*How to think like a computer scientist: learning with Python*", 2212.
4. Sheetal Taneja & Naveen kumar, "*Python Programming a Modular approach – A Modular approach with Graphics, Database, Mobile and Web applications*", Pearson, 2217.
5. Ch Satyanarayana M Radhika Mani, B N Jagadesh, "*Python programming*", Universities Press

Course Code	Course Title	L	T	P	C
22113AEC34A	Applied physics –I	4	1	0	5

AIM

To provide students with a broad and balanced foundation of physics knowledge and Practical Skill.

OBJECTIVES:

- To develop in students through an education in Physics a range of transferable skills of Value in physics and other areas.
- To instill in students a sense of enthusiasm for physics, and appreciation of its applications in different contexts.
- To provide students with a knowledge and skills base for further studies in physics or multi-disciplinary areas involving physics.

UNIT – I: ELECTROSTATICS

Gauss theorem and its application – Intensity at a point due to uniformly charged cylinders – Electrostatic potential – Equipotential surface – Capacitor – Principle of a capacitor – Spherical and cylindrical capacitors – Capacitors in series and in parallel – Energy of a charged capacitor – Energy loss due to sharing of charges.

UNIT – II: MAGNETOSTATICS

Magnetic field – Intensity of magnetization – Permeiability – Susceptibility – Relation between them – Potential due to dipole – Relation between potential and intensity – Properties of dia, para, fero magnetic matterials – Hysteresis – B.H curve.

UNIT – III: CURRENT ELECTRICITY

Ohm's law – Kirchoff's law – Application to Wheatstone's Bridge – Carey Foster Bridge – Potentiometer – Measurement of current and resistance – Calibration of low and high range voltmeter – Fleming's left and right hand rule – Theory of moving coil galvanometer – Ballistic galvanometers.

UNIT – IV:

Fundamentals of Laser: Characteristics of Laser, Types of Lasers & Applications: Solid State Laser-Ruby laser, Gas Laser- He-Ne Laser, Semiconductor Laser. Applications of Lasers: Drilling, welding, micro machining, measurement of long distances, in CD write devices & printers.

UNIT – V:

Imaging Techniques: Classification (visible, IR, electron, magnetic, UV/X-rays, gamma rays, microwaves); Imaging importance, Types of imaging - Microscopes, Telescopes.

Learning Outcomes:

Cognitive abilities and skills relating to solution of problems in Physics and Physics Related Disciplines Practical skills relating to the conduct of laboratory and industrial work in General skills relating to non-subject specific competencies, communication, ICT knowledge, interpersonal, organization skills and ethical standards.

REFERENCE BOOK:

1) Electricity and Magnetism – Brijlal and Subramaniam.
2) Electricity and Magnetism – Narayanamoorthi and Nagarathnam.
3) Electricity and Magnetism – D.L. Seghal and Chopra.

Course Code	Course Title	L	T	P	C
22120SEC35L	**PROBLEM SOLVING USING PYTHON LAB**	0	0	3	4

- **OBJECTIVES:**
- To implement the python programming features in practical applications.
- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries , turtles, Files and modules.
- **OUTCOMES:**
- Understand the numeric or real life application problems and solve them.
- Apply a solution clearly and accurately in a program using Python.
- Apply the best features available in Python to solve the situational problems.
- **LIST OF EXERCISES:**
- 1. Program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user’s choice.
- 2. Program to calculate total marks, percentage and grade of a student. Marks obtained in each of the five subjects are to be input by user. Assign grades according to the following criteria:
- Grade A: Percentage >=80 Grade B: Percentage >=70 and <80
- Grade C: Percentage >=60 and <70 Grade D: Percentage >=40 and <60
- Grade E: Percentage <40
- 3. Program, to find the area of rectangle, square, circle and triangle by accepting suitable input parameters from user.
- 4. Program to display the first n terms of Fibonacci series.
- 5. Program to find factorial of the given number using recursive function.
- 6. Write a Python program to count the number of even and odd numbers from array of N numbers.
- 7. Python function that accepts a string and calculate the number of upper case letters and lower case letters.
- 8. Python program to reverse a given string and check whether the give string is palindrome or not.
- 9. Write a program to find sum of all items in a dictionary.
- 10. Read a file content and copy only the contents at odd lines into a new file.

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Course Code	Course Title	L	T	P	C
22113AEC36AL	Applied physics Lab-I	0	0	3	2

1. Semiconductor diode Characteristics
2. Zener diode characteristics
3. Transister characteristics –CE Configuration
4. IC Regulated power supply
5. Post office Box-Resistance
6. Figure of merit of galvanometer.
7. Potentiometer- Ammeter Calibration
8. Potentiometer- Voltmeter Calibration
9. Zener Regulated Power supply.
10. Carey foster bridge

Course Outcomes:

- Practical skills relating to the conduct of laboratory and industrial work in
- General skills relating to non-subject specific competencies, communication, ICT knowledge, interpersonal, organization skills and ethical standards.
- Demonstrate a working knowledge of the basic concepts and theories of physics.
- Formulate hypotheses and devise and perform experiments to test a hypothesis as individuals and in a team.
- Effectively apply current technology and scientific methodologies for problem solving in various scientific, professional and community settings.
- Cognitive abilities and skills relating to solution of problems in Physics and Physics Related Disciplines

Course Code	Course Title	L	T	P	C
22120RMC37	Research Methodology	2	0	0	2

AIM:

To create a basic appreciation towards research process and awareness of various research publication.

OBJECTIVES:

- To understand the steps in research process and the suitable methods.
- To identify various research communications and their salient features
- To carry out basic literature survey using the common data-based
- To give exposure to MATLAB platform for effective computational and graphic works required for quality research

PREREQUISITIES:

Basic computer skill for working in window environment & conceptual knowledge on basic matrices.

UNIT-I Introduction to Research Methodology

Meaning of research – Objectives of research – Type of research – Significance of research – Research approaches.

UNIT-II Research Methods

Research methods versus Methodology – Research and scientific method – criteria of good research – Problems encountered by researchers in India.

UNIT-III Literature Survey

Articles – Thesis – Journals – Patents – Primary sources of journals and patents – Secondary sources – Listing of titles – Abstracts – Review – General treatises – Monographs.

UNIT-IV Database Survey

Database search – NIST –MSDS –PubMed – Scopus – Science citation index – Information about a specific search.

UNIT-V Introduction to MATLAB:

What is MATLAB? Matrix and its application in different areas: MATLAB approach to environmental modeling; Arithmetic Matrix – Operators; Arithmetic Array – Operators and its applications in MATLAB; Expressions, Opening M-Files; Structure of MATLAB Programming; Programming; Concatenation of strings; Vectorization ; Basic Graphics.

OUTCOME:

Ability to carry out independent literature survey corresponding to the specific publication type and assess basic computation frame works used in mathematical researches.

REFERENCES BOOK:

1. C.R. Kothari, Research Methodology, New Age International publishers. New Delhi,2204.
2. R.A Day and A.L. Underwood, Quantitative analysis, Prentice Hall, 1999.
3. R. Gopalan, Thesis writing, Vijay Nicole Imprints Private Ltd., 2205.
4. A Guide to MATLAB: For Beginners and experienced Users by Brian R. Hunt (Editor), Ronald L. Lipsman, J. Rosenberg
5. Introduction to MATLAB for Engineers by William J. Palm III.

Course Code	Course Title	L	T	P	C
221ACLSOAN	OFFICE AUTOMATION	-	-	-	2

Aim:

Course Objectives :

To provide an in-depth training in use of office automation, internet and internet tools. The course also helps the candidates to get acquainted with IT.

Course Outcomes:

After completion of the course, students would be able to documents, spreadsheets, make small presentations and would be acquainted with internet.

UNIT I

Knowing the basics of Computers

UNIT II

Word Processing (MS word)

UNIT III

Spread Sheet (MS XL)

UNIT IV

Presentation (MS Power Point)

UNIT V

Communicating with Internet

Reference:

1. Fundamentals of computers - V.Rajaraman - Prentice- Hall of india

2. Microsoft Office 2207 Bible - John Walkenbach,Herb Tyson,Faithe Wempen,cary N.Prague,Michael R.groh,Peter G.Aitken, and Lisa a.Bucki -Wiley India pvt.ltd.

3. Introduction to Information Technology - Alexis Leon, Mathews Leon, and Leena Leon, Vijay Nicole Imprints Pvt. Ltd., 2213.

4. Computer Fundamentals - P. K. Sinha Publisher: BPB Publications

5. https://en.wikipedia.org

6. https://wiki.openoffice.org/wiki/Documentation

7. http://windows.microsoft.com/en-in/windows/windows-basics-all-topics

Course Code	Course Title	L	T	P	C
22110AEC41	Tamil-IV	4	0	0	2

தாள் - IV

செய்யுள்- சங்க இலக்கியம், இலக்கணம்,இலக்கிய வரலாறு-மனப்பாடப் பகுதி

அலகு-I

எட்டுத்தொகை

நற்றினை – குறிஞ்சி 356,முல்லை-242, பாலை-397

குறுந்தொகை-2,18,25,58,67,69,135,167,283,373

ஐங்குறுநூறு- சிறுவெண் காக்கைப் பத்து

அலகு-II

கலித்தொகை-பாலை 34,குறிஞ்சி-51,நெய்தல்-133

அகநானூறு - 36,147,332

புறநானூறு- 34,173,189,235,279

அலகு-III

முல்லைப்பாட்டு

திருக்குறள்-ஐந்து அதிகாரம்- அறம் 2,பொருள் 2,இன்பம் -1 வான்சிறப்பு,அழுக்காறாமை,இறைமாட்சி,கூடாநட்பு,காதற்சிறப்புரைத்தல்

அலகு-IV

இலக்கணம்

அணி

மனப்பாடப்பகுதி

அலகு-V

இலக்கிய வரலாறு

எட்டுத்தொகை

பத்துப்பாட்டு

அறஇலக்கியங்கள்

தாள் - IV

ஒப்படைவு மதிப்பெண்-40

பாடத்தொடர்புடைய கட்டுரை 20 மதிப்பெண்

பாரதியார், பாரதிதாசன் புதிய ஆத்திச்சூடி 20 மதிப்பெண்

பாரதியார்

அச்சம் தவிர்,ஆண்மை தவறேல்,இளைத்தல் இகழ்ச்சி,உடலினை உறுதி செய்,எண்ணுவது உயர்வு,ஏறுபோல் நட,ஐம்பொறி ஆட்சி கொள்,ஒற்றுமை வலிமையாம்,காலம் அழியேல்,கீழோருக்கு அஞ்சேல்,குன்றென நிமிர்ந்து நில்,கொடுமையை எதிர்த்து நில், சிதையா நெஞ்சு கொள்,செய்வது துணிந்து செய், தீயோருக்கு அஞ்சேல்,பெரிதினும் பெரிது கேள்,வையத்தலைமை கொள்,யாரையும் மதித்து வாழ்

பாரதிதாசன்

காற்றினைத் தூய்மை செய்,குற்ற நினைவு தீர்,தளையினைக் களைந்து வாழ் தூய நீராடு, தெருவெல்லாம் மரம் வளர்,தைக்க இனிதுரை,தொன்மை மாற்று,நினைவினில் தெளிவு கொள், நீனிலம் உன் இல்லம்,போர்த் தொழில் பழகு,மாறுவது இயற்கை, வையம் வாழ வாழ்.

(மேற்கண்ட தலைப்புகளில் ஏதேனும் ஒன்றனுக்கு கவிதை(மரபு அல்லது புதுக்கவிதை) கதை,கட்டுரை,நாடகம் எழுதி வரச் செய்து சரிப்பார்த்து மதிப்பெண் வழங்கிடவும்

Course Outcomes:

- Realize how the ancient people changed their life style according to the ages
- Learn how to change one’s lifestyle according to the needs of the future
- Accept the modern trend and its uses.
- Obtaining More information about one’s culture and tradition;
- Encourage creative writing and developing self-confidence.
- Aiming at enriching human excellence.

COURSE CODE	COURSE TITLE	L	T	P	C
22111AEC41	Advanced English-IV	4	0	0	2

Aim:

- To improve the knowledge of English

Objective:

- To familiarize with the objectives and types of interview
- To know the types of questions and answering techniques
- To prepare reviews and proposals
- To learn the grammatical forms
- To understand the meaning of a poem and write the content
- To write for and against a topic
- To draw a flowchart
- To write definitions

Outcome:

- Develop communicative skill
- Read and comprehend literature

UNIT –I

Interviews

Objectives, types, ten success factors, ten failure factors - Planning and preparation –Presentation– Type of questions – Answering techniques.

UNIT – II

Flowchart

Proposals

UNIT – III

Discourse markers

Review

UNIT IV

Grammatical forms

Paraphrasing

UNIT –V

Definition

Writing for and against a topic.

References:

English Grammar -Wren and Martin

English Grammar and Composition -Radhakrishna Pillai

Essentials of Business Communication -Rajendra Pal &J.S Korlahalli Sultan Chand & Sons

Technical Communication -Meenakshi Sharma & Sangeetha Sharma

English for writers and translators -Robin Macpherson

English Work Book-I&II -Jewelcy Jawahar

Course Code	Course Title	L	T	P	C
22111AEC42	English-IV	4	0	0	2

AIM:

To acquaint students with learning English through literature

OBJECTIVE:

- To introduce learners to the standard literary texts
- To impart wisdom through morally sound poems and essays
- To introduce Shakespeare to non-literature students

UNIT –I

How to be a Doctor -Stephen Leacock

My Visions for India -A.P.J. Abdul Kalam

Woman, not the weaker sex -M.K. Gandhi

UNIT –II

My Last Duchess -Robert Browning

The Toys -Coventry Patmore

I, too -Langston Hughes

UNIT –III

The Best Investment I ever made-A.J.Cronin

The Verger -W.S Maugham

A Willing Slave -R.K.Narayan

UNIT –IV

Macbeth

As You Like It

UNIT –V

Henry IV Tempest

OUTCOME:

Read and comprehend literature

REFERENCES:-

English for Enrichment -.Devaraj Emerald Publishers

Selected Scenes from Shakespeare Book I &II -Emerald Publishers

Course Code	Course Title	L	T	P	C
22120SEC43	Active Server Programming	4	1	0	4

AIM

To equip the student to learn the Active Server Page

OBJECTIVE:

- To study about scripting languages concepts
- To understand scripting languages components
- To learn ADO cursors

UNIT I

Introduction to ASP-Active sever pages model-ASP file-The process of serving an active server page-Using scripting languages-Setting the primary scripting languages-Including other files-Understanding objects

UNIT II

Understanding components-Working with users-Working with HTML forms-retrieving form data-using text boxes and text areas

UNIT III

Cookies-Working with cookies-applications of cookies-addressing the drawbacks of using cookies-using cookies in ASP applications. Working with connections and data sources-creating connections with OLEDB and ODBC – connecting to Microsoft SQL server-Connecting to a Microsoft access database.

UNIT IV

Master Pages- Introduction to MasterPage- ContentPlaceHolder and Content tag- Accessing controls of MasterPage in ContentPage- URL's in MasterPages- UniqueID and ClientID.

UNIT V

Validation Controls - Base Validator - Required Field Validator - Compare Validator - Range Validator - Regular Expression Validator - Custom Validator - Causes Validation Property - Grouping - Validation Group Property - Page.Validators and Page.IsValid.

OUTCOMES

- Explain concepts of Active Server Pages.
- Apply methods and properties of various objects and components of ASP
- Develop Dynamic real life website using the concept of ADO and ASP.

REFERENCE BOOK:

1. Practical ASP-Ivan bayross, BPB Publications, 2200

2. Special Edition using Active Server Pages – Scot Johnson, Prentice Hall of India Private Limited 2201

Course Code	Course Title	L	T	P	C
22120SEC43	**Java and Data structures**	**4**	**1**	**0**	**4**

OBJECTIVES:

- To enable the students to learn the basic concepts of Java programming
- To use class and objects to create applications• To have an overview of interfaces, packages, multithreading and exceptions.
- To familiarize students with basic data structures and their use in algorithms.

OUTCOMES:

- Students will be able to develop Java Standalone applications and Applets.
- Choose the appropriate data structure for modeling a given problem.

UNIT - I

History and Evolution of Java - Features of Java - Object Oriented Concepts – Bytecode - Lexical Issues - Data Types – Variables- Type Conversion and Casting- Operators - Arithmetic Operators - Bitwise - Relational Operators - Assignment Operator - The conditional Operator - Operator Precedence- Control Statements – Arrays.

UNIT - II

Classes - Objects - Constructors - Overloading method - Static and fixed methods - Inner Classes - String Class- Overriding methods - Using super-Abstract class - this keyword – finalize() method – Garbage Collection.

UNIT – III

Packages - Access Protection - Importing Packages - Interfaces - Exception Handling - Throw and Throws-The Java Thread Model- Creating a Thread and Multiple Threads - Thread Priorities Synchronization-Inter thread Communication - Deadlock - Suspending, Resuming and stopping threads – Multithreading-I/O Streams - File Streams - Applets .

UNIT - IV

Abstract Data Types(ADTs)-List ADT-Array based implementation-linked list implementation-singly linked list-doubly linked list-circular linked list-Stack ADT operations-Applications-Evaluating arithmetic expressions-Conversion of infix to postfix expression-Queue ADT-operations-Applications of Queues.

UNIT - V

Trees-Binary Trees- representation - Operations on Binary Trees- Traversal of a Binary Tree -Binary Search Trees, Graphs-Representation of Graphs - Traversal in Graph -Dijkstra’s Algorithm, Depth-First vs Breadth- First Search.

TEXT BOOKS:

1. E.Balagurusamy,” Programming with Java: A Primer”, Tata McGraw Hill 2014, 5th Edition.

2. Mark Allen Weiss, “Data Structures and Algorithms Analysis in C++”, Person Education 2014, 4th Edition.

REFERENCES:

1. Herbert Schildt, “JAVA 2: The Complete Reference”, McGraw Hill 2018, 11th Edition.

2. Aho, Hopcroft and Ullman, “Data Structures and Algorithms “, Pearson Education 2003.

3. S. Sahni, “Data Structures, Algorithms and Applications in JAVA”, Universities Press 2005, 2nd Edition

Course Code	Course Title	L	T	P	C
22113AEC44A	Applied physics –II	5	1	0	5

AIM:

To prepare the student for the study of physics by introducing general concepts and methods this will be applied throughout the course.

OBJECTIVES:

- To introduce and develop the fundamental techniques of experiment in physics.
- Introduce the student to the basic concepts in electricity and magnetism.
- To expose the students to experiments in Light, Modern Physics, AC circuits, and Devices.
- To introduce the student to elementary alternating current circuits

UNIT – I: SEMI CONDUCTOR PHYSICS

Theory of Energy bands in crystals – Distinction between conductors, insulators and semiconductors – Hall effect in semi conductors – Zener diode – Tunnel diode – Backward diode – Breakdown voltage – Avalanche Breakdown.

UNIT – II: TRANSISTORS

NPN and PNP transistors – Characteristics of CE and CB configurations – H-Parameters – Transistor as an amplifier and oscillator – FET – N-Channel and P-Channel – FET Characteristics – FET amplifier.

UNIT – III: LASER AND MASERS

Basic concepts of stimulated emission – Principles of Laser – Population inversion and Meta stable state – Ammonia maser – Ruby laser and He-Ne laser production – Applications of laser and maser.

UNIT – IV: INTRINSIC AND EXTRINSIC SEMICONDUCTORS

Intrinsic and extrinsic semiconductors, Direct and indirect band gap semiconductors, Carrier concentration in intrinsic and extrinsic semiconductors.

Formation of PN junction, V-I characteristics of PN diode, energy diagram of PN diode, Hall experiment, semiconductor materials for optoelectronic devices - LED, Solar cell.

UNIT – V: DIELECTRICS

Introduction, Types of polarizations (Electronic and Ionic) and calculation of their polarizabilities, internal fields in a solid, Clausius-Mossotti relation.

Learning Outcomes:

The Applied Physics program will produce intellectually engaged graduates accomplished in application of fundamental physics principles, and prepared for direct entry into the workplace or continuing professional development. Demonstrate a working knowledge of the basic concepts and theories of physics.

REFERENCE BOOK:

1. Principles of Electronics – V.K. Metha, S. chand and Co.,
2. Electronic Devices and Circuits – Millman and Halkias.
3. The Fundamentals of solid state physics – Theraja.

Course Code	Course Title	L	T	P	C
221EVNSTU	Environmental Studies	2	0	0	2

AIM:
To create the awareness about environmental problems among the students.

OBJECTIVE:
- It deals with the study of flow of energy and materials in the environment
- It deals with the study of natural and its function

UNIT–I

The Multidisciplinary Nature of Environmental Studies – Definition, Scope and Importance - Need for public awareness - **Natural Resources: Renewable and Non-Renewable Resources** - Forest resources - Water resources - Mineral resources - Food resources - Energy resources - Land resources.

UNIT-II

Ecosystems - Concept of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Energy flow in the ecosystem - Ecological succession - Food chains, food webs and ecological pyramids - Types of ecosystem - Forest ecosystem - Grassland ecosystem - Desert ecosystem - Aquatic ecosystems.

UNIT-III

Biodiversity and its Conservation – Definition - Genetic, species and ecosystem diversity - Biogeographical classification of India - Values of biodiversity - Biodiversity at global, National and local levels - India as a mega - diversity nation - Hot-spots of biodiversity - Threats to biodiversity - Endangered and endemic species of India - Conversation of biodiversity.

UNIT-IV

Environmental Pollution – Definition - Air pollution - Water pollution - Soil pollution - Marine pollution - Noise pollution - Thermal pollution - Nuclear hazards - Solid waste Management - Role of an individual in prevention of pollution - Disaster management.

UNIT-V

Social Issues and the Environment - From Unsustainable to Sustainable development - Urban problems related to energy - Water conservation, rain water harvesting, watershed management - Environmental ethics - Climate change green house effect and global warming - Ozone depletion - Waste land reclamation - Consumerism and waste products - Environmental Legislation - Issues involved in enforcement of environmental legislation - Public awareness - **Human Population and the Environment**.

Course Outcomes:

- Understand key concepts from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions.
- Appreciate concepts and methods from ecological and physical sciences and their application in environmental problem solving.
- Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
- Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.

REFERENCE BOOK:

1. "ENVIRONMENTAL STUDIES", K.Kumarasamy, A.Alagappa Moses, M.Vasanthy.

Course Code	Course Title	L	T	P	C
22120SEC45L	**Data structures using Java Lab**	**0**	**0**	**3**	**2**

OBJECTIVES:

- To implement linear and non-linear data structures
- To understand the different operations of search trees
- To implement graph traversal algorithms

OUTCOMES:

- Write functions to implement linear and non-linear data structure operations.
- Suggest appropriate linear and non-linear data structure operations for solving a given problem.

LIST OF EXERCISES:

1. Write a Java program to implement the Stack ADT using a singly linked list.
2. Write a Java program to implement the Queue ADT using a singly linked list.
3. Write a Java program for the implementation of circular Queue.
4. Write a Java program that reads an infix expression, converts into postfix form
5. Write a Java program to evaluate the postfix expression (use stack ADT).
6. Write a Java program to an Insert an element into a binary search tree.
7. Write a Java program to delete an element from a binary search tree.
8. Write a Java program to search for a key element in a binary search tree.
9. Write a Java program for the implementation of BFS for a given graph.
10. Write a Java program for the implementation of DFS for a given graph.

Course Code	Course Title	L	T	P	C
22120SEC46L	Active Server Programming Lab	0	0	3	2

1. Create an ASP file to display the message “Have a good Week end” if it a Saturday other wise “Have a nice day”

2. Write an ASP program to get the rollno and display the corresponding name & mark details

3. Create a login form to expire if the user does not type the password within 100 seconds.

4. Create an advertisement for a book shop using Ad Rotator component.

5. Create a course registration form with name, address and list of available course. Reply with the corresponding course fees on selection of a single course or a collection of courses.

6. Write an ASP program to manipulate cookies with the information between HTTP sessions such as

   a. Last date visited

   b. Last Time visited

   c. Number of visits

7. Create a student database and manipulate the records using the connection object in ASP

8. Create an employee database and manipulate the records using command object in ASP

Course Outcomes:

Contrast and compare major elements of the .NET Framework and explain how C# fits into the .NET platform.

Analyze the basic structure of a C# application and be able to document, debug, compile, and run a simple application.

Create, name, and assign values to variables.

Use common statements to implement flow control, looping, and exception handling.

Create methods (functions and subroutines) that can return values and take parameters.

Create, initialize, and use arrays.

Course Code	Course Title	L	T	P	C
22113AEC47AL	Applied physics Lab –II	0	0	3	2

1) FET-Characteristics
2) Logic Gates-Universality of NOR Gate.
3) LCR — Series Resonance Circuit.
4) LCR parallel – resonance circuit.
5) OP AMP-Addition,Subtraction.
6) Verification basic logic gates.
7) Verification of Demorgon's theorem..
8) Half adder and Half subtractor.
9) Logic Gates-Universality of NAND Gate.
10) OP AMP Differentiator ,Intergrator.

Course Outcomes:

- Effectively use and critically evaluate current technical/scientific research literature, online information, as well as information related to scientific issues in the mass media.
- Integrate and relate scientific knowledge learned from classroom with real life situations.
- Communicate in written and oral forms with interested citizens and professionals on key concepts in physics and general scientific issues.
- Work cooperatively as part of a research team.
- Maintain life-long learning in the sciences and incorporate new information into the existing body of knowledge.
- Outline the applications of physics in industry and the role of physicists as entrepreneurs.

Course Code	Course Title	L	T	P	C
221ACLSLMS	Leadership and Management Skills	-	-	-	2

Aim:

The aim of the course cultivating and nurturing the innate leadership skills of the youth so that they may transform these challenges into opportunities and become torch bearers of the future by developing creative solutions.

Course Objective:

The Module is designed to**:**

- Help students to develop essential skills to influence and motivate others
- Inculcate emotional and social intelligence and integrative thinking for effective leadership
- Create and maintain an effective and motivated team to work for the society
- Nurture a creative and entrepreneurial mindset
- Make students understand the personal values and apply ethical principles in professional and social contexts.

Course Outcomes :

Upon completion of the course students will be able to:

1. Examine various leadership models and understand/assess their skills, strengths and abilities that affect their own leadership style and can create their leadership vision
2. Learn and demonstrate a set of practical skills such as time management, self management, handling conflicts, team leadership, etc.
3. Understand the basics of entrepreneurship and develop business plans
4. Apply the design thinking approach for leadership
5. Appreciate the importance of ethics and moral values for making of a balanced personality.

UNIT I- Leadership Skills

a. **Understanding Leadership and its Importance**
- What is leadership?
- Why Leadership required?
- Whom do you consider as an ideal leader?

b. ***Traits and Models of Leadership***
- Are leaders born or made?
- Key characteristics of an effective leader
- Leadership styles

- Perspectives of different leaders

c. ***Basic Leadership Skills***

- Motivation
- Team work
- Negotiation
- Networking

UNIT II - Managerial Skills

a. **Basic Managerial Skills**

- Planning for effective management
- How to organise teams?
- Recruiting and retaining talent
- Delegation of tasks
- Learn to coordinate
- Conflict management

b. ***Self Management Skills***

- Understanding self concept
- Developing self-awareness
- Self-examination
- Self-regulation

UNIT III - Entrepreneurial Skills

a. **Basics of Entrepreneurship**

- Meaning of entrepreneurship
- Classification and types of entrepreneurship
- Traits and competencies of entrepreneur

b. ***Creating Business Plan***

- Problem identification and idea generation
- Idea validation
- Pitch making

UNIT IV - Innovative Leadership and Design Thinking

a. **Innovative Leadership**

- Concept of emotional and social intelligence
- Synthesis of human and artificial intelligence
- Why does culture matter for today's global leaders

b. ***Design Thinking***

- What is design thinking?
- Key elements of design thinking:
  - Discovery
  - Interpretation
  - Ideation
  - Experimentation
  - Evolution.
- How to transform challenges into opportunities?

- How to develop human-centric solutions for creating social good?

UNIT V- Ethics and Integrity

a. **Learning through Biographies**

- What makes an individual great?
- Understanding the persona of a leader for deriving holistic inspiration
- Drawing insights for leadership
- How leaders sail through difficult situations?

b. ***Ethics and Conduct***

- Importance of ethics
- Ethical decision making
- Personal and professional moral codes of conduct
- Creating a harmonious life

Bibliography and Suggested Readings :

Books

- Ashokan, M. S. (2215). *Karmayogi: A Bbiography of E. Sreedharan*. Penguin, UK.
- Brown, T. (2212). *Change by Design*. Harper Business
- Elkington, J., & Hartigan, P. (2208). *The Power of Unreasonable People: How Social Entrepreneurs Create Markets that Change the World*. Harvard Business Press.
- Goleman D. (1995). *Emotional Intelligence*. Bloomsbury Publishing India Private Limited
- Kalam A. A. (2203). *Ignited Minds: Unleashing the Power within India*. Penguin Books India
- Kelly T., Kelly D. (2214). *Creative Confidence: Unleashing the Creative Potential Within Us All*. William Collins
- Kurien V., & Salve G. (2212). *I Too Had a Dream*. Roli Books Private Limited
- Livermore D. A. (2210). *Leading with cultural intelligence: The New Secret to Success*. New York: American Management Association
- McCormack M. H. (1986). *What They Don't Teach You at Harvard Business School: Notes From A Street-Smart Executive*. RHUS
- O'Toole J. (2219) *The Enlightened Capitalists: Cautionary Tales of Business Pioneers Who Tried to Do Well by Doing Good*. Harpercollins
- Sinek S. (2209). *Start with Why: How Great Leaders Inspire Everyone to Take Action*. Penguin
- Sternberg R. J., Sternberg R. J., & Baltes P. B. (Eds.). (2204). *International Handbook of Intelligence*. Cambridge University Press.

E-Resources

• Fries, K. (2219). 8 Essential Qualities That Define Great Leadership. *Forbes*. Retrieved 2219- 02-15 from https://www.forbes.com/sites/kimberlyfries/2218/02/08/8-essential-qualities-that-define-great-leadership/#452ecc963b63.
• How to Build Your Creative Confidence, Ted Talk by David Kelly - https://www.ted.com/talks/david_kelley_how_to_build_your_creative_confidence

• India's Hidden Hot Beds of Invention Ted Talk by Anil Gupta - https://www.ted.com/ talks/anil_gupta_india_s_hidden_hotbeds_of_invention
• Knowledge@Wharton Interviews Former Indian President APJ Abdul Kalam - . "A Leader Should Know How to Manage Failure" https://www.youtube.com/watch?v=laGZaS4sdeU
• Martin, R. (2207). How Successful Leaders Think. *Harvard Business Review, 85*(6): 60.
• NPTEL Course on Leadership - https://nptel.ac.in/courses/122105021/9

Course Code	Course Title	L	T	P	C
22120SEC51	Data Communication and Networking	4	1	0	4

AIM:

To equip the students with Computer Networks and its security.

OBJECTIVES:

- To learn basic network concepts.
- To understand various switching techniques and protocols.
- To study about wireless technology and network security.

UNIT-I

Introduction-Components-Topologies-Categories of Network-OSI model-TCP/IP suite - Addressing.

UNIT-II

Trasmission media-Connecting Devices-Error detection and correction-Flow and Error Control- piggy backing- IEEE standard.

UNIT-III

Switching-Namespace- DNS - TCP/UDP- Ipv4 vs Ipv6 - Remote logging- SMTP-POP-IMAP-FTP

UNIT-IV

Wireless- Radio Waves-Microwaves-Infrared. Switching: Circuit-Switched Networks - Three Phases – Efficiency – Delay - Circuit-Switched Technology in Telephone Networks - Datagram Networks - Routing Table.

UNIT-V

Analog and Digital Data - Analog and Digital Signals - Periodic and Non periodic Signals - Digital Signals: Bit Rate - Bit Length - Digital Signal as a Composite Analog Signal - Transmission of Digital Signals. Analog-To-Digital Conversion - Pulse Code Modulation (PCM) - Delta Modulation (DM)- Transmission Modes-Parallel Transmission-Serial Transmission-Digital- To-Analog Conversion.

OUTCOMES:

At the end of the course, the student should be able to:

- Identify the components required to build different types of networks.
- Identify solution for each functionality at each layer.
- Trace the flow of data from one node to another node.

REFERENCE BOOK:

1.”Data Communications and Networking “Behrouz A Forouzan, TATA McGraw-Hill

2.” Network Security Essentials” William Stallings, Pearson Education

3. “Data and Computer Communications”, William Stallings, Pearson Education

Course Code	Course Title	L	T	P	C
22120SEC52	Operating System	4	1	0	3

AIM:

To equip the students with operating system and their components

OBJECTIVES:

- To learn the fundamental functionality of Operating system
- To understand the memory management, process management
- To study about I/O management, storage management

UNIT I

Evolution of Operating System – Types of Operating System – Different views of Operating System – Design and Implementation of Operating System – I/O Programming concepts – Interrupts Structure & Processing.

UNIT II

Memory Management : Single Contiguous Allocation – Partitioned Allocation – Relocatable Partitioned Allocation – Paged and Demand – Paged Memory Management – Segmented Memory Management – Segmented and Demand – Paged memory Management – Swapping and overlay techniques.

UNIT III

Process Management : Job Scheduling – Process Scheduling – Functions and Policies – Evaluation of Round Robin multiprogramming performance – Process Synchronization – Race Condition – Synchronization Mechanism – Deadly Embrace, Prevention , Avoidance and Detection and Recovery Methods.

UNIT IV

Job and processor scheduling:

Preemptive-non-preemptive scheduling,interval time orient erupting clock,priorities,scheduling algorithms-FIFO scheduling,-RR scheduling, quantum size, SJFscheduling-,SRTscheduling-,HRNscheduling-,multi-level feedback queues,Fair-sharescheduling

UNIT V

Real Memory organization and Management:

Memory organization, Memory management, Memoryhierarchy, Memory management strategies, contiguousvsnon-contiguous memory allocation,single-user contiguous memoryallocation,fixed partition multiprogramming, variable partition multiprogramming, Memoryswapping.

OUTCOMES:

At the end of the course, the student should be able to:

- Design various Scheduling algorithms.
- Apply the principles of concurrency.
- Design deadlock, prevention and avoidance algorithms.
- Compare and contrast various memory management schemes.
- Design and Implement a prototype file systems.

REFERENCE BOOK:

1.Operating Systems by Stuart E. Madnick and John J.Donovan – Tata McGraw Hill Publishing Company Ltd.

2.. Operating Systems (Concepts and Design) Milan Milenkovic – McGraw Hill International Edition

Course Code	Course Title	L	T	P	C
22120SEC53	Microprocessor and its Applications	4	1	0	4

AIM

To equip the students with the architecture and instruction sets of different Microprocessors and to design systems using microprocessors.

OBJECTIVE

- To study the architecture of microprocessors like 8085 and higher versions
- To understand the Assembly language programming
- To know the methods of connecting them to the peripheral devices.
- **T**o learn the basic concepts and Microprocessor applications

UNIT I

Evolution of microprocessors – single chip microcomputers – memory buses -memory address capacity – Intel 8085 – instruction cycle – timing diagram.

UNIT II

Instruction set of Intel 8085 – instruction and data formats – addressing modes – status flags – Intel 8085 instruction – programming of microprocessors – assembler – stacks and subroutines – macrosand microprogramming.

UNIT III

Assembly language programming – simple examples – addition and subtraction of binary and decimal numbers – complements – shift – masking – finding max and min number in an array- arranging a series of numbers – multiplication , division, multi-byte addition and subtraction**.**

UNIT-IV

Assembly language programming based on intel 8085/8086. Instructions, data transfer, arithmetic, logic, branch operations, looping, counting, indexing, programming techniques, counters and time delays, stacks and subroutines, conditional call and return instructions.

UNIT-V

Peripheral Devices: 8237 DMA Controller, 8255 programmable peripheral interface, 8253/8254programmable timer/counter, 8259 programmable interrupt controller, 8251 USART and RS232C..

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OUTCOMES:

At the end of the course, the student should be able to:

- Design and implement programs on 8086 microprocessor.
- Design I/O circuits.
- Design Memory Interfacing circuits.
- Design and implement 8051 microcontroller based systems

REFERENCE BOOK:

1. Fundamental of microprocessor and microcomputers – Badri ram – Fifth revised and enlarged edition – Dhanpat rai publications – 2201.

1. Microprocessor architecture, programming and application with 8085 – Ramesh S. Goankar.

Course Code	Course Title	L	T	P	C
22120DSC54A	Cloud Computing	4	1	0	3

AIM:

To provide a strong foundation in Developing Cloud Services.

OBJECTIVES:

- To understand the concept of Cloud Computing.
- To get an idea about Sharing Files.

UNIT I

Understanding Cloud Computing: An introduction to Cloud Computing – Computing in the Cloud – Developing Cloud Services.

UNIT II

Cloud Computing for the Family – Cloud Computing for the Community – Cloud Computing for the Corporation

UNIT III

Collaborating on Calendars, Schedules and Task Management – On Event Management – On Contact Management – On Project Management – On Word Processing – On Spreadsheets – On Databases – On Presentations

UNIT IV CLOUD COMPUTING RISK ISSUES:

The CIA Traid, Privacy and Compliance Risks, Threats to Infrastructure, Data and Access Control, Cloud Access Control Issues, Cloud Service Provider Risks.

Cloud Computing Security challenges: Security Policy Implementation, Policy Types, and Computer Security Incident Response Team (CSIRT).

UNIT – V CLOUD COMPUTING SECURITY ARCHITECTURE:

Architectural Considerations, General Issues, Trusted Cloud Computing, Secure Execution environments and Communications, Micro architectures,Identity Management and Access Control, Autonomic Security.

OUTCOMES:

- Compare the strengths and limitations of cloud computing
- Identify the architecture, infrastructure and delivery models of cloud computing
- Apply suitable virtualization concept.
- Choose the appropriate cloud player , Programming Models and approach.
- Address the core issues of cloud computing such as security, privacy and interoperability
- Design Cloud Services and Set a private cloud

REFERENCE BOOK:

1. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Pearson, 2209.

2. Haley Beard, Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs, Emereo Pty Limited, July 2208.

Course Code	Course Title	L	T	P	C
22120DSC54B	Middleware Technology	4	1	0	3

UNIT I

CLIENT / SERVER CONCEPTS 9

Client-Server – File server – Database server – Group server – Object server – Webserver – Middleware – General middleware – Service specific middleware – Client /server building blocks – RPC.

UNIT II

EJB ARCHITECTURE

EJB – EJB architecture – Overview of EJB software architecture – View of EJB –Conversation – Building and Ddeploying EJBs – Roles in EJB.

UNIT III

EJB APPLICATIONS

EJB session beans – EJB entity beans – EJB clients – EJB deployment – Building an application with EJB

UNIT IV

CORBA

CORBA – Distributed systems – Purpose – Exploring CORBA alternatives –Architecture overview – CORBA and networking Model – CORBA object model –IDL – ORB – Building an application with CORBA.

UNIT V

COM

COM – Data types – Interfaces – Proxy and stub – Marshalling – Implementing Server/Client – Interface pointers – Object creation – Invocation – Destruction –Comparison COM and CORBA.

TEXT BOOKS

1. Robert Orfali, Dan Harkey and Jeri Edwards, "The Essential Client/Server Survival Guide", Galgotia Publications Pvt. Ltd., 2202.
2. Tom Valesky, "Enterprise Java Beans", Pearson Education, 2202
3. Jason Pritchard, "COM and CORBA side by side", Addison Wesley, 2200
4. Jesse Liberty, "Programming C#", 2nd Edition, O'Reilly Press, 2202.

Course Outcome:

- To understand how middleware facilitates the development of distributed applications in heterogeneous environments
- To study how it helps to incorporate application portability, distributed application component interoperability and integration.
- Understand Distributed systems design and implementation
- Understand existing Distributed Technologies
- Understand Web services architectures

REFERENCES

1. Mowbray, "Inside CORBA", Pearson Education, 2202.

Course Code	Course Title	L	T	P	C
22120DSC54C	**Enterprise resource planning**	4	1	0	3

COURSE OBJECTIVE

- Become familiarize with ERP process.
- Learn ERP implementation process using information technology.

COURSE OUTCOMES

- Design and Develop ERP applications by using features of ERP tools.

UNIT I BASICS OF ERP

ERP essentials – ERP evolution – ERP market – ERP tiers – information systems – Presentation tier – application tier – database tier.

UNIT II ENTERPRISE SYSTEMS

Enterprise systems – stand alone mainframe systems – client server architecture – service oriented architecture – types of enterprise systems – types of data – SAP overview.

UNIT III PROCESS IN ERP

Basic Procurement process – physical flow – document flow – information flow – financial impact-role of enterprise systems in the procurement process – fulfillment process – production process.

UNIT IV INTEGRATION

Integrated processes – Integrated processes execution – additional intracompany processes – extended (intracompany) processes.

UNIT V CASE STUDY

ERP for construction industry – ERP for a corrugated box manufacturing company – ERP for lens making company – ERP for furniture manufacturing company – ERP for toys manufacturing company - Mc Donald's story – Automobile enterprises.

REFERENCE BOOKS:

1. Simha R Magal, Jeff Word, “Essentials of Business Processes and Information Systems”, Wiley Publications, 2209.
2. Marianne Bradford, “Modern ERP: Select, Implement and use Today's advanced business systems”, Lulu Publishers, Second Edition, 2210.
3. Jyotindra Zaveri, “Enterprise Resource Planning”, Second edition, Himalaya Publishing house, 2212.

Course Outcomes:

- Make basic use of Enterprise software, and its role in integrating business functions.
- Analyze the strategic options for ERP identification and adoption.
- Design the ERP implementation strategies.
- Create reengineered business processes for successful ERP implementation.
- "To aim at preparing the students technological competitive and make them ready to
- self-upgrade with the higher technical skills.

Course Code	Course Title	L	T	P	C
22120DSC54D	**SEMANTIC WEB**	4	1	0	3

Course Objectives & Outcomes

Course Objectives

- To learn Web Intelligence
- To learn Knowledge Representation for the Semantic Web
- To learn Ontology Engineering
- To learn Semantic Web Applications, Services and Technology
- To learn Social Network Analysis and semantic web
- To understand the role of ontology and inference engines in semantic web
- To explain the analysis of the social Web and the design of a new class of applications that combine human intelligence with machine processing.
- To describe how the Semantic Web provides the key in aggregating information across heterogeneous sources.
- To understand the benefits of Semantic Web by incorporating user- generated metadata and other clues left behind by users.

UNIT –I: Web Intelligence

Thinking and Intelligent Web Applications, The Information Age ,The World Wide Web, Limitations of Today's Web, The Next Generation Web, Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Berners-Lee www, Semantic Road Map, Logic on the semantic Web.

UNIT -II: Knowledge Representation for the Semantic Web

Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web – Resource Description Framework(RDF) / RDF Schema, Ontology Web Language(OWL), UML, XML/XML Schema.

UNIT-III: Ontology Engineering

Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping, Logic, Rule and Inference Engines.

UNIT-IV: Semantic Web Applications, Services and Technology

Semantic Web applications and services, Semantic Search, e-learning, Semantic Bioinformatics, Knowledge Base ,XML Based Web Services, Creating an OWL-S

Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods

UNIT-V: .Social Network Analysis and semantic web

What is social Networks analysis, Development of the social networks analysis, Electronic Sources for Network Analysis – Electronic Discussion networks, Blogs and Online Communities, Web Based Networks. Building Semantic Web Applications with social network features.

Course Outcomes

After Completion of this course Students will be able to

 1.Ability to understand and knowledge representation for the semantic web

 2.Ability to create ontology

 3.Ability to build a blogs and social networks

 4.Understand the basics of Semantic Web and Social Networks.

 5.Understand Electronic sources for network analysis and different Ontology languages.

 6.Modeling and aggregating social network data.

 7.Develop social-semantic applications.

TEXT BOOKS:

1. Thinking on the Web - Berners Lee, Godel and Turing, Wiley inter science, 2008.

2. Social Networks and the Semantic Web, Peter Mika, Springer, 2007.

REFERENCE BOOKS:

1. Semantic Web Technologies, Trends and Research in Ontology Based Systems, J.Davies, R.Studer, P.Warren, John Wiley & Sons.

2. Semantic Web and Semantic Web Services -Liyang Lu Chapman and Hall/CRC Publishers,(Taylor & Francis Group)

3. Information Sharing on the semantic Web – Heiner Stuckenschmidt; Frank Van Harmelen, Springer Publications.

4. Programming the Semantic Web, T.Segaran, C.Evans, J.Taylor, O'Reilly, SPD.

REFERENCE BOOKS:

1. Semantic Web Technologies, Trends and Research in Ontology Based Systems, J.Davies, R.Studer, P.Warren, John Wiley & Sons.

2. Semantic Web and Semantic Web Services -Liyang Lu Chapman and Hall/CRC Publishers,(Taylor & Francis Group)

3. Information Sharing on the semantic Web – Heiner Stuckenschmidt; Frank Van Harmelen, Springer Publications.

4. Programming the Semantic Web, T.Segaran, C.Evans, J.Taylor, O'Reilly, SPD.

Course Code	Course Title	L	T	P	C
22120SEC55L	Microprocessor Lab	0	0	3	2

The following programming exercises using 8085 instruction set,

1. 8-bit addition & subtraction
2. 8-bit multiplication & division
3. Multi byte addition
4. Multi byte subtraction
5. Sum of series & data transfer
6. Maximum & minimum values
7. Hexadecimal to decimal and decimal to hexadecimal conversion
8. Sorting the numbers

Course Outcome:

- Identify relevant information to supplement to the Microprocessor and Microcontroller course.
- Set up programming strategies and select proper mnemonics and run their program on the training boards.
- Practice different types of programming keeping in mind technical issues and evaluate possible causes of discrepancy in practical experimental observations in comparison.
- Develop testing and experimental procedures on Microprocessor and Microcontroller analyze their operation under different cases.
- Prepare professional quality textual and computational results, incorporating accepted data analysis and synthesis methods, simulation software, and word-processing tools.

Course Code	Course Title	L	T	P	C
22120SEC56L	Operating System Lab	0	0	3	2

1.Write a menu driven shell program for the following :
a. List of files.
b. Processes of users.
c. Today's Date
d. Users of system.
e. Quit of Unix

2. Write a shell program which accepts the name of a file from the standard input and tests to find the file access permissions, such as read, write and execute.

3. Write a shell program which accepts the name of a file from the standard input and perform the following

a. Accept five names in a file.
a. Sorts the names in existing file.
b. Lists unsorted and sorted file.
c. Quit

4. Write a menu driven shell program to copy, edit, rename and delete a file.

5.Write a menu driven shell program to perform the following task
a. Write a sentence in file.
b. Search for a given word or pattern in an existing file.
c. Quit.

6. Write a shell program to prepare electricity bill for domestic consumers.
For first 100 units – Rs. 0.75 / Unit
For next 100 units – Rs. 1.50 / Unit
Above 220 units – Rs. 3.00 / Unit
Prepare the bill for the following format.

7. Write a shell program to display the result PASS or FAIL using the information given below student name ,student reg.no., mark1,mark2,mark3,mark4 the minimum pass for each subject is 50.

8. Merge the contents of the file file1,file2 and store in another file.

Course Outcome:

- Install a Linux operating system with a custom partitioning scheme and log into and out of a UNIX/Linux computer system using graphical and command line environments.
- Use UNIX/Linux command line (shell) commands to navigate and manage the UNIX/Linux file system, customize the user shell environment,
- Use archiving and compression to back up files.
- Use file name globing and regular expressions to find files and text in the system.
- To Manage user and group accounts and permissions.
- To Manage processes and jobs.

Course Code	Course Title	L	T	P	C
221ACLSPSL	Professional Skills	-	-	-	2

Aim:

Course Objectives:

The Objectives of the course are to help students/candidates:

1. Acquire career skills and fully pursue to partake in a successful career path
2. Prepare good resume, prepare for interviews and group discussions
3. Explore desired career opportunities in the employment market in consideration of an individual SWOT.

Course Outcomes:

At the end of this course the students will be able to:

1. Prepare their resume in an appropriate template without grammatical and other errors and using proper syntax
2. Participate in a simulated interview
3. Actively participate in group discussions towards gainful employment
4. Capture a self - interview simulation video regarding the job role concerned
5. Enlist the common errors generally made by candidates in an interview
6. Perform appropriately and effectively in group discussions
7. Explore sources (online/offline) of career opportunities
8. Identify career opportunities in consideration of their own potential and aspirations
9. Use the necessary components required to prepare for a career in an identified occupation (as a case study).

Unit I: Resume Skills

Resume Skills: Preparation and Presentation

- Introduction of resume and its importance
- Difference between a CV, Resume and Bio data
- Essential components of a good resume

ii. *Resume skills: common errors*

- Common errors people generally make in preparing their resume
- Prepare a good resume of her/his considering all essential components

Unit II: Interview Skills

i. Interview Skills : Preparation and Presentation

- Meaning and types of interview (F2F, telephonic, video, etc.)
- Dress Code, Background Research, Do's and Don'ts
- Situation, Task, Approach and Response (STAR Approach) for facing an Interview
- Interview procedure (opening, listening skills, closure, etc.)
- Important questions generally asked in a job interview (open and closed

ended questions)

ii. *Interview Skills: Simulation*

- Observation of exemplary interviews
- Comment critically on simulated interviews

iii. *Interview Skills: Common Errors*

- Discuss the common errors generally candidates make in interview
- Demonstrate an ideal interview

Unit III: Group Discussion Skills

Meaning and methods of Group Discussion

- Procedure of Group Discussion
- Group Discussion- Simulation
- Group Discussion - Common Errors

Unit IV: Exploring Career Opportunities

Knowing yourself – personal characteristics

- Knowledge about the world of work, requirements of jobs including self-employment.
- Sources of career information
- Preparing for a career based on their potentials and availability of opportunities

Course Code	**Course Title**	L	T	P	C

22120SEC61	.NET Programming	4	1	0	4

AIM

To cover the fundamental concepts of the .NET framework.

OBJECTIVES

- To gain knowledge in the concepts of the .NET framework and its technologies.
- To get experience in building sample applications of large-scale projects.

UNIT I

Visual basic.NET and the .NET Framework –The elements of Visual Basic .NET

UNIT II

Visual Basic .NET operators-software Design, conditional structures, and controls Flow-Methods.

UNIT III

Interfacing with the End user-Asp.NET Applications.

UNIT IV: WINDOW AND WEB BASED APPLICATIONS

Window Based Applications – Core ASP.NET – ASP.NET Web Forms – Server Controls, Data Binding – ASP.NET

UNIT V .NET COMPACT FRAMEWORK

.NET REMOTING-.NET SECURITY – LOCALIZATION – PEER-TO-PEER NETWORKING – BUILDING P2P APPLICATIONS –.NET COMPACT FRAMEWORK – COMPACT EDITION DATA STORES – TESTING AND DEBUGGING .

OUTCOMES:

- Create web-based distributed applications using ASP.NET, SQL Server and ADO.NET
- Utilize DirectX libraries in the .NET environment to implement 2D and 3D animations and game-related graphic displays and audio.
- Utilize the .NET environment to create Web Service-based applications and components.

REFERENCE BOOKS:

1. The Complete Reference VB.NET – Jeffrey R-Shapiro- Tata McGrawHill Edition
2. The Complete Reference ASP.NET- Matthew MacDonald- Tata McGrawHill Edition
3. Visual Basic .Net Programming -Bible.
4. Visual Basic.Net Black Book- Steven Holzner.

Course Code	Course Title	L	T	P	C

Course Code	Course Title	L	T	P	C
22120SEC61	**Advanced Web Technology**	**4**	**1**	**0**	**4**

AIM:

To equip the students with basic programming skill in Web Designing

OBJECTIVES:

- To understand and practice mark up languages
- To understand and practice embedded dynamic scripting on client side Internet Programming
- To understand and practice web development techniques on client-side

UNIT-I

Introduction to HTML – Head and body sections – Designing the body section. Ordered and unordered lists – Table handling.

UNIT-II

DHTML and Style Sheet – Frames-Forms.

UNIT-III

VBScript –VBScript Programming Basics – Working with Operators – Controlling Program flow with VBScript-Working with Functions, Subroutines and Dialog boxes – Data type Conversion Features – Putting it all together with VBScript – using the Script Debugger.

UNIT-IV

The Basic of JavaScript: Overview of JavaScript – Object Orientation and JavaScript – General Syntactic Characteristics – Primitives, Operation and Expressions – Screen Output and Keyboard Input – Control Statements – Object Creation and Modification – Arrays – Functions – Constructors – Pattern Matching Using Regular Expressions. JavaScript and Html Documents: The JavaScript Execution Environment.

UNIT-V

Introduction to PHP: Origins and Uses of PHP – Overview of PHP – General syntactic characteristics – Primitives, Operation and Expressions – Output – Control Statements – Arrays – Functions – Pattern Matching – Form Handling – Files – Cookies – Session Tracking.

OUTCOMES:

- Acquire knowledge about functionalities of world wide web
- Explore markup languages features and create interactive web pages using them
- Learn and design Client side validation using scripting languages
- Acquire knowledge about Open source JavaScript libraries
- Acquire knowledge about PHP.

REFERENCE BOOKS:

1. World Wide Web design with HTML – C. Xavier – Tata McGraw – Hill – 2200.
   For UNIT I & II.
2. “Using Active Server Page”. - Scot Johnson-For UNIT III.
3. “Programming the World Wide Web” - Robert W.Sebesta , Third edition.For UNIT IV, V.

Course Code	Course Title	L	T	P	C
22120SEC62	Relational Data Base Management System	4	1	0	5

AIM

To equip the students with principles and concepts of database design

OBJECTIVE

- To learn the basic principles of database and database design
- To learn the basics of RDBMS
- To learn the concepts of database manipulation SQL

UNIT I

An Overview of Database Management-Introduction -Definition of Database system - Data Independence - Relational Systems - Database System Architecture - Three Levels of the Architecture - Distributed Processing.

UNIT II

An Introduction to Relational Databases- Introduction - Relational Model - Relations and Relvars - Optimization - Transactions - An Introduction to SQL - Embedded SQL - Domains , Relations , Relvars .

UNIT III

Relational Algebra - Introduction - Syntax - Semantics - Examples - Additional Operators - Relational Calculus - Introduction - Tuple Calculus - Examples - Calculus Vs Algebra - Domain Calculus - SQL Specialties .

UNIT -IV

TRANSACTIONS AND CONCURRENCY MANAGEMENT:

Transactions – Concurrent Transactions - Locking Protocol - Serialisable Schedules - Locks Two Phase Locking (2PL) – Deadlock and its Prevention - Optimistic Concurrency Control. Database Recovery and Security: Database Recovery meaning - Kinds of failures - Failure controlling methods -Database errors - Backup &Recovery Techniques - Security & Integrity - Database Security - Authorization.

UNIT- V

DISTRIBUTED AND CLIENT SERVER DATABASES:

Need for Distributed Database Systems - Structure of Distributed Database - Advantages and Disadvantages of DDBMS - Advantages of Data Distribution - Disadvantages of Data Distribution - Data Replication - Data Fragmentation. Client Server Databases: Emergence of Client Server Architecture - Need for Client Server Computing -Structure of Client Server Systems & its advantages.

OUTCOMES:

At the end of the course, the student should be able to:

- Design Databases for applications.
- Use the Relational model, ER diagrams.
- Apply concurrency control and recovery mechanisms for practical problems.
- Design the Query Processor and Transaction Processor.
- Apply security concepts to databases.

REFERENCE BOOK:

" An Introduction to Database Systems - C.J.DATE Addisen - Wesley Publications - 7th Edition 2200

Course Code	Course Title	L	T	P	C
22120DSC63A	Data Mining	4	1	0	3

AIM:

To emphasis on the design aspects of Data mining and Data Warehousing.

OBJECTIVE

- To understand briefly some of the data mining Techniques.
- Discuss a number of more efficient algorithms.
- To know accuracy of classification methods and how accuracy may be improved.

UNIT-I

Introduction: What is Data Mining- Why Data Mining now-The Data Mining Process-Data Mining Application-Data Mining Techniques-The Future of Data Mining-Guidelines for Successful Data Mining-Data Mining Software-Software Evaluation and Selection.

UNIT-II

Association Rules Mining: Introduction-Basics-The Task and a Naïve Algorithm -

The Apriori Algorithm- Improving the Efficiency of the Apriori Algorithm- Apriori-Tid -Direct Hashing and Pruning (DHP)-Dynamic Itemset Counting (DIC)-Mining Frequent Pattern without Candidate Generation (FP-Growth)–Performance Evaluation of Algorithms- Software for Association Rule Mining

UNIT-III

Classification: Introduction-Decision Tree-Building a Decision Tree-The Tree Induction Algorithm-Split Algorithm Based on Information Theory-Split Algorithm based on the Gini Index- Over fitting and Pruning-Decision Tree Rules-Naïve Bayes Method-Estimating Predictive Accuracy of Classification Methods-Improving Accuracy of Classification Methods.

UNIT-IV

Cluster Analysis: What is Cluster Analysis-Desired Features of Cluster Analysis-Types of Data-Computing Distance-Types of Cluster Analysis Methods-Partitional Methods-Hierarchical Methods-Density-Based Methods-Dealing with Large Databases-Quality and Validity of Cluster Analysis Methods-Cluster Analysis Software.

UNIT-V

Web Data Mining: Introduction-Web Terminology and Characteristics-Locality and Hierarchy in the Web-Web Content Mining-Web Usage Mining-Web Structure Mining-Web Mining Software.

OUTCOMES:

- Understanding of data mining software available on the market.
- Acquiring Knowledge about various algorithms.
- Acquiring Knowledge about cluster analysis techniques.

REFERENCE BOOKS:

1. “Introduction to Data Mining with Case Studies”, G.K.Gupta, Easter Economy Edition.

Course Code	Course Title	L	T	P	C
22120DSC63B	Artificial Intelligence and Expert Systems	4	1	0	3

AIM:

To Acquire Knowledge on various AI Techniques and Expert Systems.

OBJECTIVE:

- To learn AI Basic Concepts
- To understand Expert Systems Architectural-Components
- To study Expert System development process

UNIT I

The AI definition - AI Techniques- Problems, Problem Space and search- Defining the problem as a state space search- Problem Characteristics- Heuristic Search Techniques- Generate and Test- hill Climbing- Best First Search- Problem reduction - Constraint Satisfaction- means -ends analysis.

UNIT II

Game Playing- Min-Max Procedure- Adding Alpha-Beta Cutoffs- Additional Refinements- Searching AND/OR Graphs - Using Predicate Logic- Representing Simple Facts and Logic- Representing instance and IS a relationships- Computable functions and predicates- Use of the predicate calculus in AI Resolution- natural deduction.

UNIT III

Representing knowledge using rules- Procedural versus declarative knowledge- Logic Programming- Forward versus Backward Reasoning- Resolving within AND/OR Graphs matching- control knowledge-Symbolic Reasoning under uncertainty- Non-monotonic reasoning- Implementation issues- - Fuzzy Logic.

UNIT IV

Expert Systems- Architectural-Components- Explanation facilities- Knowledge acquisition.

UNIT V

Expert System development process- Non-formal representation of knowledge- Semantic networks- Frames- Scripts- Expert System Tools.

OUTCOMES:

At the end of the course, the student should be able to:

- Identify problems that are amenable to solution by AI methods.
- Identify appropriate AI methods to solve a given problem.
- Formalize a given problem in the language/framework of different AI methods.
- Implement basic AI algorithms.

REFERENCE BOOK

1. For Units I, II, III: Elaine Rich and Kevin Kaight, **"Artificial Intelligence",** Tata McGraw Hill, 2nd Edition, 1991.
2. For Units IV, V: David W. Rolston, **"Principles of Artificial Intelligence and Expert Systems Development",** McGraw Hill.

Nills J.Nilsson **"Artificial Intelligence ",** Narosa Publicshing House, 1990**.**

Course Code	Course Title	L	T	P	C
22120DSC63C	Ethical hacking	4	1	0	3

OBJECTIVES:

To understand and analyse Information security threats & coutermeasures

To perform security auditing & testing

To understand issues relating to ethical hacking

To study & employ network defense measures

To understand penetration and security testing issues

UNIT I ETHICAL HACKING OVERVIEW

Understanding the importance of security, Concept of ethical hacking and essential TerminologiesThreat, Attack.

UNIT II FOOTPRINTING & PORT SCANNING

Footprinting - Introduction to foot printing, Understanding the information gathering methodology of the hackers, Tools used for the reconnaissance phase.Port Scanning - Introduction, using port scanning tools, ping sweeps, Scripting Enumeration-Introduction, Enumerating windows OS & Linux OS.

UNIT III SYSTEM HACKING

Aspect of remote password guessing, Role of eavesdropping ,Various methods of password cracking, Keystroke Loggers, Understanding Sniffers ,Comprehending Active and Passive Sniffing, ARP Spoofing and Redirection, DNS and IP Sniffing, HTTPS Sniffing.

UNIT IV HACKING WEB SERVICES & SESSION HIJACKING

Web application vulnerabilities, application coding errors, SQL injection into Back-end Databases,cross-site scripting, cross-site request forging, authentication bypass, web services and related flaws,protective http headers Understanding Session Hijacking, Phases involved in Session Hijacking,Types of Session Hijacking, Session Hijacking Tools.

UNIT V HACKING WIRELESS NETWORKS

Introduction to 802.11,Role of WEP, Cracking WEP Keys, Sniffing Traffic, WirelessDOSattacks,WLANScanners,WLANSniffers,HackingTools,Securing Wireless Networks.

Course Outcome:

- Plan a vulnerability assessment and penetration test for a network.
- Execute a penetration test using standard hacking tools in an ethical manner.
- Report on the strengths and vulnerabilities of the tested network.
- Identify legal and ethical issues related to vulnerability and penetration testing.
- Use of standard hacking tools in an ethical manner
- Evaluation of the penetration test results

REFERENCES

1. Kimberly Graves, "Certified Ethical Hacker", Wiley India Pvt Ltd, 2210

2. Michael T. Simpson, "Hands-on Ethical Hacking & Network Defense", Course Technology, 2210

3. Rajat Khare, "Network Seuciryt and Ethical Hacking", Luniver Press, 2206

COURSE CODE	COURSE TITLE	L	T	P	C
221ENOEC	Journalism	4	0	0	2

Aim :

- To acquaint with the basic knowledge of journalism so that it may enthuse the students to become journalists.

Objective:

- To instill in the minds of students the different aspects of journalism
- To understand the different kinds of news
- To learn the qualities and duties of a reporter, editor and sub editor
- To familiarize with the style and features of the different sections in a newspaper

Outcome:

- Become a journalist

UNIT- I

Journalism – Definition, Qualities of a journalist, Forms of journalism, Role and elements

UNIT- II

News – Definition – Kinds – Elements – Sources

UNIT- III

Reporters

UNIT- IV

The Editor and the Sub Editor

UNIT –V

Language of Journalism, Style

Qualities of a Writer

Writing a News story, Opinion Pieces, Reviews, Headlines, Editorials

References:-

Journalism -Susan

Professional Journalism - John Hogenberg

News Writing and Reporting - M.James Neal (Surjeet Publication)

Professional Journalism -M.V Komath

The Journalist's Handbook -M.V Komath

Mass Communication & Journalism - D.S Mehta

COURSE CODE	COURSE TITLE	L	T	P	C
221MAOEC	Development Of Mathematical Skills	4	0	0	2

Objectives

Knowledge and understanding are fundamental to studying mathematics and form the base from which to explore concepts and develop problem-solving skills. Through knowledge and understanding students develop mathematical reasoning to make deductions and solve problems.

To develop student's ability to apply both conventional and creative techniques to the solution of mathematical problems

Unit I

Simple interest and compound interest

Unit II

Sinking fund – discounting – trade discount – quantity discount – cash discount

Unit III

Set theory – Series

Unit IV

Matrices – Determinants

Unit V

Assignment problems

References

1. P.A.Navanitham, Business Mathematics & Statistics

2. Kanti swarup, P.K.Gupta and Manmohan, " Operations Research"

Learning outcomes

- By the end of this course, you should be able to
- know and demonstrate understanding of the concepts from the five branches of mathematics (Operations Research, Set Theory, statistics, Matrices and Business mathematics)
- use appropriate mathematical concepts and skills to solve problems in both familiar and unfamiliar situations including those in real-life contexts
- Select and apply general rules correctly to solve problems including those in real-life contexts.

Course Code	COURSE TITLE	L	T	P	C
221PHOEC	Instrumentation	4	0	0	2

Aim:

Making and analyzing measurements is the primary task of the experimental physicist. This includes designing experiments. Most experimental work, whether in bench-top situations, or using complex instruments. To many physicists this can be as interesting and involving as the basic physics one is trying to do.

Objectives:

The use of instruments is of course not confined to physicists and this kind of experience is valuable in many situations which many students will encounter after graduation.

A good physicist will bring a critical mind aiming to understand not only the result of an investigation but the primary reasons for the behavior of the data. Understand that there are finite limits to our ability to make good measurements, and why.

UNIT – I: Introduction

Potentiometer - calibration of volt meter and ammeter, measurement of resistance, Principles of network theorems – Thevenin's and Norton's theorem – Bridges :

AC bridges – Maxwell, Owen, Schering and deSauty's bridges – Wien bridges.

UNIT – II: ELECTRONIC INSTRUMENTS – I

Basic characteristics of instruments – resolution – sensitivity - Audio frequency oscillator, Conversion of galvanometer into voltmeter and ammeter – resistance meter - Amplified D.C. meter – Chopper stabilized amplifier – A.C. Voltmeter using

rectifiers – Electronic multimeter – Differential voltmeter – Digital voltmeters –

Component measuring instruments (quantitative studies)

UNIT – III: ELECTRONIC INSTRUMENTS – II

Signal conditioning systems – DC and AC carrier systems – Instrumentation

amplifiers – Vibrating capacitor amplifier – Analog to digital data and sampling – A/D and D/A convertor (successive approximation, ladder and dual slope converseons).

Unit IV – Recording Devices

Recorders necessity – Recording requirements – Analog recorders – Graphic recorders – strip chart recorders – Galvanometer types recorders – Null type recorders.

Unit V – CRO

CRO – Construction and action – Beam transit time and frequency limitations –
Measurement of potential, current, resistance, phase and frequency – Special purpose oscilloscopes – Sampling storage oscilloscope.

Books for Study

1. Electronic Instrumentation and Measurement techniques – W.D. Cooper and A.D. Helfrick – PHI – Third edn. – 1989

Learning Outcomes:

Appreciate important practical aspects of theoretical knowledge: how important components work, when to impedance match, non-ideal behaviour of op-amps etc.

Acquire a sound understanding of the role of noise in measurement systems and know how to apply noise reduction techniques.

Be able to apply Fourier and Laplace transforms to analyse the behaviour and stability of complex systems.

Books for Reference:

1. A course in electrical and electronic measurements and Instrumentation – A.K. Sawhmey – DhanpatRai and Sons – 1990.
2. Electronic measurements and instrumentation – Oliver Cage – McGraw Hill – 1975.

Course Code	COURSE TITLE	L	T	P	C
221CHOEC	Food and Adulteration	4	0	0	2

Aim: To introduce students to food safety and standardization act and quality control of foods.

Objectives:

1. To educate about common food adulterants and their detection.
2. To impart knowledge in the legislatory aspects of adulteration.
3. To educate about standards and composition of foods and role of consumer.

Unit-I Introduction to Food Chemistry

Introduction to Food Chemistry- Water (Structure of water and ice, Physical constants of water, Types of water, Water activity) Composition of Food- Carbohydrates, Proteins, Lipids, Vitamins & Minerals.

Unit- II Food Pigments

Introduction- classification, types of food pigments- chlorophyll, carotenoids, anthocyanins, flavanoids.

Unit – III Food Preservation

Introduction - Importance, principle and Types.

High and low temperatures preservation - Pasteurization - Sterilization- Canning- Freezing- Refrigeration.

Unit – IV Food Additives

introduction- antioxidants, sequestrants, preservatives, nutrient supplement, emulsifiers, stabilizers and thickening agents, bleaching and maturing agent, sweeteners, humectants and anti -caking agents, coloring and flavoring substance.

Unit-V Food Adulteration

Types of adulterants- intentional and incidental adulterants, methods of detection. Detection of common food adulterants in Spices , Grains, Coffee , Tea, Oil fats , Food colours and Milk. Health hazards and risks.

References:

1. The Food Safety and Standard ACT, 2206 – Seth & Capoor
2. Hand book of Food Adulteration and Safety Laws – Sumeet Malik
3. Food Science – B.Srilakshmi

Outcomes:

- Ability to apply principles of food engineering in industry.
- Understand, identify and analyze a problem related to food industry and ability to find an appropriate solution for the same.
- Design, implement and evaluate a research based project to meet demands of the society.
- Use appropriate techniques, skills, and modern tools in the food industry and in academic profession.
- Understanding of professional, ethical, legal, security and social issues and responsibilities for entrepreneurship skills.

Course Code	COURSE TITLE	L	T	P	C
221MBOEC	Wild Life Conservation	4	0	0	2

Aim:

To enable the students understand the need of conservation of wildlife in India.

Objectives:

Maintenance of rare species in protected areas such as national parks, santuries etc.,
Establishment of specific biosphere reserves for endangered plants and animals.
Protection of wild life through legislation such as banning hunting etc.,
Imposing specific restrictions on export of endangered plants and animals or their products.

Outcome:

Protection of natural habitats of organisms through controlled exploitation.

Educating the public about the need to protect and preserve the environment as a long range goal for the welfare of future generations

Unit I: Wildlife Management: Basic concepts and principles - Wildlife management before and after implementation of Wild Life (Protection) Act, 1972 – IUCN – CITES – NBA – IBA –

Evaluation of Wildlife habitat**:** Define habitat – Forest habitat types - basic survey techniques of habitats – Vegetative analyses – Point centered quadrat, Quadrat, strip transect – Habitat manipulation: Food, Water, shade, impact and removal of invasive alien species.

Unit II: Introduction to conservation biology, the origin of conservation biology, ethical and economical values of conservation biology, definition of biodiversity, types of biodiversity, threats to biodiversity. Scopes and importance of conservation methods – *In-situ* and *Ex-situ* conservation approaches of Indian animals. Captive breeding (Lion-tailed macaque, white tiger and vultures) and reintroduction (Tiger, rhinoceros, gaur).

Unit III: Biodiversity: Definition and importance - Biodiversity hotspots in India: Western Ghats, Eastern Himalayas. Mega diversity nations – an introduction. Landscape approach and people participation in biodiversity conservation.

Unit IV: Role of Government and Non-Government organizations in conservation.– **Government** - Wildlife Institute of India, Ministry of Environment and Forests (MoEF), National Biodiversity Authority (NBA), Zoological Survey of India (ZSI), Botanical Survey of India (BSI), Salim Ali Centre for Ornithology and Natural History (SACON), Centre for Ecological Sciences (CES). **NGOs**. –Bombay Natural History Society (BNHS), World Wide Fund for Nature (WWF), Wildlife Trust of India (WTI), Nilgiri Wildlife and Environment Association (NWEA), Wildlife Conservation Society (WCS).

Unit V: Conservation Biology Tools - Biological Parks, Zoological Parks, Forest Research Institute, Agricultural Research Institutions, Gene Pools, Cryopreservation Centres, Interpretation Centres and role of Field Biologists.

References:

1. Anon, 1992. Conservation on biological diversity. Text and annexure – WWF-India.
2. Gaughley, G. and A. Gunn. 1995. Conservation Biology in Theory and practice. Blackwell Publishers.
3. Dobson, A.P. 1996. Conservation and biodiversity scientific American Library, New Yark, USA.

COURSE CODE	COURSE TITLE	L	T	P	C
221CSOEC	Web Technology	4	0	0	2

AIM
To equip the students with basic programming skill in Web Technology.

OBJECTIVE
- To understand the concepts and architecture of the Worldwide Web.
- To understand and practice mark up languages
- To learn Style Sheet and Frames

UNIT I
Introduction to the Internet: networking- internet – email – Internet Technologies: modem internet addressing .

UNIT II
Internet browsers: Internet Explorer – Netscape navigator- Introduction to HTML: Html document – anchor tag – hyperlink.

UNIT III
Head and body sections: Header section – titles – links- colorful web page – sample html document – Designing the body section: paragraph – tab setting.

UNIT IV
Ordered and unordered lists: list – unordered list – heading in a list- order list- nested list.

UNIT V
Table handling: tables – table creation in html cell spanning multiple rows and columns- coloring cells- sample tables- frames frame set definition- nested frames set.

OUTCOMES:
- Acquire knowledge about functionalities of world wide web
- Explore markup languages features and create interactive web pages using them
- Learn and design Client side validation using scripting languages
- Acquire knowledge about Open source JavaScript libraries
- Able to design front end web page and connect to the back end databases.

REFERENCE BOOKS

1.World Wide Web design with HTML – C. Xavier – Tata McGraw – Hill – 2200.
2. Principles of web design – Joel Sklar – Vikas publishing house 2201.

COURSE CODE	COURSE TITLE	L	T	P	C
221CMOEC	BANKING SERVICES	5	0	0	5

AIM:

To Provide the Bank is financial institution which is involved in borrowing and lending money.

OBJECTIVE: you should be able to

- To provide a lending money to firms, customers and home buyers.
- To provide keep money for customers
- To provide offering financial advice and related financial services, such as insurance.

UNIT – I

Commercial Banking – An Overview: Banking-Classification- Banking system- Universal Banking-Commercial Banking- functions – Role of Banks in Economic Development

UNIT – II

E-banking –An Overview: Meaning-Service-E-banking and Financial Services –Benefits-Internet Banking –Internet Banking Vs Traditional Banking –Mechanics of Internet Banking-Services

UNIT – III

Mobile Banking and Telephone Banking –An Overview: Meaning-Features- Registration-Services –Security Issues –Banking Facilities- Telephone Banking System – Drawbacks- Call Centers

Unit – IV

ATM and Electronic Money: Concept of ATM-Features-Functions-Strategic importance of ATM-Electronic Money – Categories –Merits – E-Money and Monetary Policy-Policy Issues for the RBI

Unit-V

EFT System and INFINET: Meaning- Steps in EFT- RBI Guidelines-EFT Systems Vs Traditional System - ECS-Features-Factors- Benefits –Handicaps -Applications

OUTCOME:

To help to gather knowledge on banking and financial system in India

To provide knowledge about commercial banks and its products

To create awareness about modern banking services like e-banking-banking and internet banking, ATM System

To introduce recent trends in banking system

To make the student understand the basic concept of banking and financial institutions and expose various types of risk based by banks

REFERENCES:

1. Banking theory law and Practice
2. Banking Theory law and practice -Santhanam
3. Banking Awareness - N.K.Gupta
4. Management of Banking and financial Services-Padmalathasuresh,Justinpaul

Course Code	Course Title	L	T	P	C
22120SEC64L	.NET Programming Lab	0	0	3	2

1. Write a program in VB. Net to check whether given number is Odd or Even.
2. Write a program to find maximum from given numbers.
3. Write a program to find are of a circle
4. Design ASP.Net web form using Html Server Controls to enter job seeker's details.
5. Create an ASP.Net web form using Web control to enter E-Mail registration form.
6. Apply appropriate validation techniques in E-Mail registration form using
7. Validation controls.
8. Write an ASP.Net application to retrieve form data and display it the client browser in a table format.
9. Create a web application using ADO.Net that uses which performs basic data Manipulations:
   (i). Insertion (ii) Updating (iii) Deletion (iv) Selection
   Hint: Do operations using Ms-Access and SQL-Server
10. Create an application using Data grid control to access information's from table in SQL server.

<u>Course Outcomes</u>:

- Contrast and compare major elements of the .NET Framework and explain how C# fits into the .NET platform.
- Analyze the basic structure of a C# application and be able to document, debug, compile, and run a simple application.
- Create, name, and assign values to variables.
- Use common statements to implement flow control, looping, and exception handling.
- Create methods (functions and subroutines) that can return values and take parameters.
- Create, initialize, and use arrays

Course Code	Course Title	L	T	P	C
22120SEC65L	Oracle Lab	0	0	3	2

1. Write SQL queries to create the following tables and insert rows in it.
   Employee (eno, ename, deptno, salary, designation)
   Dept (deptno, deptname, location)
   Student (rollno, name, course, paper1, paper2, paper3)

2. Write SQL queries to create primary key and foreign key constraints in the above given tables and perform all types of simple retrieval.

3. Write SQL queries to perform all types of advance retrieval using (i) nested sub queries (ii) set operators.

4. Write SQL queries to perform all types of joins.

5. Write SQL queries to illustrate all built-in functions.

6. Write SQL queries to create views and index/indices for the tables Employee, Dept and Student.

7. Write a database trigger to prevent transactions during weekend. Create PL/SQL procedures and store them in a package and execute them in the command prompt.

8. Write a PL/SQL program that prints mark sheet of students in a University using cursor.

9. Payroll using forms

10. Mark sheet processing using forms

Course Outcomes:

- Brief knowledge about SQL Fundamentals
- Unary and Binary table Operations.
- Able to handle with different database languages.
- Table view, Log and Triggers.
- Handling online Transactions.
- Database Connectivity with front-end.
-

Course Code	Course Title	L	T	P	C
22120PRW66	Project Work	0	0	0	4

Each student will develop and implement individually developed application software based on any of the latest technologies.

Course Code	Course Title	L	T	P	C
221ACLSCET	**Community Engagement**	-	-	-	1

Aim:

Course Objectives:

- To develop an appreciation of rural culture, life-style and wisdom amongst students
- To learn about the status of various agricultural and rural development programmes
- To understand causes for rural distress and poverty and explore solutions for the same
- To apply classroom knowledge of courses to field realities and thereby improve quality of learning

Course Outcomes:

After completing this course, student will be able to

- Gain an understanding of rural life, culture and social realities
- Develop a sense of empathy and bonds of mutuality with local community
- Appreciate significant contributions of local communities to Indian society and economy
- Learn to value the local knowledge and wisdom of the community
- Identify opportunities for contributing to community's socio-economic improvements

UNIT I - Appreciation of Rural Society

Rural life style, rural society, caste and gender relations, rural values with respect to community, nature and resources, elaboration of "soul of India lies in villages" (Gandhi), rural infrastructure.

UNIT II- Understanding rural economy & livelihood

Agriculture, farming, landownership, water management, animal husbandry, non-farm livelihoods and artisans, rural entrepreneurs, rural markets

UNIT III Rural Institutions

Traditional rural organisations, Self-help Groups, Panchayati raj institutions (Gram Sabha, Gram

Panchayat, Standing Committees), local civil society, local administration

UNIT IV Rural Development Programmes

History of rural development in India, current national programmes: Sarva Shiksha Abhiyan, Beti Bachao, Beti Padhao, Ayushman Bharat, Swatchh Bharat, PM AwaasYojana, Skill India, Gram Panchayat Decentralised Planning, NRLM, MNREGA, etc.

Course Code	Course Title	L	P	T	C
221ACSSBBE	Basic Behavioural Etiquette				

Aim:

Objectives:
Training is mainly focused on discipline, grooming, career planning and building personality. As it is the first year of the university, students are given awareness about the job market right from the start so that they prepare accordingly at their own pace and potential.

Eliminating negative thought, developing enriching habits, unlocking individual potentials and well versed communication is the aim of this program. The module consists of

- Communication Skills
- Goal Setting
- Career Planning
- Reaching your Potential
- Time Management
- Stress Management
- Grooming and Discipline
- Learning skills
- Listening Skills
- Team Building

Outcomes:

- Etiquette helps us to be thoughtful about our conduct.
- It helps us to be aware of the feelings and rights of others. By eliminating discourteous behaviour and prioritising other people's feelings, etiquette promotes kindness, consideration, and humility.
- Business etiquette training, a key part of soft skills & communication, facilitated by Momentum enlightens participants on the accepted behaviour patterns and manners key to their profession.
- It emphasises on a set of practices used and accepted in a multi-national work environment.

Course Code	Course Title	L	P	T	C
221ACSSAQA	General Aptitude and Quantitative Ability				

Aim:

1. General Aptitude

- Introduction
- Introduction to Aptitude Tests
- Diagnostic Tests
- Introduction to Speed Maths
- Quantitative Ability – Number Theory
- Numbers
- Properties of Numbers
- Concept of Multiples and Factors
- LCM and HCF
- Factorial Concept
- Last Digit Concept
- Remainders Concept

Quantitative Ability – Arithmetic - 1

- Percentage
- Ratio and Proportion
- Simple Interest and Compound Interest
- Profit Loss
- Discount
- Mixture and Allegation
- Questions from Company Papers will be discussed

Quantitative Ability – Arithmetic - 2

- Speed Distance Time
- Time and Work
- Chain Rule
- Clocks and Calendars
- Averages
- Questions from Company Papers will be discussed

Quantitative Ability – Algebra

- Basic Terminologies in Algebra
- Equations
- Simple Equation

- Quadratic Equation
- Cubic Equation
- Functions
- Graphs
- Maxima and Minima
- Questions from Company Papers will be discussed

Quantitative Ability – Modern Maths

- Set Theory
- Fundamental way of Counting
- Permutations and Combinations
- Probability
- Questions from Company Papers will be discussed
- Data Analysis
- Data Sufficiency

Analytical and Logical Reasoning

- Mono variate conditions
- Multi variate conditions

Puzzles

- Coding
- Decoding
- Family tree
- Direction sense
- Alpha numeric
- Brain teasers

Deductive Reasoning

Visual Sequence

Mathematical Reasoning

2. English Aptitude

- Fill in the blanks
- Comprehension
- Odd man out
- Phrases and Sentences
- Sequencing
- Basic Grammar
- Meanings

Outcomes:

- The student will be able to • Use their logical thinking and analytical abilities to solve Quantitative aptitude questions from company specific and other competitive tests.
- Solve questions related to Time and distance and time and work etc. from company specific and other competitive tests.
- " The main aim of introducing “Quantitative Aptitude”for mathematics students is to develop skill to meet the competitive examinations for better job opportunity.
- "
- Effort has been made to accommodate fundamental, mathematical aspects to instill confidence among students.
- Effort has been made to accommodate fundamental, mathematical aspects to instill confidence among students.
- This course consists of practice exercises for Quantitative or Numerical and Verbal Ability. Prepare for Aptitude Tests for Entrance Exams like GATE, CAT, Bank PO, SAT, GMAT, GRE, UPSC and RRB.

Course Code	Course Title	L	P	T	C
221ACSSIST	Interview Skills Training and Mock Test				

Aim:

➢ Exclusive Pre-Placement Training – both General Aptitude and Technical Aptitude is carried out by External Training firms, Corporate Professionals for final year students.- with a focus on the Corporate Selection Process during the Campus Hiring Visit

➢ Mock Tests on Company Specific Aptitude Question papers are carried out along with Mock Interviews. Based on such companies face-to-face- Technical & HR – interviewing style and finally placement offer provide to the students.

Course Outcomes:

- Help candidates reduce their stress and anxiety before a real job interview.
- Help you boost your confidence.
- Provide you with useful feedback in a low-stress environment.
- Help you prepare for behavioral-based interview questions.
- Interviewing Skills Training focuses on the skills required to conduct engaging interviews that include effective questions.
- This will allow a hiring manager or interviewer to ensure the best practices are followed to hire the right candidates with the applicable skills, behavior, and mindset.

Research Integrated Curriculum

The relationship between teacher and learner is completely different in higher education from what it is in school. At the higher level, the teacher is not there for the sake of the student, both have their justification in the service of scholarship. For the students who are the professionals of the future, developing the ability to investigate problems, make judgments on the basis of sound evidences, take decisions on a rational basis and understand what they are doing and why is vital. Research and inquiry is not just for those who choose to pursue an academic career. It is central to professional lifein the twenty-first century.

It is observed that the modern world is characterized by heightened levels of complexity and uncertainty. Fluidity, fuzziness, instability, fragility, unpredictability, indeterminacy, turbulence, changeability, contestability: these are some of the terms that mark out the world of the twenty-first century. Teaching and research is correlated when they are co-related. Growing out of the research on teaching- research relations, the following framework has been developed and widely adopted to help individual staff, course teams and whole institutions analyse their curricula and consider ways of strengthening students understanding of and through research. Curricula can be:

Research – Led: Learning about current research in the discipline

Here the curriculum focus is to ensure that what students learn clearly reflects current and ongoing research in their discipline. This may include research done by staff teaching them.

Research – Oriented: Developing research skills and techniques

Here the focus is on developing student's knowledge of and ability to carry out the research methodologies and methods appropriate to their discipline(s)

Research – Based: Undertaking research and inquiry

Here the curriculum focus is on ensuring that as much as possible the student learns in research and or inquiry mode (i.e. the students become producers of knowledge not just consumers). The strongest curricula form of this is in those special undergraduate programmes for selected students, but such research and inquiry may also be mainstreamed for all or many students.

Research- Tutored: engaging in research discussions

Here the focus is on students and staff critically discussing ongoing research in the discipline.

All four ways of engaging students with research and inquiry are valid and valuable and curricula can and should contain elements of them.

Moreover, the student participation in research may be classified as,

Level 1: Prescribed Research

Level 2: Bounded Research

Level 3: Scaffolded Research

Level 4: Self actuated Research

Level 5: Open Research

Taking into consideration the above mentioned facts in respect of integrating research into the B.Sc.,(IT) curriculum, the following Research Skill Based Courses are introduced in the B.Sc.,(IT) curriculum.

Semester	**RSB Courses**	**Credits**
II	Research Led Seminar	1
III	Research Methodology	2
V	Participation in Bounded Research	1
VI	Project Work	4

Blueprint for assessment of student's performance in Research Led Seminar Course

- **Internal Assessment:** **40 Marks**
- Seminar Report (UG)/Concept Note(PG) : 5 X 4= 22 Marks
- Seminar Review Presentation : 10 Marks
- Literature Survey : 10 Marks
- **Semester Examination :** **60 Marks**

(Essay type Questions set by the concerned resource persons)

Blueprint for assessment of student's performance in Research Methodology Courses

Continuous Internal Assessment: **22 Marks**

- Research Tools(Lab) : 10 Marks
- Tutorial: 10 Marks

Model Paper Writing: **40 Marks**

- Abstract: 5 Marks
- Introduction: 10 Marks
- Discussion: 10 Marks
- Review of Literature: 5 Marks
- Presentation: 10 Marks

Semester Examination: **40 Marks**

Total: **100 Marks**

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SCHOOL OF ARTS AND SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

BCA(BACHELOR OF COMPUTER APPLICATION)

REGULATION 2022 – 2023

COURSE STRUCTURE

SEMESTER – I

Course Code	Course Title - BCA	L	T	P	C
	THEORY				
22110AEC11/ 22111AEC11/ 22132AEC11/ 22135AEC11	Tami – I/Advanced English-I/Hindi-I/ French - I	4	0	0	2
22111AEC12	English-I	4	0	0	2
22122SEC13	PROBLEM SOLVING USING PYTHON	5	1	0	4
22112AEC14B	Classical algebra	4	1	0	3
22112AEC15B	Numerical and statistical Methods	4	1	0	4
	PRACTICAL				
22122SEC16L	PROBLEM SOLVING USING PYTHON LAB	0	0	3	2
	Total	21	3	3	17
	AUDIT COURSE				
221LSCIC	Indian Constitution	-	-	-	2
221LSCUV	Universal Human Values	-	-	-	2

SEMESTER – II

Course Code	Course Title	L	T	P	C
THEORY					
22110AEC21/ 22111AEC21/ 22132AEC21/ 22135AEC21	Tamil – II/ Advanced English-II/Hindi-II/ French – II	4	0	0	2
22111AEC22	English-II	4	0	0	2
22122SEC23	Data Structure and Algorithms	5	1	0	4
22112AEC24B	Discrete Mathematics	4	1	0	4
22112AEC25B	Operations Research	4	1	0	3
PRACTICAL					
22122SEC26L	Data Structure and Algorithms Lab	0	0	3	2
RESEARCH SKILL BASED COURSE					
22122RLC27	Research Led Seminar	-	-	-	1
	Total	21	3	3	18
AUDIT COURSES					
221LSCCS	Communication Skills	-	-	-	2
221SSCBE	Basic Behavioral Etiquette	-	-	-	2

SEMESTER – III

Course Code	Course Title	L	T	P	C
THEORY					
22110AEC31/ 22132AEC31/ 22111AEC31/ 22135AEC31	Tamil – III/Hindi-III/Advanced English-III/ French – III	4	0	0	2
22111AEC32	English-III	4	0	0	2
22122SEC33	Internet and Java Programming	4	1	0	4
22161SEC34	Financial Accounting	4	1	0	4
22113AEC35A	Allied Physics –I	3	1	0	3
22122SEC33	Java and Data structures	4	1	0	4
PRACTICAL					
22122SEC36L	Internet and Java Programming Lab	0	0	3	2
22122SEC36L	Data structures using Java Lab	0	0	3	2
RESEARCH SKILL BASED COURSE					
22122RMC37	Research Methodology	2	0	0	2
	Total	21	3	3	1 9
AUDIT COURSE					
221ACLSOAN	Office Automation	-	-	-	2

SEMESTER – IV

Course Code	Course Title	L	T	P	C
THEORY					
22110AEC41/ 22111AEC41/ 22132AEC41/ 19135AEC41	Tamil-IV/Advanced English-IV /Hindi-IV/ French – IV	4	0	0	2
22111AEC42	English-IV	4	0	0	2
22122SEC43	Visual Programming	4	1	0	4
22113AEC44A	Allied Physics –II	5	1	0	5
221EVNSTU	Environmental Studies	2	0	0	2
PRACTICAL					
22122SEC45L	Visual Programming Lab	0	0	3	2
22113AEC46AL	Allied Physics Lab –I	0	0	3	2
	Total	19	2	6	1 9
AUDIT COURSE					
221LSCLS	Leadership and Management Skills	-	-	-	2
221SSCAQ	General Aptitude and Quantitative Ability				2

SEMESTER – V

Course Code	Course Title	L	T	P	C
THEORY					
22122SEC51	Relational Database Management Systems	4	1	0	4
22122SEC52	.NET Programming	4	1	0	3
22122SEC53	Designing and supporting Computer Networks	4	1	0	4
22122DSC54_	Discipline Specific Elective -I	4	1	0	3
PRACTICAL					
22122SEC55L	Oracle Lab	0	0	3	2
22122SEC56L	.NET Programming Lab	0	0	3	2
RESEARCH SKILL BASED COURSE					
22122BRC57	Participation in Bounded Research	-	-	-	1
	Total	16	4	6	19
AUDIT COURSE					
221ACLSPSL	Professional Skills	-	-	-	2

SEMESTER – VI

Course Code	Course Title	L	T	P	C
THEORY					
22122SEC61	Advanced Web Technology	4	1	0	4
22122SEC62	Operating System	4	1	0	5
22122DSC63_	Discipline Specific Elective –II	4	1	0	3
221_ _OEC(2 Digit Course Name)	Open Elective	4	0	0	2
22122SEC61	Introduction to Data Science	4	0	0	2
PRACTICAL					
22122SEC64L	Advanced Web Technology Lab	0	0	3	2
22122SEC65L	Operating System Lab	0	0	3	2
22122SEC64L	Data Science Lab	0	0	3	2
22122PRW66	Project Work	-	-	-	4
22122PROEE	Program Exit Examination	-	-	-	1
	Total	16	3	6	23
AUDIT COURSE					
221SSCIM	Interview Skills Training and Mock Test	-	-	-	2
221LSCCE	Community Engagement	-	-	-	2
Total Credits –Programme					115
Total Credits - Audit Courses					22

Discipline Specific Electives

Semester	Discipline Specific Elective Courses
V	a) 22122DSC54A - Computer Organization and Architecture b) 22122DSC54B - E-learning c)22121DSC54C- Enterprise Resource Planning d)22121DSC54D-Block Chain Technology
VI	a) 22122DSC63A - Software Project Management b) 22122DSC63B - Object Oriented Analysis and Design c) 22122DSC63C -Ethical Hacking d)22122DSC63D- WAP and WML

Open Electives

Semester	Open Elective Courses
VI	a) 221TNOEC-Tamil IlakkiyaVaralaru b) 221ENOEC-Journalism c) 221MAOEC-Development of Mathematical Skills d) 221PHOEC-Instrumentation e) 221CEOEC-Food and Adulteration f) 221MBOEC-Wildlife Conservation g) 221BTOEC-Mushroom Technology h) 221CSOEC-E-Learning i) 221CMOEC-Banking Service

Skill based Electives

Credit Distribution

Sem	AEC	SEC	DSC	OEC	Research	Others	Total
I	11	6	-	-	-	-	17
II	11	6	-	-	1	-	18
III	7	10	-	-	2	-	19
IV	11	6	-	-	-	2	19
V		15	3	-	1	-	19
VI		13	3	2	4	1	23
TOTAL	44	52	6	2	8	3	115

SCHOOL OF ARTS AND SCIENCE
DEPARTMENT OF COMPUTER SCIENCE

B. C. A., Curriculum-Regulation 2022 - 2023

B.C. A., Graduate Attributes

- Information Literacy
- Problem Analysis
- Design/development of solutions
- Modern tool usage
- Professional and Ethical understanding

PROGRAMME EDUCATIONAL OBJECTIVE (PEO)

- PEO1 - To study about I/O management, storage management
- PEO2 - To know the methods of connecting them to the peripheral devices.
- PEO3 - To learn Software design and Implementation
- PEO4 - To learn the basic principles of database and database design
- PEO5 - To understand computational development of graphics with mathematics
- PEO6 - Design and implement reliable and maintainable object-oriented applications of Moderate complexity composed of several classes
- PEO7 - To learn the basic principles of database and database design
- PEO8 - To understand computational development of graphics with mathematics
- PEO9 – To understand dynamic memory allocation, structure and pointers

PROGRAMME SPECIFIC OUTCOME (PSOs)

- To assimilate complex real time problems ideas and arguments.
- To improve your own learning and performance.
- To assimilate complex real time problems ideas and arguments.
- To improve your own learning and performance.
- To develop abstract rethinking of technologies.

PROGRAMME OUTCOME (POs)

- PO1- Able to understand and design the solution to a problem using object-oriented programming concepts
- PO2- Trace the flow of information from one node to another node in the network
- PO3- Design Databases for applications.
- PO4- Able to Measure the product and process performance using various metrics
- PO5- Gain the knowledge of different media streams in multimedia transmission
- PO6- Trace the flow of information from one node to another node in the network.

Mapping of PEOs and PO

C1 - Programming in C with C++

C2 - Data Structure and Algorithms

C3 - Internet and Java Programming

C4- Visual Programming

C5 - Relational Database Management Systems

C6 - .NET Programming

C7 - Designing and supporting Computer Networks

C8 - Advanced Web Technology

C9 - Operating System

B. C. A, Curriculum Mapping

Programme Educational Objectives vsProgramme Outcome

PO/PEO	PO1	PO2	PO3	PO4	PO5	PO6
PEO1		❐			❐	
PEO2	–					
PEO3			❐			–
PEO4				❐		–
PEO5			❐		❐	
PEO6			❐		❐	
PEO7	–			–		–
PEO8	–		❐		❐	
PEO9		❐	❐			–

B.C.A. Curriculum Mapping

Programme Outcome-PO VS Course Outcome-CO

Programme Outcome-PO Course Outcome-CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	–					
CO2	–		– –			
CO3	–		– –		–	
CO4			– –			–
CO5		❒				
CO6				–		–
CO7						–
CO8			– –			–
CO9					–	–

Course Code	Course Title	L	T	P	C
22110AEC11	Tamil-I	4	0	0	2

முதல் பருவம் - தாள் - I

இக்கால இலக்கியம், செய்யுள், சிறுகதை, இலக்கணம், இலக்கிய வரலாறு மனப்பாடப்பகுதி

அலகு – I

பாரதியார் தேசபக்திப் பாடல்கள்

சுதந்திரப் பெருமை

சுதந்திரப் பயிர்

சுதந்திர தேவியின் துதி

தொண்டு செய்யும் அடிமை

பாரதிதாசன்

வீரத்தாய்

அலகு – II

சுஜாதா – நல்ல தீர்ப்பு

கண்ணதாசன் - கந்தல் துணியின் கதை

பட்டுக்கோட்டை கல்யாணசுந்தரம் - நன்று செய்த தொண்டு – காலம் சரியில்லே

பூமேத்தா – வாழையடி வாழை
வாலி – தாய்

அலகு – III

சிறுகதை - இளவேனிற் குறிப்புகள் - திருவையாறு பாலகுமார்

அலகு – IV

இலக்கணம்

எழுத்து

மணப்பாடப்பகுதி

அலகு – V

இலக்கிய வரலாறு

சிறுகதை, புதினம், நாடகம், உரைநடை, கவிதை,புதுக்கவிதை

தாள் - I

ஒப்படைவு – மதிப்பெண் 40

பாடத்தொடர்புடைய கட்டுரை – 20 மதிப்பெண்

ஆத்திச்சூடி – 20 மதிப்பெண்

அறம் செய விரும்பு, ஆறுவது சினம், இயல்வது கரவேல், ஈவது விலக்கேல், உடையது விளம்பேல், ஊக்கமது கைவிடேல், எண் எழுத்து இகழேல்,ஏற்பது இகழ்ச்சி, ஐயம் இட்டு உண், ஒப்புரவு ஒழுகு, ஓதுவது ஒழியேல்,ஔவியம் பேசேல், கண்டு ஒன்று சொல்லேல், ஞயம்பட உரை, இடம்பட வீடு எடேல், இணக்கம் அறிந்து இணங்கு, தந்தை தாய்ப்பேண்,நன்றி மறவேல்,பருவத்தே பயிர்செய், இயல்பு அலாதன செயேல்,வஞ்சகம் பேசேல்,இளமையில் கல்,அனந்தல்ஆடேல்,கடிவது மறகீழ்மை அகற்றுதனமது கைவிடேல்,கெடுப்பது ஒழி, கேள்வி முயல்,சான்றோர் இனத்து இரு, சோம்பித்திரியேல்.

(மேற்கண்ட தலைப்புகளில் ஏதேனும் ஒன்றுக்கு கவிதை(மரபு அல்லது புதுக்கவிதை) கதை,கட்டுரை,நாடகம் எழுதி வரச் செய்து சரிப்பார்த்து மதிப்பெண் வழங்கிடவும்)

COURSE CODE	COURSE TITLE	L	T	P	C
22111AEC11	**Advanced English-I**	**4**	**0**	**0**	**2**

Aim:

- To improve the knowledge of English

Objective:

- To familiarize with the glossary terms, figures of speech
- To improve vocabulary
- To learn how to edit and proof read
- To know the comparison and contrast and cause and effect forms
- To understand the impact of the speeches of famous people

Outcome:

- Develop vocabulary
- Read and comprehend literature

UNIT –I

Glossary of grammar terms

Figures of speech

UNIT – II

Foreign words and phrases

British and American Vocabulary

UNIT – III

Speeches of famous people: Mahatma Gandhi-Abraham Lincoln-Swami Vivekananda-John F. Kennedy

UNIT – IV

Editing Proof reading

UNIT – V

Comparison and contrast

Cause and effect

References:

English Grammar -Wren and Martin
English Grammar and Composition -Radhakrishna Pillai
Essentials of Business Communication -Rajendra Pal &J.S Korlahalli Sultan Chand & Sons
English for writers and translators -Robin Macpherson
Technical Communication -Meenakshi Sharma &Sangeetha Sharma
The World's Great Speeches - Sudhir Kumar Sharma Galaxy Publishers
English Work Book-I&II -JewelcyJawahar

Course Code	Course Title	L	T	P	C
22111AEC12	English-I	4	0	0	2

AIM:

To acquaint students with learning English through literature

OBJECTIVE:

- To improve English delightfully through simple poems, essays
- To throw light on fiction
- To read and comprehend literature

OUTCOME:

- Read and comprehend literature

UNIT –I

The Art of Reading - Lin Yutang

An Eco-Feminist Vision -ArunaGnanadason

UNIT – II

The Merchant of Death -Nanda Kishore Mishra & John Kennet

She Spoke for all Nature -Young world 'The Hindu'

UNIT –III

Because I could not Stop for Death -Emily Dickinson

Stopping by Woods on a Snowy Evening -Robert Frost

UNIT –IV

Enterprise -Nissim Ezekiel

Love poem for a wife -A.K Ramanujam

UNIT –V

Oliver Twist -Charles Dickens

REFERENCES:-

The Art of Reading/ Experiencing Poetry. -S.Murugesan and Dr.K.Chellappan
Emerald Publishers

Course Code	Course Title	L	T	P	C
22122SEC13	**PROBLEM SOLVING USING PYTHON**	**0**	**0**	**3**	**4**

OBJECTIVES:

_ Describe the core syntax and semantics of Python programming language.
_ Discover the need for working with the strings and functions.
_ Illustrate the process of structuring the data using lists, dictionaries, tuples and sets.
_ Understand the usage of packages and Dictionaries.

OUTCOMES:

_ To understand the principles of Python and acquire skills in programming in python
_ To develop the emerging applications of relevant field using Python
_ Interpret the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements.
_ Able to develop simple turtle graphics programs in Python

UNIT – I

Introduction: The essence of computational problem solving – Limits of computational problem solving-Computer algorithms-The process of computational problem solving-Python programming language - Literals - Variables and Identifiers - Operators - Expressions and Data types.

UNIT - II

Control Structures: Boolean Expressions - Selection Control - If Statement- Indentation in Python- Multi-Way Selection -- Iterative Control- While Statement- Infinite loops- Definite vs. Indefinite Loops-Boolean Flags and Indefinite Loops. Lists: List Structures - Lists in Python - Iterating over lists in Python.

UNIT - III

Functions: Program Routines- Defining Functions- More on Functions: Calling Value-Returning Functions- Calling Non-Value-Returning Functions- Parameter Passing - Keyword Arguments in Python –

UNIT - V

Objects and their use: Software Objects - Turtle Graphics – Turtle attributes-Modular Design: Modules - Top-Down Design - Python Modules.

UNIT - V

Dictionaries and Sets: Dictionary type in Python - Set Data type. Object Oriented Programming using Python: Encapsulation - Inheritance – Polymorphism.

TEXT BOOKS

j) arles Dierbach, "Introduction to Computer Science using Python - A computational Problem solving Focus", Wiley India Edition, 2015.

REFERENCE BOOKS:

1. Mark Lutz, "*Learning Python Powerful Object Oriented Programming*", O'reilly Media 2018, 5th Edition.
2. Timothy A. Budd, "*Exploring Python*", Tata MCGraw Hill Education Private Limited 2011, 1st Edition.

3. Allen Downey, Jeffrey Elkner, Chris Meyers, "*How to think like a computer scientist: learning with Python*", 2012.
4. SheetalTaneja& Naveen kumar, "*Python Programming a Modular approach – A Modular approach with Graphics, Database, Mobile and Web applications*", Pearson, 2017.
5. ChSatyanarayana M Radhika Mani, B N Jagadesh, "*Python programming*", Universities Press 2018.

WEB REFERENCES

- http://interactivepython.org/courselib/static/pythonds
- http://www.ibiblio.org/g2swap/byteofpython/read/
- http://www.diveintopython3.net/
- http://greenteapress.com/wp/think-python-2e/
- NPTEL & MOOC courses titled Python programming
- http://spoken-tutorial.org/tutorial-search/?search_foss=Python&search_language=English
- http://docs.python.org/3/tutorial/index.html

Course code	Course Title	L	T	P	C
22112AEC14B	**Classical Algebra**	**4**	**1**	**0**	**3**

OBJECTIVES:

To learn about the expansion of a Binomial Theorem for a rational index using vandermonde's theorem. Further we aim at learning problems to be solved using the different types in Binomial series. Understanding the relation between roots and coefficients of polynomial equations-symmetric functions-sum of r^{th} power of the roots-two methods

And Reciprocal equations-Descartes' rule of signs-simple problems.

UNIT-I

Binomial, exponential and logarithmic series (formulae only)-Summations.

UNIT-II

Non singular, symmetric, skew symmetric orthogonal, Hermition, skew Hermition and unitary matrices-characteristic equation, Eigen values, Eigen vector-Cayley Hamilton's theorem(proof not needed)-simple applications.

UNIT-III

Relation between roots and coefficients of polynomial equations-symmetric functions-sum of r^{th} power of the roots-two methods.

UNIT-IV

Prime number; Composite number; decomposition of a composite number as a product of primes uniquely; divisors of a positive integer n; Euler function

UNIT-V

Congruence modulo n; highest power of a prime number p contained in n! ; Fermat's andWilson's theorems.

LEARNING OUTCOMES

By the end of this course, you should:

- Understand the theory of, and be able to solve problems in Cayley Hamilton Theorem, and finding the Eigen values & Eigen vectors
- be able to manipulate relation between root and coefficients, symmetric functions of the roots in terms of the coefficients and transformation of equation .
- be able to calculate summation related to Binomial, Exponential and Logarithmic series

REFERENCE BOOKS:

Algebra-T.K.M.Pillai, Vol1&2.

Course code	Course Title	L	T	P	C
22112AEC15B	**Numerical And Statistical Methods**	**4**	**1**	**0**	**4**

OBJECTIVES:

The roll of numerical analysis is to develop and analyze the numerical techniques. In this paper, different methods for finding the roots of algebraic and transcendental equations, solutions of simultaneous equations, solutions of ordinary differential equations Solution of Linear systems, Numerical differentiation and integration interpolation with equal & unequal intervals are concentrated. Correlation coefficient and its properties Linear Regression and its properties, Test of significance would also be taught.

UNIT-I

Algebraic and transcendental equations-the iteration method –the Newton Raphson method-False Position method-the bisection method

UNIT-II

Interpolation-Finite difference –Newton's formulae for interpolation-Lagrange's formulae for interpolation-Gaussian elimination method –Gauss-Seidal method.

UNIT-III

Numerical different ion and integration-Maximum and minimum values of a tabulated functions-Trapezoidal rule-Simpson's rule –Numerical solution of ordinary differential equations-Euler's method –RungeKutta methods-Predictor corrector method-Boundary value problems.

UNIT-IV

NUMERICAL DIFFERENTIATION AND INTEGRATION: Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal, Simpson's 1/3 rule

UNIT-V

Index Numbers: Consumers price index and cost of living indices

Learning outcomes

By the end of this course, you should be able to calculate the solution of algebraic and transcendental equations.

- solutions of simultaneous equations,be able to calculate the area of the given curve
- Understood the concept of correlation and regression
- A knowledge of test of significance based on parametric and non – parametric test

REFERENCE BOOKS:

1. Introductory methods of numerical analysis S.S.Sastry, PHI

2. Fundamentals of mathematical statistics-S>C>Gupta &V.K.Kapoor.

Course Code	Course Title	L	T	P	C
22122SEC16L	**PROBLEM SOLVING USING PYTHON LAB**	**0**	**0**	**3**	**4**

OBJECTIVES:

_ To implement the python programming features in practical applications.
_ To write, test, and debug simple Python programs.
_ To implement Python programs with conditionals and loops.
_ Use functions for structuring Python programs.
_ Represent compound data using Python lists, tuples, dictionaries , turtles, Files and modules.

OUTCOMES:

_ Understand the numeric or real life application problems and solve them.
_ Apply a solution clearly and accurately in a program using Python.
_ Apply the best features available in Python to solve the situational problems.

LIST OF EXERCISES:

1. Program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user's choice.

2. Program to calculate total marks, percentage and grade of a student. Marks obtained in each of the five subjects are to be input by user. Assign grades according to the following criteria:

Grade A: Percentage >=80 Grade B: Percentage >=70 and <80

Grade C: Percentage >=60 and <70 Grade D: Percentage >=40 and <60

Grade E: Percentage <40

3. Program, to find the area of rectangle, square, circle and triangle by accepting suitable input parameters from user.

4. Program to display the first n terms of Fibonacci series.

5. Program to find factorial of the given number using recursive function.

6. Write a Python program to count the number of even and odd numbers from array of N numbers.

7. Python function that accepts a string and calculate the number of upper case letters and lower case letters.

8. Python program to reverse a given string and check whether the give string is palindrome or not.

9. Write a program to find sum of all items in a dictionary.

10. Read a file content and copy only the contents at odd lines into a new file.

Course Code	Course Title	L	T	P	C
221ACLSICN	**Indian Constitution**	**-**	**-**	**-**	**-**

OBJECTIVES:

- To make the students understand about the Democratic Rule and Parliamentarian Administration.
- To appreciate the salient features of the Indian Constitution.
- To know the fundamental Rights and Constitutional Remedies.
- To make familiar with powers and positions of the Union Executive, Union Parliament and the Supreme Court.
- To exercise the adult franchise of voting and appreciate the Electoral system of Indian Democracy.

UNIT I: THE MAKING OF INDIANCONSTITUTION

The Constituent Assembly Organization Character – Work – Salient features of the constitution – Written and Detailed Constitution – Socialism – Secularism – Democracy and Republic.

UNIT II: FUNDAMENTAL RIGHTS AND FUNDAMENTAL DUTIES OF THE CITIZENS

Right of Equality – Right of Freedom – Right against Exploitation – Right to Freedom of Religion – Cultural and Educational Rights – Right to Constitutional Remedies – Fundamental Duties .

UNIT III: DIRECTIVE PRINCIPLES OF STATE POLICY

Socialism Principles – Gandhian Principles – Liberal and General Principles – Differences between Fundamental Rights and Directive principles.

UNIT IV: THE UNION EXECUTIVE, UNIONPARLIAMENT AND SUPREME COURT

Powers and positions of the President – Qualification Method of Election of President and vice president – Prime Minister RajyaSabha- LokSabha – The Supreme Court – High Court – Functions and position of Supreme court and High Court.

UNIT V: STATE COUNCIL – ELECTION SYSTEM AND PARTLIAMENTARY DEMOCRACY IN INDIA

State council of Ministers – Chief Minister – Election system in India- Main features – Election Commission - Features of Indian Democracy.

OUTCOMES

1. Democratic values and citizenship Training are gained.
2. Awareness on Fundamental Rights are established.
3. The functions of union Government and State Governments are learnt.
4. The power and functions of the Judiciary learnt thoroughly.
5. Appreciation of Democratic parliamentary Rule is learnt.

REFERENCE BOOKS:

1. Palekar S.A. Indian Constitution Government and polities, ABD Publications, India.
2. AiyerAlladi, Krishnaswami, Constitution and fundamental rights 1955.
3. Markandan K.C. Directive Principles in the Indian Constitution 1966.
4. KashyapSubash C Our Parliament, National Book, Trust New Delhi 1989.

Course Code	Course Title	L	T	P	C
221ACLSUHV	Universal Human Values	-	-	-	2

Aim:

This course aims at making learners conscious about universal human values in an integralmanner, without ignoring other aspects that are needed for learner's personality development.

Course Objectives :

The present course deals with meaning, purpose and relevance of universal human values and how to inculcate and practice them consciously to be a good human being and realiseone's potentials.

Course Outcomes :

By the end of the course the learners will be able to:

1. Know about universal human values and understand the importance of values in individual, social circles, career path, and national life.
2. Learn from case studies of lives of great and successful people who followed and practised human values and achieved self-actualisation.
3. Become conscious practitioners of human values.
4. Realise their potential as human beings and conduct themselves properly in the ways of the world.

Unit I

- Introduction:What is love? Formsoflove—forself, parents, family, friend, spouse, community, nation, humanity and other beings, both for living and non-living
- Love and compassion and inter-relatedness
- Love, compassion, empathy, sympathy and non-violence
- Individuals who are remembered in history for practicing compassion and love.
- Narratives and anecdotes from history, literature including local folklore
- Practicing love and compassion: What will learners learn gain if they practice love and compassion? What will learners lose if they don't practice love and compassion?
- Sharing learner's individual and/or group experience(s)
- Simulated Situations
- Casestudies

Unit II

- Introduction: What is truth? Universal truth, truth as value, truth as fact (veracity, sincerity, honesty among others)
- Individuals who are remembered in history for practicing thisvalue
- Narratives and anecdotes from history, literature including localfolklore
- Practicing Truth: What will learners learn/gain if they practice truth? What will learners lose if they don't practiceit?
- Learners' individual and/or group experience(s)

- Simulated situations
- Casestudies

Unit III

- Introduction: What is non-violence? Its need. Love, compassion, empathy sympathy for others as pre-requisites for non-violence
- Ahimsa as non-violence and non-killing
- Individuals and organisations that are known for their commitment to non-violence
- Narratives and anecdotesaboutnon-violence from history,and literature including local folklore
- Practicingnon-violence: What will learners learn/gain if they practice non- violence? What will learners lose if they don't practice it?
- Sharing learner's individual and/or group experience(s) about non-violence
- Simulated situations
- Casestudies

Unit IV

- Introduction: What is righteousness?
- Righteousness and *dharma*, Righteousness and Propriety
- Individuals who are remembered in history for practicing righteousness
- Narratives and anecdotes from history, literature including local folklore
- Practicing righteousness: What will learners learn/gain if they practice righteousness? What will learners lose if they don't practice it?
- Sharing learners' individual and/or group experience(s)
- Simulated situations
- Casestudies

Unit V

- Introduction: What is peace? Its need, relation with harmony and balance
- Individuals and organisations that are known for their commitment to peace
- Narratives and Anecdotes about peace from history, and literature including local folklore
- Practicing peace: What will learners learn/gain if they practice peace? What will learners lose if they don't practice it?
- Sharing learner's individual and/or group experience(s) about peace
- Simulatedsituations
- Casestudies

Unit VI

- Introduction: What is service? Forms of service for self, parents, family, friend, spouse, community, nation, humanity and other beings—living and non-living, persons in distress ordisaster.
- Individuals who are remembered in history for practicing this value.
- Narratives and anecdotes dealing with instances of service from history, literature including local folklore
- Practicingservice: What will learners learn/gain gain if they practice service? What will learners lose if they don't practice it?

- Sharing learners' individual and/or group experience(s) regarding service
- Simulated situations
- Casestudies

Unit VII

- Introduction: What is renunciation? Renunciation and sacrifice. Self-restrainand Ways of overcoming greed. Renunciation with action as true renunciation
- Individuals who are remembered in history for practicing this value.
- Narratives and anecdotes from history and literature,including local folklore about individuals who are remembered for their sacrifice and renunciation.
- Practicing renunciation and sacrifice: What will learners learn/gain if they practice Renunciation and sacrifice? What will learners lose if they don't practiceit?
- Sharing learners' individual and/or group experience(s)
- Simulated situations
- Casestudies

Course Code	Course Title	L	T	P	C
22110AEC21	Tamil-II	4	0	0	2

தாள் - II

செய்யுள் - பக்தி இலக்கியம், சிற்றிலக்கியம், இலக்கணம், இலக்கிய வரலாறு மனப்பாடப்பகுதி

அலகு I

திருஞானசம்பந்தர் தேவாரம் -இடரினும் தளரினும் - பதிகம்

திருநாவுக்கரசர் தேவாரம் - அன்னம் பாலிக்கும் தில்லை – பதிகம்

திருவாசகம் - கோயிற் திருப்பதிகம்

திருமந்திரம் - 25, 85, 139,238,250,252,270,724,2104,2716

திருஅருட்பா – தெய்வமணி மாலை 1.8.9

அலகு-II

நம்மாழ்வார் - 1 பாசுரம்- திருவாய்மொழி –எம்பெருமானுக்கு ஆட்படுதல் இன்பமே

பெரியாழ்வார் - 1 பாசுரம் - திருப்பல்லாண்டு – தாலப்பருவம்

நாச்சியார் திருமொழி -10 பாடல்கள்- ஆறாம் திருமொழி

அலகு-III

சிற்றிலக்கியம் , **முக்கூடற்பள்ளு** வளமை, செழுமை

மதுரை மீனாட்சியம்மை பிள்ளைத்தமிழ் தாலப்பருவம்-ஐந்துபாடல்கள்

அலகு-IV

இலக்கணம்

சொல்

மனப்பாடப்பகுதி

அலகு-V

இலக்கிய வரலாறு

சைவ, வைணவ இலக்கியங்கள்

சிற்றிலக்கியம்பள்ளு

பிள்ளைத்தமிழ்

பரணி

தாள் II

ஒப்படைவு – மதிப்பெண் 40 பாடத்தொடர்புடைய கட்டுரை 20 மதிப்பெண் கொள்குறி வினாக்கள் 20 மதிப்பெண்

அன்னையும் பிதாவும் முன்னறி தெய்வம், இல்லறம் அல்லது நல்லறம் அன்று, ஊருடன் பகைக்கின் வேருடன் கெடும்,ஏவா மக்கள் மூவா மருந்து,ஔவியம் பேசுதல் ஆக்கத்திற்கு அழிவு, அஃகமும் காசும் சிக்கெனத்தேடு,கற்பெனப்படுவது சொல்திறம்பாமை,கிட்டாதாயின் வெட்டென மற,கீழோர் ஆயினும் தாழ உரை,குற்றம் பார்க்கின் சுற்றம் இல்லை, கூர் அம்பு ஆயினும் வீரியம் பேசேல், கெடுவது செய்யின் விடுவது கருமம், கைப்பொருள் தன்னின்மெய்ப்பொருள் கல்வி,சீரைத்தேடின் ஏரைத்தேடு, சுற்றத்திற்கு அழகு சூழ இருத்தல்,சூதும் வாதும் வேதனை செய்யும்,சேமம்புகினும் யாமத்து உறங்கு, சோம்பர் என்பவர் தேம்பித்திரிவர், தந்தை சொல்மிக்க மந்திரம் இல்லை, தாயிற் சிறந்த ஒரு கோயிலும் இல்லை, திரைகடல் ஓடியும் திரவியம் தேடு, தீராக் கோபம் போராய் முடியும், தோழனோடும் ஏழைமை பேசேல்,நாடெங்கும் வாழக் கேடொன்றும் இல்லை,நீரகம் பொருந்திய ஊரகத்து இரு, பாலோடு ஆயினும் காலம் அறிந்து உண், பையச் சென்றால் வையம் தாங்கும், மருந்தே ஆயினும் விருந்தோடு உண். முற்பகல் செய்யின் பிற்பகல் விளையும். மேழிச் செல்வம் கோழைபடாது.(மேற்கண்ட தலைப்புகளில் ஏதேனும் ஒன்றுக்கு கவிதை மரபு அல்லது புதுக்கவிதை) கதை,கட்டுரை,நாடகம் எழுதி வரச் செய்து சரிபார்த்து மதிப்பெண் வழங்கிடவும்)

COURSE CODE	COURSE TITLE	L	T	P	C
22111AEC21	**Advanced English-II**	**4**	**0**	**0**	**2**

Aim:

- To improve the knowledge of English

Objective:

- To understand the format of e-mail, fax and memos
- To write itinerary, checklist, invitation, circular, instruction, recommendations
- To understand the impact of the biographies of famous people

Outcome:

- Develop writing skill
- Read and comprehend literature

UNIT –I

E-mail, Fax, Memos

UNIT – II

Itinerary, Checklist

UNIT – III

Invitation, Circular

UNIT – IV

Instruction, Recommendations

UNIT – V

Biographies of famous people:

Mother Teresa-Madam Curie-Charles Chaplin-Vikram Sarabhai

References:

English Grammar -Wren and Martin

English Grammar and Composition -Radhakrishna Pillai

Technical Communication -Meenakshi Sharma &Sangeetha Sharma

Inspiring Lives -Maruthi Publishers

English Work Book-I&II -JewelcyJawahar

Course Code	Course Title	L	T	P	C
22111AEC22	**English-II**	**4**	**0**	**0**	**2**

AIM:

To acquaint learners with different trends of writing

OBJECTIVE:

- To empower students to acquire language skills through literature
- To enable the students to appreciate literature
- To develop the conversational skills through one act plays

OUTCOME:

- Read and comprehend literature

UNIT – I

Ecology -A.K. Ramanujan

Gift -Alice Walker

The First Meeting -Sujata Bhatt

UNIT –II

Fueled -Marcie Hans

Asleep -Ernst Jandl

Buying and selling -Khalil Gibran

UNIT –III

The End of living and The Beginning of Survival - Chief Seattle

My Wood - E.M.Forster

The Meeting of Races - Rabindranath Tagore

UNIT – IV

The Refugee -K.A. Abbas

I Have a Dream -Martin Luther king

Those People Next Door -A.G. Gardiner

UNIT – V

Marriage is a private Affair -Chinua Achebe

The Fortune Teller -Karel Capek

Proposal -Anton Chekov

REFERENCES:-

Gathered Wisdom -GowriSivaramanEmeraldPublishers

Course Code	Course Title	L	T	P	C
22122SEC23	**Data Structure and Algorithms**	**5**	**1**	**0**	**4**

AIM

To equip the students with principles data structure concepts and algorithms.

OBJECTIVES:

The Student Should Be Made To:

- Be Familiar with the Basics of C Programming Language.
- Be Exposed To The Concepts Of Adts
- Learn Linear Data Structures – List, Stack, And Queue.
- Be Exposed To Sorting, Searching, Hashing Algorithms

UNIT –I

Arrays and sequential Representations - Ordered Lists - stacks and Queues- Evaluation of expressions - Multiple stacks and queues - Singly Linked lists - linked stacks and queues - polynomial addition - doubly linked lists and dynamic storage management - strings.

UNIT-II

Trees - binary tree representations - Tree traversal - Threaded binary trees - binary tree representation of trees - set representations -decision trees - games trees and counting binary trees - graphs and representations traversals, connected components and spanning trees shortest paths and transitive closure - activity networks - topological sort and critical paths.

UNIT-III

Algorithms - conventions - Writing structured programs - Analyzing algorithms - sorting heap sort - binary search - finding the maximum and minimum – merge sort – quick sort - selection sort

.

UNIT-IV

Definition-Representation of Graph-Types of graph-Breadth first traversal – Depth first traversal-Topological sort- Bi-connectivity – Cut vertex- Euler circuits- Applications of graphs.

UNIT-V

Searching- Linear search-Binary search-Sorting-Bubble sort-Selection sort-Insertion sort-Shell sort-Radix sort- Hashing-Hash functions-Separate chaining-Open Addressing-Rehashing Extendible Hashing

OUTCOMES:

At the end of the course, the student should be able to:

- Use the control structures of C appropriately for problems.
- Apply the different linear data structures to problem solutions.
- Critically analyze the various algorithms.

REFERENCE BOOKS:

1. Fundamental of Data Structure - Ellis Horowitz and SartajSahni.

Chapters 2,3,4,5 only (Excluding 2.3,3.2,4.5,4.6,4.7,4.10,4.12,6.5)

2. Fundamental of computer algorithms - Ellis Horowitz and sartajSahni

Galgotia Publications.

3. Data Structures - LIPSCHUTA, Tata MaGrawHill, Schaum's Outline series.

Course code	Course Title	L	T	P	C
22112AEC24B	**Discrete Mathematics**	**4**	**1**	**0**	**4**

OBJECTIVES:

Algebraic structures like Groups ,cosets , different types of morphisms of groups fundamental them of homomorphism are concentrated. Graph Theory is an integral part of Discrete Mathematics. It has applications to many fields, including computer science, physics, chemistry, psychology and sociology. In this course we teach basic topics in graph theory 22 such as Trees, Directed graphs, Connectivity, Euler tours are also concentrated

UNIT I

Groups- Types – Propertices Of Groups- Semi Groups-Monoids – Problem In Groups- Cyclic Groups And Subgroups

UNIT-II

cosets&lagrange'sthm-Normal groups and quotient groups- Different types of morphisms of groups fundamental thm of homomorphism.

UNIT III

Graph theory - Basic concepts- Finite and infinite graph – Incidence and degree ideas on vertices- Isomorphism-sub graphs – Walks – Paths and circuits

UNIT IV

RELATIONS:Relations – Relations and their properties, Representing Relations, Closures of relations, Equivalence relations, Partial orderings-Recurrence Relations Binary Relations

UNIT V

MATRIX, DETERMINANT OF MATRIX AND ITS APPLICATION: Introduction, definitions, Types of Matrix, Properties of matrix, operations on matrix, Inverse of matrix, Cayley Hamilton of matrix-applications

Learning outcomes

By the end of this course, you should be able

- Understood the concept of Algebraic structures like Groups ,cosets , different types of morphisms of groups fundamental theorem of homomorphism
- Knowledge in Graph Theory
- Understood the properties of Graph Theory
- Understood the concept of Euler theorem and its applications

REFERENCE BOOKS:

1. Algebra - ArumuganIssac
2. Graph theory – Narasinghdeo

Course Code	Course Title	L	T	P	C
22112AEC25B	**Operations Research**	**4**	**1**	**0**	**3**

OBJECTIVES:

Optimization is an important tool of modern applied mathematics. This course gives an idea to the student to recognize potential linear programming problems, to humiliate such problems as linear programming models, to employ the proper computational techniques to solve these problems, and to understand the mathematical aspects that tie together these elements of linear programming. The objective of this paper is to highlight the theoretical, computational and applied aspects of linear programming problems.

UNIT — I

Basic of operations research (OR) characteristics of OR - Necessity of OR in industry, OR and decision making - role of computers in OR Linear Programming: Formulations and graphical solution of (2 variable) canonical and standard terms of linear programming problem.

UNIT — II

Algibric Solution: Simplex methods — Charnes method of penality - Two phase simplex method.

UNIT — III

Transportation Model: Definition — Formulation and solution of transportation models the row — Minima, column minima, Matrix minima and Vogel's approximationmethod.Assignment Model: Definition of assignment model— comparison with transportation model - Formulation and solution of assignment model

UNIT — IV

Assignment problem – Algorithm – Hungarian method – simple problems.

UNIT — V

Network models and simulation. Network models for project analysis CPM; Network construction and time analysis; cost time trade off, PERT – problems Learning outcomes

By the end of this course,

- Students using OR techniques in business tools for decision making
- Students develop PERT and CPM networks and finding the shortest path
- Understand the concept of sequencing problems and game theory
- Students gets the knowledge about inventory theory

REFERENCE BOOKS:

1. Hamdy A. Taha: Operation Research - An Introduction 5th Edition, PHI, New Delhi 1996
2. Ackoff, R Land Sasieni, M.N: Fundamental of Operation research, John Wiley and sons, New york 1968.

Course Code	Course Title	L	T	P	C
22122SEC26L	**Data Structure and Algorithms Lab**	**0**	**0**	**3**	**2**

1. SORTING:

    a. Bubble sort

    b. Heap sort

    c. Insertion Sort

2. SEARCHING:

    a. Linear search

    b. Binary search

3. Operations on Stack

4. Operations on Queue

5. Operations on single Linked list

6. Operations on doubly linked list

7. Binary Tree Traversal

Course Code	Course Title	L	T	P	C
221ACLSCOS	**Communication Skills**	**-**	**-**	**-**	**2**

Aim:

Course Objectives :

This course has been developed with the following objectives:

1. Identify common communication problems that may be holding learnersback
2. Identify what their non-verbal messages are communicating toothers
3. Understand role of communication in teaching-learningprocess
4. Learning to communicate through the digitalmedia
5. Understand the importance of empatheticlistening
6. Explore communication beyondlanguage.

Course Outcome :

By the end of this program participants should have a clear understanding of what good communication skills are and what they can do to improve their abilities.

Unit I

- Techniques of effectivelistening
- Listening andcomprehension
- Probing questions
- Barriers tolistening

Unit II

- Pronunciation
- Enunciation
- Vocabulary
- Fluency
- CommonErrors

Unit III

- Techniques of effectivereading
- Gathering ideas and information from a giventext
  - i. Identify the main claim of thetext
  - ii. Identify the purpose of thetext
  - iii. Identify the context of thetext
  - iv. Identify the conceptsmentioned
- Evaluating these ideas andinformation
  - i. Identify the arguments employed in thetext
  - ii. Identify the theories employed or assumed in thetext
- Interpret thetext
  - i. To understand what a textsays
  - ii. To understand what a textdoes
  - iii. To understand what a textmeans

Unit IV

- Clearly state theclaims
- Avoid ambiguity, vagueness, unwanted generalisations and over simplification of issues

- Provide backgroundinformation
- Effectively argue theclaim
- Provide evidence for theclaims
- Use examples to explainconcepts
- Followconvention
- Be properlysequenced
- Use proper signpostingtechniques
- Be well structured
  - i. Well-knit logicalsequence
  - ii. Narrativesequence
  - iii. Categorygroupings
- Different modesofWriting -
  - i. E-mails
  - ii. Proposal writing for HigherStudies
  - iii. Recording the proceedings ofmeetings
  - iv. Any other mode of writing relevant forlearners

Unit V

k) le of Digital literacy in professionallife
l) ends and opportunities in using digital technology inworkplace
m) ternetBasics
n) troduction to MS Officetools
   - i. int
   - ii. ice
   - iii. l
   - iv. erpoint

Unit VI

o) troduction to social mediawebsites
p) vantages of socialmedia
q) hics and etiquettes of socialmedia
r) to use Google searchbetter
s) fective ways of using SocialMedia
t) troduction to DigitalMarketing

Unit VII

u) aning of non-verbalcommunication
v) troduction to modes of non-verbalcommunication
w) eaking the misbeliefs
x) en and Closed Bodylanguage
y) Contact and FacialExpression
z) ndGestures aa)

Do's andDon'ts

bb) Learning fromexperts
cc) Activities-BasedLearning

Reference:

1. SenMadhucchanda (2210), *An Introduction to Critical Thinking*, Pearson,Delhi
2. Silvia P. J. (2207), *How to Read a Lot*, American Psychological Association, Washington DC

Course Code	Course Title	L	T	P	C
22110AEC31	**Tamil-III**	**4**	**0**	**0**	**2**

தாள் - III

செய்யுள் - காப்பியங்கள், இலக்கணம்,இலக்கிய வரலாறு, மனப்பாடப்பகுதி

அலகு-I

சிலப்பதிகாரம்-வழக்குரை காதை **மணிமேகலை**-ஆதிரை பிச்சையிட்ட காதை

சீவகசிந்தாமணி-நாட்டுவளம் 10 பாடல்கள்

அலகு-II

பெரியபுராணம்- மெய்ப்பொருள் நாயனார் புராணம், கம்பராமாயணம்-வாலி வதைப்படலம்

அலகு-III

சீறாப்புராணம் - கரம் பொருத்து படலம்; **இயேசுகாவியம்** - மலைப்பொழிவு

அலகு-IV

இலக்கணம்

யாப்பு

மனப்பாடப்பகுதி

அலகு-V

இலக்கிய வரலாறு

காப்பியங்கள்

ஐஞ்சிறுகாப்பியங்கள்

புராணங்கள், இதிகாசங்கள்

தாள் - III

ஒப்படைவு – மதிப்பெண் 40

பாடத்தொடர்புடையக் கட்டுரை 20 மதிப்பெண்

வெற்றி வேற்கை 20 மதிப்பெண்

எழுத்து அறிவித்தவன் இறைவன் ஆகும். கல்விக்கு அழகு கசடற மொழிதல். செல்வர்க்கு அழகு செழுங்கிளை தாங்குதல், மன்னர்க்கு அழகு செங்கோல் முறைமை, வைசியர்க்கு அழகு வளர் பொருள் ஈட்டல், உழவர்க்கு அழகு உழுது ஊண் விரும்பல், மந்திரிக்கு அழகு வரும் பொருள் உரைத்தல், தந்திரிக்கு அழகு தறுகண் ஆண்மை, உண்டிக்கு அழகு விருந்தோடு உண்டல், பெண்டிர்க்கு அழகு எதிர் பேசாதிருத்தல்,அறிஞர்க்கு அழகு கற்றுணர்ந்து அடங்கல், வறிஞர்க்கு அழகு வறுமையில் செம்மை, பெரியோர் எல்லாம் பெரியோரும் அல்லர்.சிறியோர் எல்லாம் சிறியரும் அல்லர்.அடினும் ஆவின் பால் தன் சுவை குன்றாது, சுடினும் செம்பொன் தன்னொளி கெடாது, அரைக்கினும் சந்தனம் தன் மணம் மாறாது பெருமையும் சிறுமையும் தான் தர வருமே. அறிவுடை ஒருவனை அரசும் விரும்பு, யானைக்கு இல்லை தானமும், தருமமும் பூனைக்கு இல்லை தவமும் தயையும். ஞானிக்கு இல்லை இன்பமும் துன்பமும் . அச்சமும் நாணமும் அறிவிலோருக்கு இல்லை. நாளும் கிழமையும் நலிந்தோருக்கு இல்லை. கேளும் கிளையும் கெட்டோருக்கு இல்லை உடைமையும் வறுமையும் ஒரு வழி நில்லா இறந்தோர்க்கு ஈவதும் உடையோர் கடனே.ஒழியா வருவது மொழியாது ஒழிவது. ஒழியா வருபவை இழியாது ஒழிவது, துணையோடு அல்லது நெடுவழி போகேல்.

(மேற்கண்ட தலைப்புகளில் ஏதேனும் ஒன்றுக்கு கவிதை(மரபு அல்லது புதுக்கவிதை) கதை,கட்டுரை,நாடகம் எழுதி வரச் செய்து சரிபார்த்து மதிப்பெண் வழங்கிடவும்)

Course Code	COURSE TITLE	L	T	P	C
22111AEC31	**Advanced English-III**	**4**	**0**	**0**	**2**

Aim:

- To improve the knowledge of English

Objective:

- To familiarize with the organs of speech and the description and classification of speech sounds
- To understand consonant cluster, syllable, word accent and intonation.
- To know how to interpret graphics
- To write slogans and advertisements

Outcome:

- Understand Phonetics
- Develop writing skill

UNIT –I

The organs of speech, Classification of speech sounds , Vowels and Diphthongs

UNIT –II

Consonants, Consonant cluster

UNIT – III

Syllable, Word accent, Intonation

UNIT – IV

Idiom, Interpretation of graphics

UNIT – V

Slogan writing, Writing advertisement

References:

English Grammar -Wren and Martin
English Grammar and Composition -Radhakrishna Pillai
Technical Communication -Meenakshi Sharma &Sangeetha Sharma
A text book of Phonetics for Indian Students -T.B. Balasubramaniyan

Course Code	Course Title	L	T	P	C
22111AEC32	**English-III**	**4**	**0**	**0**	**2**

AIM:

To acquaint students with learning English through literature

OBJECTIVE:

a) To sensitize students to language use through prescribed text
b) To develop the conversational skills through one act plays
c) Read and comprehend literature

UNIT – 1

The Doctor's World - R.K. Narayan

The Postmaster - Rabindranath Tagore

Princess September - E.Somerest Maugham

UNIT – II

The Price of Flowers -Prabhat Kumar Mukhopadhyay

The Open Window -Saki

The Model Millionaire -Oscar Wilde

UNIT –III

My Brother My Brother - Norah Burke

Uneasy Home Coming - Will F. Jenkins

Resignation - Premchand

UNIT –IV

The Referee -W.H. Andrews & Geoffrey Dreamer

The Case of the Stolen Diamonds -Farrell Mitchell

UNIT – V

The Dear Departed -Stanley Houghton

The Princess and the Wood Cutter -Alan Alexander Milne

REFERENCES:-

Nine Short Stories -SteuartH.King Blackie Books

One-Act plays of Today -T.Prabhakar Emerald Publishers

Course Code	Course Title	L	T	P	C
22122SEC33	**Internet and Java Programming**	**4**	**1**	**0**	**4**

AIM

To equip the students with basic programming skill in Java

OBJECTIVE

- To understand the core principles of the Java Language
- To study about Graphics programming using java Language
- To learn visual tools to produce well designed, effective applications and applets.

UNIT-I

Introduction to the Internet - Internet Technologies - Internet Browsers

UNIT-II

Decision making and looping statements -Classes, Objects and Methods

UNIT-III

Arrays, strings and vectors- Interfaces: Multiple Inheritance – Packages: Putting classes together - Multithreaded Programming

UNIT-IV

Managing Errors and Exceptions - Applet programming- Graphics programming

UNIT-V

Managing Input/Output files in Java

OUTCOMES:

- Understand the format and use of objects.
- Understand basic input/output methods and their use.
- Understand object inheritance and its use.
- Understand development of JAVA applets vs. JAVA applications.
- Understand the use of various system libraries.

REFERENCE BOOKS:

1. “World Wide Web Design with HTML”, C.Xavier, Tata McGraw-Hill Publishing Company Limited for Unit-1.

2. “Programming with Java”, E.Balagurusamy, Tata McGraw-Hill Publishing Company Limited for Unit-2, 3, 4, 5.

Course Code	Course Title	L	T	P	C
22161SEC34	**Financial Accounting**	**4**	**1**	**0**	**4**

AIM:

To train the students to record all business events as per standard principles and established conventions.

OBJECTIVIES:

- To ascertain whether the business operations have been profitable or not
- To assess the financial position of the business.
- To generate information.

UNIT – I

Meaning of Accounting- Meaning & objects of Book Keeping – Advantages of Accounting – Concepts and conventions – Principles of double entry – Kinds of accounts – Journal and ledger accounts.

UNIT – II

Subsidiary books – Advantages Subsidiary books - Purchases Book, Sales Book, Purchases returns Book, Sales returns Book, - Cash Book.

UNIT – III

Trial balance – Preparation - Rectification of errors –Bank Reconciliation Statement.

UNIT – IV

Final Accounts – Trading Accounts - Profit and Loss Accounts - Balance Sheet.

UNIT – V

Bills of Exchange – Single Entry System – Simple Problems.

OUTCOMES:

Students are now familiarizes with the accounting principles and practices and the ascertainment of the profitability and the financial position of the business.

REFERENCE BOOKS:

1. R.L.Gupta – Financial Accounting
2. S.P.Jain and K.L.Narang – Principles of Accounting
3. Readdy and Murthy – Financial Accounting
4. Dr.Radha - Financial Accounting

Course Code	Course Title	L	T	P	C
22113AEC35A	**Allied Physics – I Electricity and Electronics**	**3**	**1**	**0**	**3**

AIM:

To introduce the scientific principles relevant to electric circuits, and electronic devices.

OBJECTIVES:

Solve simple problems in basic electrical circuit theory.Analyse and predict the behaviour of simple logic circuits and electronic devices.To prepare the student for the study of physics by introducing general concepts and methods which will be applied throughout the course.

UNIT – I: CIRCUIT ELEMENTS:

Resistance in series and parallel – Capacitor in series and parallel – Conversion of galvanometer into voltmeter – Conversion of galvanometer into ammeter – Multimeter – CRO, AFO (Qualitative study only).

UNIT – II: ELECTRICITY:

Ohm;s law – Kirchof's law – Wheatsotne bridge – condition for bridge balance – Meter bridge – Specific resistance – Temperature co-efficient of resistance – Potentiometer – Measurement of current – voltage and resistance.

UNIT – III: SEMICONDUCTORS:

Conductors, Insulators, Semiconductors, P-type, N-type – semiconductors – PN-Junction diode – Zener diode – Static characteristics – Voltage regulation – Rectifiers: – Half wave rectifiers – Bridge Rectifiers – Calculation of ripple factor and efficiency.

UNIT – IV: BREAK DOWN DEVICES:

Ohm‟s Law, Factors affecting resistance, color code variable resistors, power and energy, D.C. series and parallel circuits kickoff‟s voltage and current law., voltage and current divider rules, Network Theorems: Maximum Power transfer theorem thevenin‟s theorem, Norton‟s theorem, Super position theorem, Millman‟s Theorem, Reciprocity theorem

UNIT – V: OPTO ELECTRONIC DEVICES:

Classification of Solids: Energy bands in solids, Conductor, Semiconductor & Insulator, Chemical Bands in Germanium & Silicon, Intrinsic & Extrinsic Semiconductors, Conductivity Diode & the Transistor, Super Conductivity.

LEARNING OUTCOMES:

Learn how to develop and employ circuit models for elementary electronic components, e.g., resistors, sources, inductors, capacitors, diodes and transistors;

Become adept at using various methods of circuit analysis, including simplified methods such as series-parallel reductions, voltage and current dividers, and the node method;

REFERENCE BOOKS:

1) Electricity and Magnitism by Brijlal and Subramaniam.
2) Principles of electronics by V.K. Metha.

Course Code	Course Title	L	T	P	C
22122SEC33	**Java and Data structures**	4	1	0	4

OBJECTIVES:

- To enable the students to learn the basic concepts of Java programming
- To use class and objects to create applications• To have an overview of interfaces, packages, multithreading and exceptions.
- To familiarize students with basic data structures and their use in algorithms.

OUTCOMES:

- Students will be able to develop Java Standalone applications and Applets.
- Choose the appropriate data structure for modeling a given problem.

UNIT - I

History and Evolution of Java - Features of Java - Object Oriented Concepts – Bytecode - Lexical Issues - Data Types – Variables- Type Conversion and Casting- Operators - Arithmetic Operators - Bitwise - Relational Operators - Assignment Operator - The conditional Operator - Operator Precedence- Control Statements – Arrays.

UNIT - II

Classes - Objects - Constructors - Overloading method - Static and fixed methods - Inner Classes - String Class- Overriding methods - Using super-Abstract class - this keyword – finalize() method – Garbage Collection.

UNIT – III

Packages - Access Protection - Importing Packages - Interfaces - Exception Handling - Throw and Throws- The Java Thread Model- Creating a Thread and Multiple Threads - Thread Priorities Synchronization-Inter thread Communication - Deadlock - Suspending, Resuming and stopping threads – Multithreading-I/O Streams - File Streams - Applets .

UNIT - IV

Abstract Data Types(ADTs)-List ADT-Array based implementation-linked list implementation-singly linked list-doubly linked list-circular linked list-Stack ADT operations-Applications-Evaluating arithmetic expressions-Conversion of infix to postfix expression-Queue ADT-operations-Applications of Queues.

UNIT - V

Trees-Binary Trees- representation - Operations on Binary Trees- Traversal of a Binary Tree -Binary Search Trees, Graphs-Representation of Graphs - Traversal in Graph -Dijkstra's Algorithm, Depth-First vs Breadth-First Search.

TEXT BOOKS:

1. E.Balagurusamy," Programming with Java: A Primer", Tata McGraw Hill 2014, 5th Edition.

2. Mark Allen Weiss, "Data Structures and Algorithms Analysis in C++", Person Education 2014, 4th Edition.

REFERENCES:

1. Herbert Schildt, "JAVA 2: The Complete Reference", McGraw Hill 2018, 11th Edition.

2. Aho, Hopcroft and Ullman, "Data Structures and Algorithms ", Pearson Education 2003.

3. S. Sahni, "Data Structures, Algorithms and Applications in JAVA", Universities Press 2005, 2nd Edition

Course Code	Course Title	L	T	P	C
22122SEC36L	**Internet and Java Programming Lab**	**0**	**0**	**3**	**2**

1. Simple programming using for, while, do-while, ternary and switch.
2. String handling using string and string buffer.
3. Inheritance.
4. Polymorphism
5. Interfaces and Packages
6. Data files(creation, processing)
7. Vector manipulation
8. Simple programs using Applets
9. Exercises using predefined and user defined exceptions
10. Graphics programs for drawing lines, rectangle, oval, string using Applets.

Course Code	Course Title	L	T	P	C
22122SEC36L	**Data structures using Java Lab**	**0**	**0**	**3**	**2**

OBJECTIVES:

- To implement linear and non-linear data structures
- To understand the different operations of search trees
- To implement graph traversal algorithms

OUTCOMES:

- Write functions to implement linear and non-linear data structure operations.
- Suggest appropriate linear and non-linear data structure operations for solving a given problem.

LIST OF EXERCISES:

1. Write a Java program to implement the Stack ADT using a singly linked list.
2. Write a Java program to implement the Queue ADT using a singly linked list.
3. Write a Java program for the implementation of circular Queue.
4. Write a Java program that reads an infix expression, converts into postfix form
5. Write a Java program to evaluate the postfix expression (use stack ADT).
6. Write a Java program to an Insert an element into a binary search tree.
7. Write a Java program to delete an element from a binary search tree.
8. Write a Java program to search for a key element in a binary search tree.
9. Write a Java program for the implementation of BFS for a given graph.
10. Write a Java program for the implementation of DFS for a given graph.

Course Code	Course Title	L	T	P	C
22122RMC37	**Research Methodology**	**2**	**0**	**0**	**2**

AIM:

To create a basic appreciation towards research process and awareness of various research publication.

OBJECTIVES:

- To understand the steps in research process and the suitable methods.
- To identify various research communications and their salient features
- To carry out basic literature survey using the common data-based
- To give exposure to MATLAB platform for effective computational and graphic works required for quality research

OUTCOME:

Ability to carry out independent literature survey corresponding to the specific publication type and assess basic computation frame works used in mathematical researches.

PREREQUISITIES:

Basic computer skill for working in window environment & conceptual knowledge on basic matrices.

UNIT-I Introduction to Research Methodology

Meaning of research – Objectives of research – Type of research – Significance of research – Research approaches.

UNIT-II Research Methods

Research methods versus Methodology – Research and scientific method – criteria of good research – Problems encountered by researchers in India.

UNIT-III Literature Survey

Articles – Thesis – Journals – Patents – Primary sources of journals and patents – Secondary sources – Listing of titles – Abstracts – Review – General treatises – Monographs.

UNIT-IV Database Survey

Database search – NIST –MSDS –PubMed – Scopus – Science citation index – Information about a specific search.

UNIT-V Introduction to MATLAB:

What is MATLAB? Matrix and its application in different areas: MATLAB approach to environmental modeling; Arithmetic Matrix – Operators; Arithmetic Array – Operators and its applications in MATLAB; Expressions, Opening M-Files; Structure of MATLAB Programing; Programing; Concatenation of strings; Vectorization ; Basic Graphics.

REFERENCE BOOKS:

1. C.R. Kothari, Research Methodology, New Age International publishers. New Delhi,2204.
2. R.A Day and A.L. Underwood, Quantitative analysis, Prentice Hall, 1999.
3. R. Gopalan, Thesis writing, Vijay Nicole Imprints Private Ltd., 2205.
4. A Guide to MATLAB: For Beginners and experienced Users by Brian R. Hunt (Editor), Ronald L. Lipsman, J. Rosenberg
5. Introduction to MATLAB for Engineers by William J. Palm III.

Course Code	Course Title	L	T	P	C
221ACLSOAN	OFFICE AUTOMATION	-	-	-	2

Aim:

To provide an in-depth training in use of office automation, internet and internet tools. The course also helps the candidates to get acquainted with IT.

Course Outcomes:

After completion of the course, students would be able to documents, spreadsheets, make small presentations and would be acquainted with internet.

UNIT I

Knowing the basics of Computers

UNIT II

Word Processing (MS word)

UNIT III

Spread Sheet (MS XL)

UNIT IV

Presentation (MS Power Point)

UNIT V

Communicating with Internet

Reference:

1. Fundamentals of computers - V.Rajaraman - Prentice- Hall of india

2. Microsoft Office 2207 Bible - John Walkenbach,HerbTyson,FaitheWempen,caryN.Prague,MichaelR.groh,PeterG.Aitken, and Lisa a.Bucki - Wiley India pvt.ltd.

3. Introduction to Information Technology - Alexis Leon, Mathews Leon, and Leena Leon, Vijay Nicole Imprints Pvt. Ltd., 2213.

4. Computer Fundamentals - P. K. Sinha Publisher: BPB Publications

5. https://en.wikipedia.org

6. https://wiki.openoffice.org/wiki/Documentation

7. http://windows.microsoft.com/en-in/windows/windows-basics-all-topics

Course Code	Course Title	L	T	P	C
22110AEC41	Tamil-IV	4	0	0	2

தாள் - IV

செய்யுள்- சங்க இலக்கியம், இலக்கணம்,இலக்கிய வரலாறுமனப்பாடப் பகுதி

அலகு-I

எட்டுத்தொகை

நற்றிணை – குறிஞ்சி 356,முல்லை-242, பாலை-397

குறுந்தொகை-2,18,25,58,67,69,135,167,283,373

ஐங்குறுநூறு சிறுவெண் காக்கைப் பத்து

அலகு-II

கலித்தொகை-பாலை 34,குறிஞ்சி-51,நெய்தல்-133

அகநானூறு - 36,147,332

புறநானூறு 34,173,189,235,279

அலகு-III

முல்லைப்பாட்டு

திருக்குறள்-ஐந்து அதிகாரம்- அறம் 2,பொருள் 2,இன்பம் -1
வான்சிறப்பு,அழுக்காறாமை,இறைமாட்சி,கூடாநட்பு,காதற்சிறப்புரைத்தல்

அலகு-IV

இலக்கணம்

அணி

மனப்பாடப்பகுதி

அலகு-V

இலக்கிய வரலாறு

எட்டுத்தொகை

பத்துப்பாட்டு

அறஇலக்கியங்கள்

தாள் - IV

ஒப்படைவு மதிப்பெண்-40

பாடத்தொடர்புடைய கட்டுரை 20 மதிப்பெண்

பாரதியார், பாரதிதாசன் புதிய ஆத்திசூடி 20 மதிப்பெண்

பாரதியார்

அச்சம் தவிர்,ஆண்மை தவறேல்,இளைத்தல் இகழ்ச்சி,உடலினை உறுதி செய்,எண்ணுவது உயர்வு,ஏறுபோல் நட,ஐம்பொறி ஆட்சி கொள்,ஒற்றுமை வலிமையாம்,காலம் அழியேல்,கீழோருக்கு அஞ்சேல்,குன்றென நிமிர்ந்து நில்,கொடுமையை எதிர்த்து நில், சிதையா நெஞ்சு கொள்,செய்வது துணிந்து செய், தீயோருக்கு அஞ்சேல்,பெரிதினும் பெரிது கேள்,வையத்தலைமை கொள்,யாரையும் மதித்து வாழ்

பாரதிதாசன்

காற்றினைத் தூய்மை செய்,குற்ற நினைவு தீர்,தனிமையினைக் களைந்து வாழ் தூய நீராடு, தெருவெல்லாம் மரம் வளர்த்திடுக்க இனித்துறை,தொன்மை மாற்று,நிலைமையினில் தெளிவு கொள், நீளியம் உள் இல்லம்,போர்த் தொழில் பழகு,மாறுவது இயற்கை, வையம் வாழ வாழ்.

(மேற்கண்ட தலைப்புகளில் ஏதேனும் ஒன்றுக்கு கவிதை(மரபு அல்லது புதுக்கவிதை) கதை,கட்டுரை,நாடகம் எழுதி வரச் செய்து சரிபார்த்து மதிப்பெண் வழங்கிடவும்

COURSE CODE	COURSE TITLE	L	T	P	C
22111AEC41	**Advanced English-IV**	**4**	**0**	**0**	**2**

Aim:

- To improve the knowledge of English

Objective:

- To familiarize with the objectives and types of interview
- To know the types of questions and answering techniques
- To prepare reviews and proposals
- To learn the grammatical forms
- To understand the meaning of a poem and write the content
- To write for and against a topic
- To draw a flowchart
- To write definitions

Outcome:

- Develop communicative skill
- Read and comprehend literature

UNIT –I

Interviews

Objectives, types, ten success factors, ten failure factors - Planning and preparation –Presentation– Type of questions – Answering techniques.

UNIT – II

Flowchart

Proposals

UNIT – III

Discourse markers

Review

UNIT IV

Grammatical forms

Paraphrasing

UNIT –V

Definition

Writing for and against a topic.

References:

English Grammar	-Wren and Martin
English Grammar and Composition	-Radhakrishna Pillai
Essentials of Business Communication	-Rajendra Pal &J.S Korlahalli Sultan Chand & Sons
Technical Communication	-Meenakshi Sharma &Sangeetha Sharma
English for writers and translators	-Robin Macpherson
English Work Book-I&II	-JewelcyJawahar

Course Code	Course Title	L	T	P	C
22111AEC42	**English-IV**	**4**	**0**	**0**	**2**

AIM:

To acquaint students with learning English through literature

OBJECTIVE:

- To introduce learners to the standard literary texts
- To impart wisdom through morally sound poems and essays
- To introduce Shakespeare to non-literature students

OUTCOME:

- Read and comprehend literature

UNIT –I

How to be a Doctor -Stephen Leacock

My Visions for India -A.P.J. Abdul Kalam

Woman, not the weaker sex -M.K. Gandhi

UNIT –II

My Last Duchess -Robert Browning

The Toys -Coventry Patmore

I, too -Langston Hughes

UNIT –III

The Best Investment I ever made-A.J.Cronin

The Verger -W.S Maugham

A Willing Slave -R.K.Narayan

UNIT –IV

Macbeth

As You Like It

UNIT –V

Henry IV

Tempest

REFERENCE BOOKS:-

English for Enrichment -.Devaraj Emerald Publishers

Selected Scenes from Shakespeare Book I &II -Emerald Publishers

Course Code	Course Title	L	T	P	C
22122SEC43	**Visual Programming**	**4**	**1**	**0**	**4**

AIM:

To equip the students with principles of various visual programming environment

OBJECTIVE:

- To learn the basic principles of visual programming
- To study the necessary skills to create software solutions using visual programming
- Understood the Open Data Base Connectivity using Visual programming.
- To inculcate knowledge on Programming and Project Development using Visual Basic.

UNIT I

Visual Basic – Integrated Development Environment (IDE) features – VB editor – customizing the IDE – anatomy of a form working with form properties – setting form's properties – introducing form events and form methods.

UNIT II

Variables in Visual Basic : Declaring variables – Data types – Null values, Error value – empty value – the scope of a variable – Module level variable – Constants – Creating your own constants – Scope of a constant – Converting data types – arrays – Declaring arrays – Fixed size arrays – Dynamic arrays – Preserve keywords – ReDim. Writing code in Visual Basic – The anatomy of a procedure – Subroutine and Functions – Language constructs – For…Next, The While loop, Select case…End select, Exit statement, with structure.

UNIT III

Selecting and Using controls – Introduction to standard controls: command buttons – Text boxes – labels – frames – option buttons – Check boxes – Scroll Bars – Timer – working with Common Dialog Control.

UNIT IV

The Image list control – the List view control – slider control – status bar control – Tool bar control – The Tree view control – Menu editor. –File System Controls (Drive, Dirlist, File List boxes).

UNIT V

OLE properties – OLE automation – building COM/OLE DLL servers – Data control – design time(for access – style databases) –programming with the data control– Database access – set using SQL –transaction control – testing the control – Open Database Connectivity.

OUTCOMES:

Upon completion of this course, the student will be able to:

- Design, create, build, and debug Visual Basic applications.
- Explore Visual Basic's Integrated Development Environment (IDE).
- Implement syntax rules in Visual Basic programs.
- Write Windows applications using forms, controls, and events
- Write and apply decision structures for determining different operations.
- Write and apply loop structures to perform repetitive tasks.

REFERENCE BOOKS:

1. Mohammed Azam, Programming with Visual Basic 6.0 – Vikas Publishing House Pvt Ltd – 2202(unit-I, unit-II)
2. Content Development Group, Visual Basic 6.0 – Tata McGraw Hill Publishing Company Limited – 2202(unit-III, unit-IV, unit-V)

Course Code	Course Title	L	T	P	C
22113AEC44A	**Allied Physics-II**	**5**	**1**	**0**	**5**

Digital Electronics

AIM:

To understand various digital system and their applications

OBJECTIVES:

To learn about the design principles of different digital electronic circuits.

To study the application digital electronics circuits

UNIT – I: NUMBER SYSTEMS AND CODES:

Decimal, Binary, Octal, and Hexa decimal systems – Conversion from one to another – Binary addition – Binary subtraction – Binary multiplication – Binary division – Complements, Codes: BCD, Gray, Alpha numeric.

UNIT – II: BOOLEAN ALGEBRA:

Basic logic gates – Universal gates – Fundamental concepts of Boolean algebra – De Morgan's theorem: Simplification of expressions – Karnaugh map.

UNIT – III: LOGIC DESIGN:

Half adder – Half subtractor – Multiplexers – Demultiplexer, Flip-flops: R-S flip flop, J-K flip flop, D-flip flop, T-flip flop.

UNIT – IV: MEMORY ELEMENTS:

Addressing techniques and registers: Addressing techniques-Direct, immediate addressing; paging, relative, Indirect and indexed addressing. Memory buffer register; accumulators; Registers-Indexed, General purpose, Special purpose; overflow, carry, shift, scratch registers; stack pointers; floating point; status information and buffer registers.

UNIT – V: REGISTERS AND COUNTERS:

Memory: Main, RAM, static and Dynamic, ROM, EPROM, EAROM, EEPROM, Cache and Virtual memory. Interconnecting System components: Buses, Interfacing buses, Bus formats-address, data and control, Interfacing keyboard, display, auxiliary storage devices, and printers. I/O cards in personal computers

LEARNING OUTCOMES

Express positive integers in different number systems (binary, octal, decimal hexadecimal)

Codify data elements or information (signal values) by binary variables (signals) using standard codes for positive integers (binary, BCD, Gray) and characters (ASCII code)

Codify signed integers (positive and negative) using the two's-complement system

Perform basic arithmetic operations (addition, subtraction, multiplication) of signed integers by means of the 2's complement system

List a set of simulation tools for digital electronics

REFERENCE BOOKS:

1) Digital Principles and Applications by Malvino and Leach

Course Code	Course Title	L	T	P	C
221ENSTU45	**Environmental Studies**	**2**	**0**	**0**	**2**

UNIT–I

The Multidisciplinary Nature of Environmental Studies – Definition, Scope and Importance - Need for public awareness - Natural Resources: Renewable and Non-Renewable Resources - Forest resources - Water resources - Mineral resources - Food resources - Energy resources - Land resources.

UNIT-II

Ecosystems - Concept of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Energy flow in the ecosystem - Ecological succession - Food chains, food webs and ecological pyramids - Types of ecosystem - Forest ecosystem - Grassland ecosystem - Desert ecosystem - Aquatic ecosystems.

UNIT-III

Biodiversity and its Conservation – Definition - Genetic, species and ecosystem diversity - Biogeographical classification of India - Values of biodiversity - Biodiversity at global, National and local levels - India as a mega - diversity nation - Hot-spots of biodiversity - Threats to biodiversity - Endangered and endemic species of India - Conversation of biodiversity.

UNIT-IV

Environmental Pollution – Definition - Air pollution - Water pollution - Soil pollution - Marine pollution - Noise pollution - Thermal pollution - Nuclear hazards - Solid waste Management - Role of an individual in prevention of pollution - Disaster management.

UNIT-V

Social Issues and the Environment - From Unsustainable to Sustainable development - Urban problems related to energy - Water conservation, rain water harvesting, watershed management - Environmental ethics - Climate change green house effect and global warming - Ozone depletion - Waste land reclamation - Consumerism and waste products - Environmental Legislation - Issues involved in enforcement of environmental legislation - Public awareness - Human Population and the Environment.

REFERENCE BOOK:

1. “ENVIRONMENTAL STUDIES”, K.Kumarasamy, A.Alagappa Moses, M.Vasanthy.

Course Code	Course Title	L	T	P	C
22122SEC46L	**Visual Programming Lab**	**0**	**0**	**3**	**2**

1. Simple exercises using standard controls.
2. Write a program to design a calendar of any year.
3. Write a program to expand and shrinking an object – while program is running.
4. Write a code to design and implement a scientific calculator.
5. Write a program to create animation by using move method and timer Object.
6. Write a program for preparing students mark list.
7. Write a program to populate the label entities using data bound control.
8. Write a program to expand and shrink Objects using timer control and move method

Course Code	Course Title	L	T	P	C
22113AEC47AL	**Allied Physics Lab -I**	**0**	**0**	**3**	**2**

1) FET-Characteristics
2) Logic Gates-Universality of NOR Gate.
3) LCR — Series Resonance Circuit.
4) LCR parallel – resonance circuit.
5) OP AMP-Addition,Subtraction.
6) Verification basic logic gates.
7) Verification of Demorgon's theorem..
8) Half adder and Halfsubtractor.
9) Logic Gates-Universality of NAND Gate.
10) OP AMP Differentiator ,Intergrator.

Course Code	Course Title	L	T	P	C
221ACLSLMS	**Leadership and Management Skills**	**-**	**-**	**-**	**2**

Aim:

The aim of the course cultivating and nurturing the innate leadership skills of the youth so that they may transform these challenges into opportunities and become torch bearers of the future by developing creative solutions.

Course Objective:

The Module is designed to:

- Help students to develop essential skills to influence and motivate others
- Inculcate emotional and social intelligence and integrative thinking for effective leadership
- Create and maintain an effective and motivated team to work for the society
- Nurture a creative and entrepreneurial mindset
- Make students understand the personal values and apply ethical principles in professional
  and social contexts.

Course Outcomes :

Upon completion of the course students will be able to:

1. Examine various leadership models and understand/assess their skills, strengths and abilities that affect their own leadership style and can create their leadership vision
2. Learn and demonstrate a set of practical skills such as time management, self management,
   handling conflicts, team leadership, etc.
3. Understand the basics of entrepreneurship and develop business plans
4. Apply the design thinking approach for leadership
5. Appreciate the importance of ethics and moral values for making of a balanced personality.

UNIT I- Leadership Skills

a. Understanding Leadership and its Importance
- What is leadership?
- Why Leadership required?
- Whom do you consider as an ideal leader?

b. *Traits and Models of Leadership*
- Are leaders born or made?
- Key characteristics of an effective leader
- Leadership styles
- Perspectives of different leaders

c. *Basic Leadership Skills*

- Motivation
- Team work
- Negotiation
- Networking

UNIT II - Managerial Skills

a. Basic Managerial Skills

- Planning for effective management
- How to organise teams?
- Recruiting and retaining talent
- Delegation of tasks
- Learn to coordinate
- Conflict management

b. *Self Management Skills*

- Understanding self concept
- Developing self-awareness
- Self-examination
- Self-regulation

UNIT III - Entrepreneurial Skills

a. Basics of Entrepreneurship

- Meaning of entrepreneurship
- Classification and types of entrepreneurship
- Traits and competencies of entrepreneur

b. *Creating Business Plan*

- Problem identification and idea generation
- Idea validation
- Pitch making

UNIT IV - Innovative Leadership and Design Thinking

a. Innovative Leadership

- Concept of emotional and social intelligence
- Synthesis of human and artificial intelligence
- Why does culture matter for today's global leaders

b. *Design Thinking*

- What is design thinking?
- Key elements of design thinking:
  - Discovery
  - Interpretation
  - Ideation
  - Experimentation
  - Evolution.
- How to transform challenges into opportunities?
- How to develop human-centric solutions for creating social good?

UNIT V- Ethics and Integrity

a. Learning through Biographies

- What makes an individual great?
- Understanding the persona of a leader for deriving holistic inspiration
- Drawing insights for leadership
- How leaders sail through difficult situations?

b. *Ethics and Conduct*

- Importance of ethics
- Ethical decision making
- Personal and professional moral codes of conduct
- Creating a harmonious life

Bibliography and Suggested Readings :

Books

- Ashokan, M. S. (2215). *Karmayogi: A Bbiography of E. Sreedharan*. Penguin, UK.
- Brown, T. (2212). *Change by Design.* Harper Business
- Elkington, J., &Hartigan, P. (2208). *The Power of Unreasonable People: How Social Entrepreneurs Create Markets that Change the World*. Harvard Business Press.
- Goleman D. (1995). *Emotional Intelligence*. Bloomsbury Publishing India Private Limited
- Kalam A. A. (2203). *Ignited Minds: Unleashing the Power within India*. Penguin Books India
- Kelly T., Kelly D. (2214). *Creative Confidence: Unleashing the Creative Potential Within Us All.* William Collins
- Kurien V., & Salve G. (2212). *I Too Had a Dream*. Roli Books Private Limited
- Livermore D. A. (2210). *Leading with cultural intelligence: The New Secret to Success*. New York: American Management Association
- McCormack M. H. (1986). *What They Don't Teach You at Harvard Business School: Notes From A Street-Smart Executive*. RHUS
- O'Toole J. (2219) *The Enlightened Capitalists: Cautionary Tales of Business Pioneers Who Tried to Do Well by Doing Good.* Harpercollins
- Sinek S. (2209). *Start with Why: How Great Leaders Inspire Everyone to Take Action*. Penguin
- Sternberg R. J., Sternberg R. J., &Baltes P. B. (Eds.). (2204). *International Handbook of Intelligence*. Cambridge University Press.

E-Resources

- Fries, K. (2219). 8 Essential Qualities That Define Great Leadership. *Forbes*. Retrieved 2219-02-15 from https://www.forbes.com/sites/kimberlyfries/2218/02/08/8-essential-qualities-that-define-great-leadership/#452ecc963b63.
- How to Build Your Creative Confidence, Ted Talk by David Kelly - https://www.ted.

com/talks/david_kelley_how_to_build_your_creative_confidence

- India’s Hidden Hot Beds of Invention Ted Talk by Anil Gupta - https://www.ted.com/talks/anil_gupta_india_s_hidden_hotbeds_of_invention
- Knowledge@WhartonInterviews Former Indian President APJ Abdul Kalam - . "A Leader Should Know How to Manage Failure" https://www.youtube.com/watch?v=laGZaS4sdeU
- Martin, R. (2207). How Successful Leaders Think. *Harvard Business Review*, *85*(6): 60.
- NPTEL Course on Leadership - https://nptel.ac.in/courses/122105021/9

Course Code	Course Title	L	T	P	C
22122SEC51	Relational Database Management Systems	4	1	0	4

AIM

To equip the students with principles and concepts of database design

OBJECTIVES:

- To learn the basic principles of database and database design
- To learn the basics of RDBMS
- To learn the concepts of database manipulation SQL

UNIT- I

An Overview of Database Management-Introduction -Definition of Database system - Data Independence - Relational Systems - Database System Architecture - Three Levels of the Architecture - Distributed Processing.

UNIT -II

An Introduction to Relational Databases- Introduction - Relational Model - Relations and Relvars - Optimization - Transactions - An Introduction to SQL - Embedded SQL - Domains , Relations , Relvars.

UNIT- III

Relational Algebra - Introduction - Syntax - Semantics - Examples - Additional Operators - Relational Calculus - Introduction - Tuple Calculus - Examples - Calculus Vs Algebra - Domain Calculus - SQL Specialties .

UNIT -IV

TRANSACTIONS AND CONCURRENCY MANAGEMENT:

Transactions - ConcurrentTransactions - Locking Protocol - Serialisable Schedules - Locks Two Phase Locking (2PL) - Deadlockand its Prevention - Optimistic Concurrency Control. Database Recovery and Security: DatabaseRecovery meaning - Kinds of failures - Failure controlling methods - Database errors - Backup &Recovery Techniques - Security & Integrity - Database Security - Authorization.

UNIT- V

DISTRIBUTED AND CLIENT SERVER DATABASES:

Need for Distributed DatabaseSystems - Structure of Distributed Database - Advantages and Disadvantages of DDBMS - Advantages ofData Distribution - Disadvantages of Data Distribution - Data Replication - Data Fragmentation. ClientServer Databases: Emergence of Client Server Architecture - Need for Client Server Computing -Structure of Client Server Systems & its advantages.

OUTCOMES:

At the end of the course, the student should be able to:

- Design Databases for applications.
- Use the Relational model, ER diagrams.
- Design the Query Processor and Transaction Processor.

REFERENCE BOOKS:

"An Introduction to Database Systems". C.J.DATE. Addisen - Wesley Publications - 7th Edition 2200.

Course Code	Course Title	L	T	P	C
22122SEC52	**.NET Programming**	**4**	**1**	**0**	**3**

AIM

To cover the fundamental concepts of the .NET framework.

OBJECTIVES

_ To gain knowledge in the concepts of the .NET framework and its technologies.
_ To get experience in building sample applications of large-scale projects.

UNIT I

Visual basic.NET and the .NET Framework –The elements of Visual Basic .NET

UNIT II

Visual Basic .NET operators-software Design, conditional structures, and controls Flow-Methods.

UNIT III

Interfacing with the End user-Asp.NET Applications.

UNIT IV

. ADONET Overview–Database Connections–Commands –Data Reader-Data Adapter-Data Sets-Data Controls and Its Properties–Data Binding

UNIT V

Grid View control: Deleting, editing, Sorting and Paging. XML classes–Web form to manipulate XML files-Website Security-Authentication-Authorization–

Creating a Web application.

OUTCOMES:

- Create web-based distributed applications using ASP.NET, SQL Server and ADO.NET
- Utilize DirectX libraries in the .NET environment to implement 2D and 3D animations and game-related graphic displays and audio.
- Utilize the .NET environment to create Web Service-based applications and components.

REFERENCE BOOKS:

1. The Complete Reference VB.NET – Jeffrey R-Shapiro- Tata McGrawHill Edition

2. The Complete Reference ASP.NET- Matthew MacDonald- Tata McGrawHill Edition

3. Visual Basic .Net Programming -Bible.

4. Visual Basic.Net Black Book- Steven Holzner.

Course Code	Course Title	L	T	P	C
22122SEC53	**Designing and supporting Computer Networks**	**4**	**1**	**0**	**4**

AIM:

To equip the students with Computer Networks

OBJECTIVE:

- To learn the Network concepts
- To understand the Network Switching Concepts
- To study aboutNetwork Security.

UNIT I

The Internet and its uses – OSI model – ISP Troubleshooting – Planning a Network Upgrade

UNIT II

Planning the Addressing Structure – IP Addressing in the LAN – NAT and PAT – Configuring Network Devices: Initial ISR Configuration – Configuring an ISR with SDM

UNIT III

Configuring a Router Using IOS CLI – Connecting the CPE to the ISP – Routing: Enabling Routing Protocols – Exterior Routing Protocols

UNIT IV

Network Layer-Design Issues-Routing Algorithms-Congestion Control Algorithms–IP Protocol–IP Addresses–Internet Control Protocols.

UNIT V

Transport Layer-Services-Connection Management-Addressing, Establishing and Releasing a Connection Simple Transport Protocol Internet Transport Protocols(ITP)-Network Security:Cryptography

OUTCOMES:

At the end of the course, the student should be able to:

- Identify the components required to build different types of networks
- Choose the required functionality at each layer for given application
- Identify solution for each functionality at each layer
- Trace the flow of information from one node to another node in the network

REFERENCE BOOKS:

"Working at a Small-to-Medium Business or ISP CCNA Discovery Learning Guide" – Allan Reid and Jim Lorenz – CISCO Press – Pearson Education

Course Code	Course Title	L	T	P	C
22122DSC54A	**Computer Organization and Architecture**	**4**	**1**	**0**	**3**

AIM:

To equip the students with the Computer Organization and Architecture.

OBJECTIVES:

- To Make Students Understand The Basic Structure And Operation Of Digital Computer.
- To Familiarize The Students With Arithmetic And Logic Unit And Implementation Of Fixed Point And Floating-Point Arithmetic Operations.
- To Expose The Students With Different Ways Of Communicating With I/O Devices And Standard I/O Interfaces.

UNIT I

Digital logic circuits: Digital computers- Logic gates – Boolean algebra - Map simplification - Combinational circuits - Flip-flops - Sequential circuits.

UNIT II

Digital components: Integrated circuits – Decoders - Multiplexers - Registers - Shift Registers - Binary Counters - Memory unit.

UNIT III

Data Representation: Data types - Complements – Fixed point representation –Floating Point representation – Other binary codes – Error detection codes.

UNIT IV

Basic Computer Organization And Design Instruction codes, Computer registers- Memory-Reference Instructions-Timing and Control, Instruction cycle-Computer instructions. Design of Basic computer, Design of Accumulator Unit- Input-output and interrupt.

UNIT V

Introduction, General Register Organization, Stack-Central Processing Unit Organization Data transfer and manipulation-Addressing Modes - Instruction format- Program Control, Reduced Instruction Set Computer.

OUTCOMES:

At the end of the course, the student should be able to:

- Design arithmetic and logic unit.
- Design and anlayse pipelined control units
- Evaluate performance of memory systems.

REFERENCE BOOKS:

1. Computer System Architecture - Morris Mano.M PHI, Third Edition - 1999

2. Digital Computer Fundamentals – Thomas C. Bartee- Sixth Edition - TataMcGrawHill.

3. Digital Design – Mano – Second Edition

Course Code	Course Title	L	T	P	C
22122DSC54B	**E-Learning**	**4**	**1**	**0**	**3**

COURSE OBJECTIVES

- Learn the basics of E-Learning concepts.
- Learn the content development techniques.

COURSE OUTCOMES

- Develop e – learning application on their own.
- Ability to develop contents for e-learning.
- To perform course management using tools.

UNIT I INTRODUCTION

Introduction – Training and Learning, Understanding elearning, components and models of e-learning, Advocacy of e-learning – benefits, learning styles, criteria for choosing, - Applications of E-learning.

UNIT II CONCEPTS and DESIGN

E-Learning Strategy, the essential elements of elearning strategy, Quality assuring e-learning, suppliers and resources, virtual learning environments, authoring tools, e-assessment, Learning Design Issues – purpose, general principles, designing live e-learning, designing self managed learning.

UNIT III APPLICATIONS

Moodle 2.0 E-Learning Course Development – Features, Architecture, Installation and Configuring Site.

UNIT IV COURSE MANAGEMENT

Creating – Categories, Courses, Adding Static Course Material – Links, Pages, Moodle HTML Editor, Media Files, Interacting with Lessons and Assignments – Evaluating Students – Quizzes and Feedback.

UNIT V ENHANCEMENT

Adding Social Activities - Chat, Forum, Ratings, Blocks – Types, Activities, Courses, HTML, Online Users – Features for Teachers.

REFERENCE BOOKS:

1. Delivering E-Learning: A complete Strategy for Design, Application and Assessment, Kenneth Fee, Kogan page, 2209.
2. Designing Successful e-Learning, Michael Allen, Pfeiffer Publication, 2207.
3. Moodle 2.0 E-learning Course Development, William Rice, PACKT, 2211.
4. Moodle 2.0 First Look, Mary Cooch, 2210.

Course Code	Course Title	L	T	P	C
22122SEC55L	**Oracle Lab**	**0**	**0**	**3**	**2**

1. Write SQL queries to create the following tables and insert rows in it.
   Employee (eno, ename, deptno, salary, designation)
   Dept (deptno, deptname, location)
   Student (rollno, name, course, paper1, paper2, paper3)
2. Write SQL queries to create primary key and foreign key constraints in the above given tables and perform all types of simple retrieval.
3. Write SQL queries to perform all types of advance retrieval using (i) nested subqueries (ii) set operators.
4. Write SQL queries to perform all types of joins.
5. Write SQL queries to illustrate all built-in functions.
6. Write SQL queries to create views and index/indices for the tables Employee, Dept and Student.
7. Write a database trigger to prevent transactions during weekend. Create PL/SQL procedures and store them in a package and execute them in the command prompt.
8. Write a PL/SQL program that prints mark sheet of students in a University using cursor.

Course Code	Course Title	L	T	P	C
22122SEC56L	.NET Programming Lab	0	0	3	2

1. Write a program in VB. Net to check whether given number is Odd or Even.
2. Write a program to find maximum from given numbers.
3. Write a program to find are of a circle
4. Design ASP.Net web form using Html Server Controls to enter job seeker's details.
5. Create an ASP.Net web form using Web control to enter E-Mail registration form.
6. Apply appropriate validation techniques in E-Mail registration form using
7. Validation controls.
8. Write an ASP.Net application to retrieve form data and display it the client browser in a table format.
9. Create a web application using ADO.Net that uses which performs basic data Manipulations:
   (i). Insertion (ii) Updating (iii) Deletion (iv) Selection
   Hint: Do operations using Ms-Access and SQL-Server
10. Create an application using Data grid control to access information's from table in SQL server.

Course Code	Course Title	L	T	P	C
221ACLSPSL	**Professional Skills**	**-**	**-**	**-**	**2**

Aim:

CourseObjectives :

The Objectives of the course are to help students/candidates:

1. Acquire career skills and fully pursue to partake in a successful career path
2. Prepare good resume, prepare for interviews and group discussions
3. Explore desired career opportunities in the employment market in consideration of an individual SWOT.

CourseOutcomes:

At the end of this course the students will be able to:

1. Prepare their resume in an appropriate template without grammatical and other errors and using proper syntax
2. Participate in a simulated interview
3. Actively participate in group discussions towards gainful employment
4. Capture a self - interview simulation video regarding the job role concerned
5. Enlist the common errors generally made by candidates in an interview
6. Perform appropriately and effectively in group discussions
7. Explore sources (online/offline) of career opportunities
8. Identify career opportunities in consideration of their own potential and aspirations
9. Use the necessary components required to prepare for a career in an identified occupation (as a case study).

Unit I: Resume Skills

Resume Skills : Preparation and Presentation

- Introduction of resume and its importance
- Difference between a CV, Resume and Bio data
- Essential components of a good resume

ii. *Resume skills : common errors*

- Common errors people generally make in preparing their resume
- Prepare a good resume of her/his considering all essential components

Unit II: Interview Skills

i. Interview Skills : Preparation and Presentation

- Meaning and types of interview (F2F, telephonic, video, etc.)
- Dress Code, Background Research, Do’s and Don’ts
- Situation, Task, Approach and Response (STAR Approach) for facing an

interview

- Interview procedure (opening, listening skills, closure, etc.)
- Important questions generally asked in a job interview (open and closed ended questions)

ii. *Interview Skills : Simulation*

- Observation of exemplary interviews
- Comment critically on simulated interviews

iii. *Interview Skills : Common Errors*

- Discuss the common errors generally candidates make in interview
- Demonstrate an ideal interview

Unit III: Group Discussion Skills

Meaning and methods of Group Discussion

- Procedure of Group Discussion
- Group Discussion- Simulation
- Group Discussion - Common Errors

Unit IV: Exploring Career Opportunities

Knowing yourself – personal characteristics

- Knowledge about the world of work, requirements of jobs including self-employment.
- Sources of career information
- Preparing for a career based on their potentials and availability of opportunities

Course Code	Course Title	L	T	P	C
22121DSC54C	Enterprise Resource Planning	4	1	0	3

COURSE OBJECTIVES

The objectives of this Course are

1. To provide a contemporary and forward-looking on the theory and practice of Enterprise Resource Planning Technology.

2. To focus on a strong emphasis upon practice of theory in Applications and Practicaloriented approach.

3. To train the students to develop the basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth.

4. To aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills

OUTCOMES:

After completing this course, student will be able to

1. Make basic use of Enterprise software, and its role in integrating business functions

2. Analyze the strategic options for ERP identification and adoption.

3. Design the ERP implementation strategies.

4. Create reengineered business processes for successful ERP implementation

UNIT I

RPANDTECHNOLOGY

Introduction – Related Technologies – Business Intelligence – E-Commerce and EBusiness– Business Process Reengineering – Data Warehousing – Data Mining –OLAP – Product life Cycle management – SCM – CRM

UNIT II

ERPIMPLEMENTATION

Implementation Challenges – Strategies – Life Cycle – Pre-implementation Tasks –Requirements Definition – Methodologies – Package selection – Project Teams –Process Definitions – Vendors and Consultants – Data Migration – Project management– Post Implementation Activities. **UNIT III**

ERPINACTIONBUSINESSMODULES

Operation and Maintenance – Performance – Maximizing the ERP System – BusinessModules – Finance – Manufacturing – Human Resources – Plant maintenance –Materials Management – Quality anagement –MarketingSales,Distributionandservice.

UNIT IV

ERPMARKET Marketplace – Dynamics – SAP AG – Oracle – PeopleSoft – JD Edwards – QAD Inc – SSA Global – Lawson Software – Epicor – Intutive.

UNITV

Enterprise Application Integration – ERP and E-Business – ERP II – Total qualitymanagement – Future Directions–TrendsinERP.

TEXTBOOKS

1. Alexis Leon, “ERP DEMYSTIFIED”, Tata McGraw Hill, Second Edition, 2008.
2. Mary Sumner, “Enterprise Resource Planning”, Pearson Education, 2007.

REFERENCES

1.JimMazzullo,”SAPR/3forEveryone”,Pearson,2007.
2. Jose Antonio Fernandz, “ The SAP R /3 Handbook”, Tata McGraw Hill, 1998.
3. Biao Fu, “SAP BW: A Step-by-Step Guide”, First Edition, Pearson Education,

Course Code	Course Title	L	T	P	C
22121DSC54D	**Block Chain Technology**	4	1	0	3

OBJECTIVES:

- To understand the concepts of block chain technology
- To understand the consensus and hyper ledger fabric in block chain technology.

OUTCOMES:

- State the basic concepts of block chain
- Paraphrase the list of consensus and Demonstrate and Interpret working of Hyper ledger Fabric
- Implement SDK composer tool and explain the Digital identity for government

UNIT – I

History: Digital Money to Distributed Ledgers -Design Primitives: Protocols, Security, Consensus, Permissions, Privacy- : Block chain Architecture and Design-Basic crypto primitives: Hash, SignatureHash chain to Block chain-Basic consensus mechanisms.

UNIT - II

Requirements for the consensus protocols-Proof of Work (PoW)-Scalability aspects of Block chain consensus protocols: Permissioned Block chains-Design goals-Consensus protocols for Permissioned Block chains.

UNIT - III

Decomposing the consensus process-Hyper ledger fabric components-Chain code Design and Implementation: Hyper ledger Fabric II:-Beyond Chain code: fabric SDK and Front End-Hyper ledger composer tool.

UNIT – IV

Block chain in Financial Software and Systems (FSS): -Settlements, -KYC, -Capital markets-InsuranceBlock chain in trade/supply chain: Provenance of goods, visibility, trade/supply chain finance, invoice management/discounting.

UNIT - V

Block chain for Government: Digital identity, land records and other kinds of record keeping between government entities, public distribution system / social welfare systems: Block chain Cryptography: Privacy and Security on Block chain.

TEXT BOOKS:

1. Mark Gates, “Block chain: Ultimate guide to understanding block chain, bit coin, crypto currencies, smart contracts and the future of money”, Wise Fox Publishing and Mark Gates 2017.

2. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, “Hands-On Block chain with Hyper ledger: Building decentralized applications with Hyperledger Fabric and Composer”, 2018.

3. Bahga, Vijay Madisetti, “Block chain Applications: A Hands-On Approach”, Arshdeep Bahga, Vijay Madisetti publishers 2017.

SEMESTER – VI

Course Code	Course Title	L	T	P	C
22122SEC61	**Advanced Web Technology**	**4**	**1**	**0**	**4**

AIM:

To equip the students with basic programming skill in Web Designing

OBJECTIVES:

- To understand and practice mark up languages
- To understand and practice embedded dynamic scripting on client side Internet Programming
- To understand and practice web development techniques on client-side

UNIT-I

Introduction to HTML – Head and body sections – Designing the body section. Ordered and unordered lists – Table handling.

UNIT-II

DHTML and Style Sheet – Frames-Forms.

UNIT-III

VBScript –VBScript Programming Basics – Working with Operators – Controlling Program flow with VBScript- Working with Functions, Subroutines and Dialog boxes – Data type Conversion Features – Putting it all together with VBScript – using the Script Debugger.

UNIT-IV

XML : Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, Well formed, using XML with application.XML, XSL and XSLT. Introduction to XSL, XML transformed simple example, XSL elements, transforming with XSLT

UNIT-V

Style sheets : Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2

OUTCOMES:

- Acquire knowledge about functionalities of world wide web
- Explore markup languages features and create interactive web pages using them
- Learn and design Client side validation using scripting languages
- Acquire knowledge about Open source JavaScript libraries
- Acquire knowledge about PHP.

REFERENCE BOOKS:

1. World Wide Web design with HTML – C. Xavier – Tata McGraw – Hill – 2200.
   For UNIT I & II.
2. "Using Active Server Page". - Scot Johnson-For UNIT III.
3. "Programming the World Wide Web" - Robert W.Sebesta , Third edition.

For UNIT IV, V.

Course Code	Course Title	L	T	P	C
22122SEC62	**Operating System**	**4**	**1**	**0**	**5**

AIM:

To equip the students with operating system and their components

OBJECTIVES:

The student should be made to:

- Study the basic concepts and functions of operating systems.
- Understand the structure and functions of OS.
- Learn about Processes, Threads and Scheduling algorithms.
- Understand the principles of concurrency and Deadlocks.
- Learn various memory management schemes.
- Study I/O management and File systems.

UNIT- I

Evolution of Operating Systems – Types of Operating Systems – Different views of OS – Design and implementation of Operating Systems – I/O Programming concepts – Interrupt structure and Processing.

UNIT-II

Memory management: Single contiguous allocation – Partitioned Allocation – Relocatable Partitioned Allocation – Paged and Demand Pages Memory Management – Segment Memory Management – Segmented and Demand Paged Memory Management – Swapping and Overlay Techniques.

UNIT- III

Processor management: Job Scheduling – Process Scheduling – Functions and Policies – Evaluation of Round Robin Multiprogramming performance – Process synchronization – Race condition – Synchronization Mechanism – Deadly Embrace Prevention and Detect and Recover Methods.

UNIT- IV

Job and processor scheduling:scheduling levels,scheduling objectives, scheduling criteria, Pre emptive vs non- preemptive scheduling, interval time interrupting clock,priorities, scheduling algorithms-FIFO scheduling, RR scheduling, quantum size, SJF scheduling, SRT scheduling, HRN scheduling, multilevel feedback queues, Fair shares scheduling

UNIT-V

Deadlock and indefinite postponement: Resource concepts, four necessary conditions for deadlock, deadlock prevention, deadlock avoidance and Dijkstra's Banker's algorithm, deadlock detection, deadlock recovery.

OUTCOMES:

At the end of the course, the student should be able to:

- Design various Scheduling algorithms.
- Apply the principles of concurrency.
- Design deadlock, prevention and avoidance algorithms.
- Compare and contrast various memory management schemes.
- Design and Implement a prototype file systems.
- Perform administrative tasks on Linux Servers.

REFERENCE BOOKS:

1. Operating systems – E. Madnick and John J. Donovan – Tata McGraw Hill

2. Operating Systems (Concepts and Design) Milan Milenkovic – McGraw Hill International Edition

Course Code	Course Title	L	T	P	C
22122SEC61	**Introduction to Data Science**	**4**	**0**	**0**	**2**

Course objective:

To provide strong foundation for data science and application area related to it and understand the underlying core concepts and emerging technologies in data science.

Unit I

Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications, Mathematical Foundations for Data Science: linear algebra; Analytical and numerical solutions of linear equations; Mathematical structures, concepts and notations used in discrete mathematics. Introduction to Statistical Methods: basic and some advanced concepts of probability and statistics; Concepts of statistics in solving problems arising in data science.

Unit II

Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, using multiple data sources

Unit III

Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.

Unit IV

Data visualization: Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, mapping variables to encodings, Visual encodings.

Unit V

Computer science and engineering applications Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning

Course outcome:

Explore the fundamental concepts of data science

- Understand data analysis techniques for applications handling large data
- Understand various machine learning algorithms used in data science process
- Visualize and present the inference using various tools.
- Learn to think through the ethics surrounding privacy, data sharing and algorithmic decision-making

Text Book:

1. Cathy O'Neil, Rachel Schutt, Doing Data Science, Straight Talk from The Frontline. O'Reilly, 2013.

2. Introducing Data Science, Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Manning Publications Co., 1st edition, 2016

3. An Introduction to Statistical Learning: with Applications in R, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer, 1st edition, 2013

Reference Book:

1. Jure Leskovek, Anand Rajaraman, Jeffrey Ullman, Mining of Massive Datasets. v2.1, Cambridge University Press, 2014.

2. Data Science from Scratch: First Principles with Python, Joel Grus, O'Reilly, 1st edition, 2015.

3. Doing Data Science, Straight Talk from the Frontline, Cathy O'Neil, Rachel Schutt, O' Reilly, 1st edition, 2013.

4. Mining of Massive Datasets, Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Cambridge University Press, 2nd edition, 2014.

Course Code	Course Title	L	T	P	C
22122DSC63A	**Software Project management**	**4**	**1**	**0**	**3**

UNIT I INTRODUCTION TO PROJECT MANAGEMENT

Project Definition – Contract Management – Activities Covered By Software Project Management – Overview Of Project Planning – Stepwise Project Planning.

UNIT II PROJECT EVALUATION

Strategic Assessment – Technical Assessment – Cost Benefit Analysis – Cash Flow Forecasting – Cost Benefit Evaluation Techniques – Risk Evaluation.

UNIT III ACTIVITY PLANNING

Objectives – Project Schedule – Sequencing And Scheduling Activities – Network Planning Models – Forward Pass – Backward Pass – Activity Float – Shortening Project Duration – Activity On Arrow Networks – Risk Management – Nature Of Risk – Types Of Risk – Managing Risk – Hazard Identification – Hazard Analysis – Risk Planning And Control.

UNIT IV MONITORING AND CONTROL

Creating Framework – Collecting The Data – Visualizing Progress – Cost Monitoring – Earned Value – Prioritizing Monitoring – Getting Project Back To Target – Change Control – Managing Contracts – Introduction – Types Of Contract – Stages In Contract Placement – Typical Terms Of A Contract – Contract Management – Acceptance.

UNIT V MANAGING PEOPLE AND ORGANIZING TEAMS

Introduction – Understanding Behavior – Organizational Behaviour: A Background – Selecting The Right Person For The Job – Instruction In The Best Methods – Motivation – The Oldman–Hackman Job Characteristics Model – Working In Groups – Becoming A Team – Decision Making – Leadership – Organizational Structures – Stress – Health And Safety – Case Studies.

REFERENCES:

1. Bob Hughes and MikeCotterell “Software Project Management”, Third Edition, TATA McGraw Hill Edition 2204.

2. Ramesh, Gopalaswamy: "Managing Global Projects ", Tata McGraw Hill, 2201.
3. Royce." Software Project Theory", Pearson Education, 1999.
4. P.Jalote "Software Project Management In Practice", Pearson Education, 2200.

Course Code	Course Title	L	T	P	C
22122DSC63B	**Object oriented analysis and design**	**4**	**1**	**0**	**3**

AIM:

To equip the students with object oriented analysis and design

OBJECTIVES:

The student should be made to:

- Learn the basics of object oriented analysis and design skills.
- Learn the UML design diagrams.
- Learn to map design to code.
- Be exposed to the various testing techniques.

UNIT- I

Introduction to object-oriented Development- object-oriented themes – Modeling- The object modeling Technique- object and classes Links and Associations concepts- Generalization and Inheritance- Grouping constructs.

UNIT- II

Advanced object modeling- Aggregation- Abstract classes- Extension and Restriction- Multiple inheritance- Metadata – Candidate keys- Constraints. Dynamic modeling:- Events and states – Operations- Nested state diagram- Concurrency. Function modeling:- Functional models- Data flow diagram- Specifying operations- Constraints.

UNIT- III

OMT as software Engineering Methodology- The OMT Methodology- Impact of an objectoriented Approach. Analysis: - Overview of analysis – problem statement – automated teller machine example – object modeling – Dynamic modeling – functional modeling- adding operations iterating the analysis.

UNIT- IV

System Design- overview of system design – Breaking a system into subsystem – identifying concurrency – allocating subsystems to processors and tasks – management of data stores- handling global resources –

choosing software control implementation- handling boundary design – overview of object design – combining the three models – designing algorithms - design optimization - implementation of control.

UNIT- V

Implementation: Implementation using a programming language- Implementation using a database system. Programming style: object – oriented style – reusability – extensibility – Robustness - object oriented language features – survey of object – oriented languages.

OUTCOMES:

At the end of the course, the student should be able to:

- Design and implement projects using OO concepts.
- Use the UML analysis and design diagrams.
- Apply appropriate design patterns.
- Create code from design.
- Compare and contrast various testing techniques.

REFERENCE BOOKS:

1. Object Oriented Modeling and Design – James Rumbaugh, Michael Blaha, William Premerlani – PHI Twelfth Printing – 2201.

2. Object Oriented Analysis and Design with Applications- Grady Booch Second Edition – Pearson Education Asia publications.

CourseCode	CourseTitle	L	T	P	C
19120DSC66C	Ethicalhacking	4	1	0	3

OBJECTIVES:

- TounderstandandanalyseInformationsecuritythreats&coutermeasuresToperformsecurityauditing &testing Tounderstand issuesrelatingtoethicalhackingTostudy&employ networkdefensemeasures
- Tounderstandpenetrationandsecuritytestingissues

UNITIETHICALHACKING OVERVIEW

Understandingtheimportanceofsecurity,ConceptofethicalhackingandessentialTerminologiesT hreat,Attack.

UNITIIFOOTPRINTING&PORTSCANNING

Footprinting-Introductiontofootprinting,Understandingtheinformationgatheringmethodologyofthehackers,T oolsusedforthereconnaissancephase.PortScanning-Introduction,usingportscanningtools,pingsweeps,ScriptingEnumeration-Introduction,EnumeratingwindowsOS&LinuxOS.

UNITIIISYSTEMHACKING

Aspect of remote password guessing, Role of eavesdropping ,Various methods of passwordcracking,KeystrokeLoggers,UnderstandingSniffers,ComprehendingActiveandPassiv eSniffing,ARP Spoofing and Redirection,DNSandIPSniffing,HTTPSSniffing.

UNITIVHACKINGWEBSERVICES&SESSIONHIJACKING

Webapplicationvulnerabilities,applicationcodingerrors,SQLinjectionintoBack-endDatabases,cross-site scripting, cross-site request forging, authentication bypass, web services andrelatedflaws,protectivehttpheadersUnderstandingSessionHijacking,PhasesinvolvedinSessi onHijacking,Types ofSessionHijacking,SessionHijackingTools.

UNITVHACKINGWIRELESSNETWORKS

Introductionto802.11,RoleofWEP,CrackingWEPKeys,SniffingTraffic,WirelessDOSattacks, WLANScanners,WLANSniffers,HackingTools,SecuringWirelessNetworks.

<u>Course Outcomes</u>:

Outline ethical considerations of hacking

_ Outline legal considerations of hacking

_ Assess an environment using footprinting

_ Collect information using network scanning

_ Identify methods to gain access to systems

REFERENCES

1. KimberlyGraves,"Certified EthicalHacker",WileyIndiaPvtLtd,2010

2. MichaelT.Simpson,"Hands-onEthicalHacking&NetworkDefense",CourseTechnology,2010

3. RajatKhare,"NetworkSeucirytandEthicalHacking",LuniverPress,2006

4. RamachandranV,BackTrack5WirelessPenetrationTestingBeginner’sGuide(3rded.).PacktPublishing,2011

COURSE CODE	COURSE TITLE	L	T	P	C
221ENOEC	**Journalism**	**4**	**0**	**0**	**2**

Aim :

- To acquaint with the basic knowledge of journalism so that it may enthuse the students to become journalists.

Objective:

- To instill in the minds of students the different aspects of journalism
- To understand the different kinds of news
- To learn the qualities and duties of a reporter, editor and sub editor
- To familiarize with the style and features of the different sections in a newspaper

Outcome:

- Become a journalist

UNIT- I

Journalism – Definition, Qualities of a journalist, Forms of journalism, Role and elements

UNIT- II

News – Definition – Kinds – Elements – Sources

UNIT- III

Reporters

UNIT- IV

The Editor and the Sub Editor

UNIT –V

Language of Journalism, Style

Qualities of a Writer

Writing a News story, Opinion Pieces, Reviews, Headlines, Editorials

References:-

Journalism -Susan

Professional Journalism - John Hogenberg

News Writing and Reporting - M.James Neal (Surjeet Publication)

Professional Journalism -M.V Komath

The Journalist's Handbook -M.V Komath

Mass Communication &Journalism - D.S Mehta

COURSE CODE	COURSE TITLE	L	T	P	C
221MAOEC	**Development Of Mathematical Skills**	**4**	**0**	**0**	**2**

Objectives

Knowledge and understanding are fundamental to studying mathematics and form the base from which to explore concepts and develop problem-solving skills. Through knowledge and understanding students develop mathematical reasoning to make deductions and solve problems.

To develop student's ability to apply both conventional and creative techniques to the solution of mathematical problems

Unit I

Simple interest and compound interest

Unit II

Sinking fund – discounting – trade discount – quantity discount – cash discount

Unit III

Set theory – Series

Unit IV

Matrices – Determinants

Unit V
Assignment problems

References

1. P.A.Navanitham, Business Mathematics & Statistics

2. Kantiswarup, P.K.Gupta and Manmohan, " Operations Research"

- Learning outcomes
- By the end of this course, you should be able to
- know and demonstrate understanding of the concepts from the five branches of mathematics (Operations Research, Set Theory, statistics, Matrices and Business mathematics)
- use appropriate mathematical concepts and skills to solve problems in both familiar and unfamiliar situations including those in real-life contexts
- Select and apply general rules correctly to solve problems including those in real-life contexts.

Course Code	COURSE TITLE	L	T	P	C
221PHOEC	**Instrumentation**	**4**	**0**	**0**	**2**

Aim:

Making and analyzing measurements is the primary task of the experimental physicist. This includes designing experiments. Most experimental work, whether in bench-top situations, or using complex instruments. To many physicists this can be as interesting and involving as the basic physics one is trying to do.

Objectives:

The use of instruments is of course not confined to physicists and this kind of experience is valuable in many situations which many students will encounter after graduation.

A good physicist will bring a critical mind aiming to understand not only the result of an investigation but the primary reasons for the behavior of the data.Understand that there are finite limits to our ability to make good measurements, and why.

UNIT – I: Introduction

Potentiometer - calibration of volt meter and ammeter, measurement of resistance, Principles of network theorems – Thevenin's and Norton's theorem – Bridges :
AC bridges – Maxwell, Owen, Schering and deSauty's bridges – Wien bridges.

UNIT – II: ELECTRONIC INSTRUMENTS – I

Basic characteristics of instruments – resolution – sensitivity - Audio frequency oscillator, Conversion of galvanometer into voltmeter and ammeter – resistance meter - Amplified D.C. meter – Chopper stabilized amplifier – A.C. Voltmeter using rectifiers – Electronic multimeter – Differential voltmeter – Digital voltmeters – Component measuring instruments (quantitative studies)

UNIT – III: ELECTRONIC INSTRUMENTS – II

Signal conditioning systems – DC and AC carrier systems – Instrumentation amplifiers – Vibrating capacitor amplifier – Analog to digital data and sampling – A/D and D/A convertor (successive approximation, ladder and dual slope converseons).

Unit IV – Recording Devices

Recorders necessity – Recording requirements – Analog recorders – Graphic recorders – strip chart recorders – Galvanometer types recorders – Null type recorders.

Unit V – CRO

CRO – Construction and action – Beam transit time and frequency limitations – Measurement of potential, current, resistance, phase and frequency – Special purpose oscilloscopes – Sampling storage oscilloscope.

Books for Study

1. Electronic Instrumentation and Measurement techniques – W.D. Cooper and A.D. Helfrick – PHI – Third edn. – 1989

Learning Outcomes:

Appreciate important practical aspects of theoretical knowledge: how important components work, when to impedance match, non-ideal behaviour of op-amps etc.

Acquire a sound understanding of the role of noise in measurement systems and know how to apply noise reduction techniques.

Be able to apply Fourier and Laplace transforms to analyse the behaviour and stability of complex systems.

Books for Reference:

1. A course in electrical and electronic measurements and Instrumentation – A.K. Sawhmey – DhanpatRai and Sons – 1990.

2. Electronic measurements and instrumentation – Oliver Cage – McGraw Hill – 1975.

Course Code	COURSE TITLE	L	T	P	C
221CHOEC	**Food and Adulteration**	**4**	**0**	**0**	**2**

Aim: To introduce students to food safety and standardization act and quality control of foods.

Objectives:

1. To educate about common food adulterants and their detection.
2. To impart knowledge in the legislatory aspects of adulteration.
3. To educate about standards and composition of foods and role of consumer.

Unit-I Introduction to Food Chemistry

Introduction to Food Chemistry- Water (Structure of water and ice, Physical constants of water, Types of water, Water activity) Composition of Food- Carbohydrates, Proteins, Lipids, Vitamins & Minerals.

Unit- II Food Pigments

Introduction- classification, types of food pigments- chlorophyll, carotenoids, anthocyanins, flavanoids.

Unit – III Food Preservation

Introduction - Importance, principle and Types.

High and low temperatures preservation - Pasteurization - Sterilization- Canning- Freezing- Refrigeration.

Unit – IV Food Additives

introduction- antioxidants, sequestrants, preservatives, nutrient supplement, emulsifiers, stabilizers and thickening agents, bleaching and maturing agent, sweeteners, humectants and anti -caking agents, coloring and flavoring substance.

Unit-V Food Adulteration

Types of adulterants- intentional and incidental adulterants, methods of detection. Detection of common food adulterants in Spices , Grains, Coffee , Tea, Oil fats , Food colours and Milk. Health hazards and risks.

References:

1. The Food Safety and Standard ACT, 2206 – Seth &Capoor
2. Hand book of Food Adulteration and Safety Laws – Sumeet Malik
3. Food Science – B.Srilakshmi

Course Code	COURSE TITLE	L	T	P	C
221MBOEC	**Wild Life Conservation**	**4**	**0**	**0**	**2**

Aim:

To enable the students understand the need of conservation of wildlife in India.

Objectives:

Maintenance of rare species in protected areas such as national parks, santuries etc.,
Establishment of specific biosphere reserves for endangered plants and animals.
Protection of wild life through legislation such as banning hunting etc.,
Imposing specific restrictions on export of endangered plants and animals or their products.

Outcome:

Protection of natural habitats of organisms through controlled exploitation.

Educating the public about the need to protect and preserve the environment as a long range goal for the welfare of future generations

Unit I: Wildlife Management: Basic concepts and principles - Wildlife management before and after implementation of Wild Life (Protection) Act, 1972 – IUCN – CITES – NBA – IBA –

Evaluation of Wildlife habitat: Define habitat – Forest habitat types - basic survey techniques of habitats – Vegetative analyses – Point centered quadrat, Quadrat, strip transect – Habitat manipulation: Food, Water, shade, impact and removal of invasive alien species.

Unit II: Introduction to conservation biology, the origin of conservation biology, ethical and economical values of conservation biology, definition of biodiversity, types of biodiversity, threats to biodiversity. Scopes and importance of conservation methods – *In-situ* and *Ex-situ* conservation approaches of Indian animals. Captive breeding (Lion-tailed macaque, white tiger and vultures) and reintroduction (Tiger, rhinoceros, gaur).

Unit III: Biodiversity: Definition and importance - Biodiversity hotspots in India: Western Ghats, Eastern Himalayas. Mega diversity nations – an introduction. Landscape approach and people participation in biodiversity conservation.

Unit IV: Role of Government and Non-Government organizations in conservation.– Government - Wildlife Institute of India, Ministry of Environment and Forests (MoEF), National Biodiversity Authority (NBA), Zoological Survey of India (ZSI), Botanical Survey of India (BSI), Salim Ali

Centre for Ornithology and Natural History (SACON), Centre for Ecological Sciences (CES). NGOs. –Bombay Natural History Society (BNHS), World Wide Fund for Nature (WWF), Wildlife Trust of India (WTI), Nilgiri Wildlife and Environment Association (NWEA), Wildlife Conservation Society (WCS).

Unit V: Conservation Biology Tools - Biological Parks, Zoological Parks, Forest Research Institute, Agricultural Research Institutions, Gene Pools, Cryopreservation Centres, Interpretation Centres and role of Field Biologists.

References:

1. Anon, 1992. Conservation on biological diversity. Text and annexure – WWF-India.
2. Gaughley, G. and A. Gunn. 1995. Conservation Biology in Theory and practice. Blackwell Publishers.
3. Dobson, A.P. 1996. Conservation and biodiversity scientific American Library, New Yark, USA.

Course Code	Course Title	L	T	P	C
221CSOEC	**E-Learning**	**4**	**0**	**0**	**2**

COURSE OBJECTIVES

- Learn the basics of E-Learning concepts.
- Learn the content development techniques.

COURSE OUTCOMES

- Develop e – learning application on their own.
- Ability to develop contents for e-learning.
- To perform course management using tools.

UNIT I INTRODUCTION

Introduction – Training and Learning, Understanding elearning, components and models of e-learning, Advocacy of e-learning – benefits, learning styles, criteria for choosing, - Applications of E-learning.

UNIT II CONCEPTS and DESIGN

E-Learning Strategy, the essential elements of elearning strategy, Quality assuring e-learning, suppliers and resources, virtual learning environments, authoring tools, e-assessment, Learning Design Issues – purpose, general principles, designing live e-learning, designing self managed learning.

UNIT III APPLICATIONS

Moodle 2.0 E-Learning Course Development – Features, Architecture, Installation and Configuring Site.

UNIT IV COURSE MANAGEMENT

Creating – Categories, Courses, Adding Static Course Material – Links, Pages, Moodle HTML Editor, Media Files, Interacting with Lessons and Assignments – Evaluating Students – Quizzes and Feedback.

UNIT V ENHANCEMENT

Adding Social Activities - Chat, Forum, Ratings, Blocks – Types, Activities, Courses, HTML, Online Users – Features for Teachers.

REFERENCE BOOKS:

1. Delivering E-Learning: A complete Strategy for Design, Application and Assessment, Kenneth Fee, Kogan page, 2209.
2. Designing Successful e-Learning, Michael Allen, Pfeiffer Publication, 2207.
3. Moodle 2.0 E-learning Course Development, William Rice, PACKT, 2211.
4. Moodle 2.0 First Look, Mary Cooch, 2210.

B.COM

COURSE CODE	COURSE TITLE	L	T	P	C
221CMOEC	**BANKING SERVICES**	**5**	**0**	**0**	**5**

AIM:

To Provide the Bank is financial institution which is involved in borrowing and lending money.
OBJECTIVE: you should be able to

- To provide a lending money to firms, customers and home buyers.
- To provide keep money for customers
- To provide offering financial advice and related financial services, such as insurance.

UNIT – I
Commercial Banking – An Overview: Banking-Classification- Banking system- Universal Banking-Commercial Banking- functions – Role of Banks in Economic Development
UNIT – II
E-banking –An Overview: Meaning-Service-E-banking and Financial Services –Benefits-Internet Banking –Internet Banking Vs Traditional Banking –Mechanics of Internet Banking-Services
UNIT – III
Mobile Banking and Telephone Banking –An Overview: Meaning-Features- Registration-Services – Security Issues –Banking Facilities- Telephone Banking System – Drawbacks- Call Centers
Unit – IV
ATM and Electronic Money: Concept of ATM-Features-Functions-Strategic importance of ATM-Electronic Money – Categories –Merits – E-Money and Monetary Policy-Policy Issues for the RBI
Unit-V
EFT System and INFINET: Meaning- Steps in EFT- RBI Guidelines-EFT Systems Vs Traditional System - ECS-Features-Factors- Benefits –Handicaps -Applications
OUTCOME:

To help to gather knowledge on banking and financial system in India

To provide knowledge about commercial banks and its products

To create awareness about modern banking services like e-banking-banking and internet banking, ATM System

To introduce recent trends in banking system

To make the student understand the basic concept of banking and financial institutions and expose various types of risk based by banks

REFERENCES:

1. Banking theory law and Practice
2. Banking Theory law and practice -Santhanam
3. Banking Awareness - N.K.Gupta
4. Management of Banking and financial Services-Padmalathasuresh,Justinpaul

Course Code	Course Title	L	T	P	C
22122SEC64L	**Advanced Web Technology Lab**	**0**	**0**	**3**	**2**

1. Create a small paragraph about 10 lines. Try to use different font, title, head tags,

   Size and colors.
2. Create a table with rows & columns and split them using row span & cols pan.
3. Create a web page in the format of front page of a newspaper using text link
4. Write a program for addition using VBScript.
5. Develop a picture gallery having at least 3 pages. Each of them is having several pictures.
6. Create a java script for automatic type conversion.
7. Develop a Java Script program that handles event using button and check box.
8. Develop a program using java script for events handling text area and text field.
9. Develop a calculator for simple calculation using java script.
10. Develop a PHP program and check message passing mechanism between pages.

Course Code	Course Title	L	T	P	C
22122SEC64L	**Data Science Lab**	**0**	**0**	**3**	**2**

List of Experiments:

1. Python program to display details about the operating system, working directory, files and directories in the current directory, lists the files and all directories, scan and classify them as directories and files.

2. Python program to convert an array to an array of machine values and vice versa.

3. Python program to get information about the file pertaining to the file mode and to get time values with components using local time and gm time.

4. Python program to connect to Google using socket programming.

5. Python program to perform Array operations using Numpy package.

6. Python program to perform Data Manipulation operations using Pandas package.

7. Python program to display multiple types of charts using Matplotlib package.

8. Python program to perform File Operation on Excel Data Set.

9. Python program to implement with Python Sci Kit-Learn & NLTK.

10. Python program to implement with Python NLTK/Spicy/Py NLPI.

Course Code	Course Title	L	T	P	C
22122SEC65L	**Operating System Lab**	**0**	**0**	**3**	**2**

1. Write a menu driven shell program for the following:
   a. List of files.
   b. Processes of users.
   c. Today's Date
   d. Users of system.
   e. Quit of Unix

2. Write a shell program which accepts the name of a file from the standard input and tests to find the file access permissions, such as read, write and execute.

3. Write a shell program which accepts the name of a file from the standard input and perform the following

   a. Accept five names in a file.
   b. Sorts the names in existing file.
   c. Lists unsorted and sorted file.
   d. Quit

4. Write a menu driven shell program to copy, edit, rename and delete a file.

5. Write a menu driven shell program to perform the following task
   a. Write a sentence in file.
   b. Search for a given word or pattern in an existing file.
   c. Quit.

6. Write a shell program to prepare electricity bill for domestic consumers.

   For first 100 units – Rs. 0.75 / Unit
   For next 100 units – Rs. 1.50 / Unit
   Above 220 units – Rs. 3.00 / Unit
   Prepare the bill for the following format.

7. Write a shell program to display the result PASS or FAIL using the information given below student name, student register number, mark1, mark2, mark3, mark4 the minimum pass for each subject is 50.

8. Merge the contents of the file file1, file2 and store in another file

Course Code	Course Title	L	T	P	C
22122DSC63D	**WAP and WML**	**4**	**0**	**0**	**2**

Unit I

Overview of WAP: WAP and the wireless world – WAP application architecture – WAP internal structure – WAP versus the Web – WAP 1.2 – WTA and push features. Setting up WAP: Available software products – WAP resources – The Development Toolkits.

Unit II

WAP gateways: Definition – Functionality of a WAP gateway – The Web model versus the WAP model – Positioning of a WAP gateway in the network – Selecting a WAP gateway Basic WML: Extensible markup language – WML structure – A basic WML card – Text formatting – navigation – Advanced display features.

Unit III

Interacting with the user: Making a selection – Events – Variables – Input and parameter passing. WML Script: Need for WML script – Lexical Structure – Variables and literals – Operators – Automatic data type conversion – Control Constructs Functions – Using the standard libraries – programs – Dealing with Errors.

Unit IV

XML: Introduction XML: An Eagle's Eye view of XML – XML Definition – List of an XML Document – Related Technologies – An introduction to XML Applications – XML Applications – XML for XML – First XML Documents and Structuring Data: Examining the Data XMLizing the data – The advantages of the XML format – Preparing a style sheet for Document Display.

Unit V

Attributes, Empty Tags and XSL: Attributes – Attributes Versus Elements – Empty Tags – XSL – Well formed XML documents – Foreign Languages and Non Roman Text – Non Roman Scripts on the Web Scripts, Character sets, Fonts and Glyphs – Legacy character sets– The Unicode Character set – Procedure to Write XML Unicode.

Text Books:

1) For Unit I, II, III Charles Arehart and Others. "Professional WAP with WML, WML script, ASP, JSP, XML, XSLT, WTA Push and Voice XML" Shroff Publishers and Distributers Pvt. Ltd 2000.

2) For Unit IV & V Eliotte Rusty Harlod "XML TM Bible", Books India (P) Ltd, 2000

Course Code	Course Title	L	T	P	C
22122PRW66	**Project Work**	**0**	**0**	**0**	**4**

Each student will develop and implement individually developed application software based on any of the latest technologies.

Course Code	Course Title	L	T	P	C
221ACLSCET	**Community Engagement**	**-**	**-**	**-**	**1**

Aim:

Course Objectives:

- To develop an appreciation of rural culture, life-style and wisdom amongst students
- To learn about the status of various agricultural and rural development programmes
- To understand causes for rural distress and poverty and explore solutions for the same
- To apply classroom knowledge of courses to field realities and thereby improve quality of learning

Course Outcomes:

After completing this course, student will be able to

- Gain an understanding of rural life, culture and social realities
- Develop a sense of empathy and bonds of mutuality with local community
- Appreciate significant contributions of local communities to Indian society and economy
- Learn to value the local knowledge and wisdom of the community
- Identify opportunities for contributing to community's socio-economic improvements

UNIT I - Appreciation of Rural Society

Rural life style, rural society, caste and gender relations, rural values with respect to community, nature and resources, elaboration of "soul of India lies in villages" (Gandhi), rural infrastructure.

UNIT II-Understanding rural economy & livelihood

Agriculture, farming, landownership, water management, animal husbandry, non-farm livelihoods and artisans, rural entrepreneurs, rural markets

UNIT IIIRural Institutions

Traditional rural organisations, Self-help Groups, Panchayati raj institutions (Gram Sabha, Gram Panchayat, Standing Committees), local civil society, local administration

UNIT IVRural Development Programmes

History of rural development in India, current national programmes: SarvaShikshaAbhiyan, BetiBachao, BetiPadhao, Ayushman Bharat, Swatchh Bharat, PM AwaasYojana, Skill India, Gram PanchayatDecentralised Planning, NRLM, MNREGA, etc.

Research Integrated Curriculum

The relationship between teacher and learner is completely different in higher education from what it is in school. At the higher level, the teacher is not there for the sake of the student, both have their justification in the service of scholarship. For the students who are the professionals of the future, developing the ability to investigate problems, make judgments on the basis of sound evidences, take decisions on a rational basis and understand what they are doing and why is vital. Research and inquiry is not just for those who choose to pursue an academic career. It is central to professional life in the twenty-first century.

It is observedthat the modern world is characterized by heightened levels of complexity and uncertainty. Fluidity, fuzziness, instability, fragility, unpredictability, indeterminacy, turbulence, changeability, contestability: these are some of the terms that mark out the world of the twenty-first century. Teaching and research is correlated when they are co-related. Growing out of the research on teaching-research relations, the following framework has been developed and widely adopted to help individual staff, course teams and whole institutions analyse their curricula and consider ways of strengthening students understanding of and through research. Curricula can be:

Research – Led: Learning about current research in the discipline

Here the curriculum focus is to ensure that what students learn clearly reflects current and ongoing research in their discipline. This may include research done by staff teaching them.

Research – Oriented: Developing research skills and techniques

Here the focus is on developing student's knowledge of and ability to carry out the research methodologies and methods appropriate to their discipline(s)

Research – Based: Undertaking research and inquiry

Here the curriculum focus is on ensuring that as much as possible the student learns in research and or inquiry mode (i.e. the students become producers of knowledge not just consumers). The strongest curricula form of this is in those special undergraduate programmes for selected students, but such research and inquiry may also be mainstreamed for all or many students.

Research- Tutored: engaging in research discussions

Here the focus is on students and staff critically discussing ongoing research in the discipline.

All four ways of engaging students with research and inquiry are valid and valuable and curricula can and should contain elements of them.

Moreover, the student participation in research may be classified as,

Level 1: Prescribed Research

Level 2: Bounded Research

Level 3: Scaffolded Research

Level 4: Self actuated Research

Level 5: Open Research

Taking into consideration the above mentioned facts in respect of integrating research into the B.C.A., curriculum, the following Research Skill Based Courses are introduced in the B.C.A., curriculum.

Semester	RSB Courses	Credits
II	Research Led Seminar	1
III	Research Methodology	2
V	Participation in Bounded Research	1
VI	Project Work	4

Blueprint for assessment of student's performance in Research Led Seminar Course

- Internal Assessment: 40 Marks
  - Seminar Report (UG)/Concept Note(PG) : 5 X 4= 22 Marks
  - Seminar Review Presentation : 10 Marks
  - Literature Survey : 10 Marks
- Semester Examination : 60 Marks

  (Essay type Questions set by the concerned resource persons)

Blueprint for assessment of student's performance in Research Methodology Courses

Continuous Internal Assessment: 22 Marks

- Research Tools(Lab) : 10 Marks
- Tutorial: 10 Marks

Model Paper Writing: 40 Marks

- Abstract: 5 Marks
- Introduction: 10 Marks
- Discussion: 10 Marks
- Review of Literature: 5 Marks
- Presentation: 10 Marks

Semester Examination: 40 Marks

Total: 100 Marks

PRIST DEEMED TO BE UNIVERSITY
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THANJAVUR – 613 403 - TAMIL NADU

SCHOOL OF ARTS & SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

M.C.A.,
REGULATION 2022 - COURSE STRUCTURE

(For the candidates admitted in the academic year 2021-2022 onwards)

Semester I

Course Code	Course Title	L	T	P	C
22222SEC11	**ADVANCED DATA SCIENCE**	4	0	0	4
22222SEC12	**ADVANCE DATABASE MANAGEMENT SYSTEM**	4	0	0	4
22222SEC13	Routing and Switching in LAN	4	0	0	4
22212SEC14	Discrete Mathematics	4	0	0	4
22222SEC15L	**ADVANCED DATA SCIENCE LAB**	0	0	3	2
22222SEC16L	**ADVANCE DATABASE MANAGEMENT SYSTEM LAB**	0	0	3	2
22222DSC17_	Discipline Specific Elective – I	4	0	0	4
22222RLC18	Research Led Seminar	-	-	-	1
	Total	**22**	**0**	**6**	**25**

Semester II

Course Code	Course Title	L	T	P	C
22222SEC21	Python Programming	4	0	0	4
22222SEC22	Cryptography Network security	4	1	0	3
22222SEC23	Open Source programming	4	0	0	3
22222SEC24	Web Service	4	0	0	3
22222SEC25L	Python Programming Lab	0	0	3	2
22222SEC26L	Open Source programming Lab	0	0	3	2
22222DSC27_	Discipline Specific Elective – II	5	0	0	4
22222RMC28	Research Methodology	3	0	0	2
22222BRC29	Participation in Bounded Research	0	0	0	2
	Total	**24**	**1**	**6**	**25**

Semester III

Course Code	Course Title	L	T	P	C
22222SEC31	Data mining and warehousing	6	1	0	5
22222SEC32	Grid and Cloud Computing.	6	1	0	4
22222SEC33	.NET Programming	5	0	0	4
22222SEC34	Object Oriented System Design	5	0	0	4
22222SEC35L	.NET Programming Lab.	0	0	3	2
22222DSC36_	Discipline Specific Elective – III	5	0	0	4
22222SRC37	Societal project (Mini Project)	0	0	0	2
	Total	**27**	**2**	**3**	**25**

Semester IV

Course Code	Course Title	L	T	P	C
22222SEC41	Human Computer Interaction.	4	0	0	4
22222SEC42	Software Project Management	4	0	0	3
22222SEC43	Big Data	5	0	0	3
22222DSC44_	Discipline Specific Elective –IV	5	0	0	3
22222PRW44	Project work	0	0	15	10
22222PEE	Program Exit Examination	-	-	-	2
	Total	18	0	15	**25**
	Total Credits of the Programme				**100**

DISCIPLINE SPECIFIC ELECTIVE COURSES:

Semester	Discipline Specific Elective Courses
I	a) 22222DSC17A - Mobile Computing b)22222DSC17B - Knowledge based decision support system c)22222DSC17C - Augmented Reality d) 22222DSC17D - Ruby On Rails e) 22222DSC17E - Soft computing Techniques f)22222DSC17F - Quantum information and Computation

II	a) 22222DSC27A - Game Programming b) 22222DSC27B - Multimedia and Graphics c) 22222DSC27C - Middleware Technology d)22222DSC27D - Haskell programming e) 22222DSC27E - Natural Language Processing f) 22222DSC27F- Artificial Neural Networks
III	a) 22222DSC 36A - Information Security b) 22222DSC36B - Internet of Things c) 22222DSC36C - M-Marketing d) 22222DSC36D - Software Forensics e) 22222DSC36E - Information System Management f) 22222DSC36F - Social Media Mining
IV	a) 22222DSC44A - Design and Analysis of Algorithm b) 22222DSC44B - Computer Ethics c) 22222DSC44C - Web Mining d) 22222DSC44D - Sensor Networks e) 22222DSC44E - Graphics and Computer Vision f)22222DSC44F - Agile Frameworks

Credit Distribution:

Sem	AEC	SEC	DSC	OEC	Research	Others	Total
I	4	16	4		1		**25**
II		17	4		4		**25**
III		19	4		2		**25**
IV		13			10	2	**25**
TOTAL	**4**	**65**	**12**		**17**	**2**	**100**

Course Code	Course Title	L	T	P	C
22222SEC11	**ADVANCED DATA SCIENCE**	4	0	0	4

Unit – I: Introduction Introduction to Data Science – Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues.

Unit – II: Data Collection and Data Pr-Processing Data Collection Strategies – Data Pr-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretionary.

Unit – III: Exploratory Data Analytics Descriptive Statistics – Mean, Standard Deviation, Skewers and Kurtosis – Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA.

Unit – IV: Model Development Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot – Distribution Plot – Polynomial Regression and Pipelines – Measures for In-sample Evaluation – Prediction and Decision Making.

Unit – V: Model Evaluation Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Over fitting – Under Fitting and Model Selection – Prediction by using Ridge Regression – Testing Multiple Parameters by using Grid Search.

OUTCOME

- Apply appropriate principles, frameworks, and models to evaluate and interpret the frontiers of knowledge in their primary area of study.
- Demonstrate expository and oral communication skills appropriate to a Ph.D., publishing and presenting work in their field.
- Critique data practices for ethical issues, including discriminatory practices, power imbalances, and invasions of privacy.

REFERENCES: 1. Jogo Molehill, “Smarter Decisions : The Intersection of IoT and Data Science”, PACKT, 2216.

2. Cathy O’Neil and Rachel Schutt , “Doing Data Science”, O'Reilly, 2215.

3. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics”, EMC 2213

4. Raj, Pethuru, “Handbook of Research on Cloud Infrastructures for Big Data Analytics”, IGI

Course Code	Course Title	L	T	P	C
22222SEC12	**ADVANCE DATABASE MANAGEMENT SYSTEM**	4	0	0	4

Objective

- To understand the basic concepts and terminology related to DBMS and Relational Database Design
- To the design and implement Distributed Databases.
- To understand advanced DBMS techniques to construct tables and write effective queries, forms, and reports

Unit I

Formal review of relational database and FDs Implication, Closure, its correctness

Unit II

3NF and BCNF, Decomposition and synthesis approaches, Review of SQL99, Basics of query processing, external sorting, file scans

Unit III

Processing of joins, materialized vs. pipelines processing, query transformation rules, DB transactions, ACID properties, interleaved executions, schedules, serviceability

Unit IV

Correctness of interleaved execution, Locking and management of locks, 2PL, deadlocks, multiple level granularity, CC on B+ trees, Optimistic CC

Unit V

T/O based techniques, Multiversion approaches, Comparison of CC methods, dynamic databases, Failure classification, recovery algorithm, XML and relational databases

Outcome

- Exposure for students to write complex queries including full outer joins, self-join, sub queries, and set theoretic queries.
- Knowhow of the file organization, Query Optimization, Transaction management, and database administration techniques

Text Books

1. R. Ramakrishnan, J. Gehrke, Database Management Systems, McGraw Hill, 2204
2. A. Silberschatz, H. Korth, S. Sudarshan, Database system concepts, 5/e, McGraw Hill, 2208.

Reference Books

1. K. V. Iyer, Lecture notes available as PDF file for classroom use.

Course Code	Course Title	L	T	P	C
22222SEC13	Routing and Switching in LAN	4	0	0	4

AIM:

To provide complementary perspective on the LAN routing and Switching in an Enterprise.

OBJECTIVES:

- Gives a systematic approach to hierarchical network that support voice, video, and data.
- Expertise the functions of basic switch.
- Provides idea on VLAN, VTP, STP and Inter-VLAN Routing.
- Teaches components of a wireless LAN and its operations.

UNIT I

LAN Design: Switched LAN Architecture-Matching Switches to specific LAN functions.

UNIT II

Basic switching concepts and configuration-Introduction to Ethernet-802.3 LANS-Forwarding frame using switches-switch management configuration.

UNIT III

VLAN- Introducing VLAN - VLAN Trucking- Configure VLAN and Trunks.

UNIT IV

VTP-VTP –Concepts-VTP Operation- configure VTP

UNIT V

Introduction to STP-STP convergence- Inter VLAN routing-the wireless LAN.

OUTCOMES:

At the end of the course, the student should be able to:

- Systematic approach to hierarchical network that support voice, video, and data.
- Idea on VLAN, VTP, STP and Inter-VLAN Routing.
- Components of a wireless LAN and its operations.

REFERENCES:

1. "LAN Switching and wireless" CCNA Exploration companion guide- waylay lewis- cisco press-Pearson Education.

Course Code	Course Title	L	T	P	C
22212SEC14	Discrete Mathematics	4	0	0	4

AIM:

To provide in-depth knowledge of Mathematical logic, Boolean Algebra.

OBJECTIVES:

- To understand the concept of Set Theory and Functions.
- To solve the Recurrence Relations using Generating functions.

UNIT I

Sets, Relations & Functions : Property of binary relations, Equivalence, Compatibility, Partial ordering relations, Hesse diagram, Functions, Inverse function, Compositions of functions, Recursive functions.

UNIT II

Mathematical logic : Logic operators, Truth tables, Theory of inference and deduction, Mathematical Calculus, Predicate Calculus, Predicates and Qualifiers.

UNIT III

Groups & Subgroups : Group axioms, Permutation groups, Co sets, Normal subgroups, Semi groups, Free semi groups, Mono ids, Sequential Machines, Error Correcting Codes, Modular arithmetic Grammars.

UNIT IV

Lattices & Boolean Algebra: Axiomatic definition of Boolean algebra as algebra as algebraic structures with two operations, Basic results truth values and truth tables, The algebra of propositional functions, Boolean algebra of truth tables.

UNIT V

Combinatorial & Recurrence Relations : Disjunctive and sequential counting, Combinations and permutations, Enumeration without repetition, Recurrence Relation, Fibonacci relation, Solving recurrence relation by Substitution, Solving non recurrence relation by conversion to linear recurrence relation.

OUTCOME:

1. Apply the properties of relations, functions, and sequences to complete operations on discrete structures such as sets, functions, relations, and sequences
2. Verify the correctness of an argument using propositional logic, predicate logic, and truth tables.
3. Construct mathematical proofs using counter-examples, direct proofs, proof by contrapositive, proof by contradiction, case analysis, and mathematical induction.

REFERENCES:

1. Trenbly J.P & Manohar. P. "Discrete Mathematical Structures with Applications to Computer Science".

2. Kolman, Busy & Rose " Discrete Mathematical Structures "PHI

3. K.D Joshi " Foundations of Discrete Mathematics" , Wiley Eastern Limited.

1. Seymour Lipschutz & March Lipson Tata Mc Graw Hill.
2. C.L.Liu " Elements of Discrete Mathematics " Tata Mc Graw Hill.

Course Code	Course Title	L	T	P	C
22222SEC15L	**ADVANCED DATA SCIENCE LAB**	0	0	3	2

Objective:

- To explore the features of a Database Management Systems
- To interface a database with front end tools
- To understand the internals of a database system

1. **R AS CALCULATOR APPLICATION**
   i) Using mathematical functions on console
   ii) Write an R script, to create R objects for calculator application and save in a specified location in disk.
2. Write an R script to find subset of dataset by using subset (), aggregate () functions on iris dataset.
3. Find the data distributions using box and scatter plot in R visualization. Find the outliers using plot.
4. **CORRELATION AND COVARIANCE:**
   i) Find the Correlation matrix
   ii) Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data.
5. **MULTIPLE REGRESSION MODEL:**
   i) Apply multiple regressions, if data have a continuous Independent variable. Apply on above dataset
6. **REGRESSION MODEL FOR PREDICTION:**
   i) Apply regression Model techniques to predict the data on above dataset.

7. **CLASSIFICATION MODEL:**

ii) Install relevant package for classification. b. Choose classifier for classification problem.

iii)

iv) Evaluate the performance of classifier

8. **CLUSTERING MODEL**

i) Clustering algorithms for unsupervised classification.

ii) Plot the cluster data using R visualization

Outcome:

- Ability to use databases for building web applications.
- Gaining knowledge about the internals of a database system.

Course Code	Course Title	L	T	P	C
22222SEC16L	**ADVANCE DATABASE MANAGEMENT SYSTEM LAB**	0	0	3	2

Objective:

- To explore the features of a Database Management Systems
- To interface a database with front end tools
- To understand the internals of a database system

1. Creating, Updating and Inserting into databases and simple queries.
2. Intermediate SQL
3. Advanced Built-in functions of SQL
4. Creation of simple forms
5. Database Design and Normalization
6. Accessing Databases from Programs using JDBC
7. Building Web Applications using PHP & MySQL
8. Indexing and Query Processing
9. Query Evaluation Plans
10. Concurrency and Transactions

Outcome:

- Ability to use databases for building web applications.
- Gaining knowledge about the internals of a database system.

Course Code	Course Title	L	T	P	C
22222DSC17A	Discipline Specific Elective – I Mobile Computing	4	0	0	4

UNIT-I

Mobile Computing: An Overview of Mobile Computing-Mobile Computing Architecture-Mobile Devices-Mobile System Networks-Mobility Management. Mobile Device and Systems: Mobile Phones-Digital Music Players-Hand Held Devices: operating System-Limitation of Mobile Devices

UNIT-II

Medium Access Control-SDMA, FDMA, TDMA-Tele Communication System:

GSM-Mobile Services-System Architecture-Satellite System: Application, Basics.

UNIT-III

Wireless LAN: Infra-red Vs Radio transmission-Infra Structure and ad-hoc networks-

IEEE 802.11: System Architecture, Protocol Architecture, Physical Layer-MAC Management-HIPERLAN: WATM-Bluetooth: User Scenarios, Architecture.

UNIT-IV

Mobile IP: Goals, assumptions and requirements-Entities and terminology-IP Packet Delivery-Tunneling and Encapsulation-Reverse Tunneling-Mobile ad-hoc Networks: Overview ad-hoc routing protocols

UNIT-V

Mobile Application Language: XML, Java, J2ME & Java Card-Mobile Operating System

OUTCOME:

1. Define mobile technologies in terms of hardware, software, and communications.
2. Utilize mobile computing nomenclature to describe and analyze existing mobile computing frameworks and architectures.
3. Evaluate the effectiveness of different mobile computing frameworks.

REFERENCE BOOKS:

1. “Mobile computing”-Raj Kamal, Oxford University published in 2227. For Unit1-1,Unit-5.

2.”Mobile Communications”-Jochen H.Schiller,published by Pearson Education Limited.For

Unit-2, 3, 4.

Course Code	Course Title	L	T	P	C
22222DSC17B	Discipline Specific Elective – I Knowledge based decision support system.	4	0	0	4

AIM:

To Explore the use of Artificial Intelligence techniques for applications development.

OBJECTIVES:

To understand the various AI Techniques for application development using:

- LISP programming
- Symbolic logic
- Matching techniques
- Knowledge Acquisition

UNIT I

Overview of AI – Knowledge: General Concepts – LISP and other programming languages.

UNIT II

Formalized symbolic logic – Dealing with inconsistencies and uncertainties – structured knowledge: Graphs, Frames & Related Structures – Object Oriented representations.

UNIT III

Search and control strategies – Matching Techniques.

UNIT IV

General concepts in knowledge Acquisition – Learning by induction.

UNIT V

Natural language processing – Pattern recognition – Visual image understanding – Expert system architecture.

OUTCOMES:

At the end of the course, the student should be able to:

- Identify problems that are amenable to solution by AI methods.
- Identify appropriate AI methods to solve a given problem.
- Formalist a given problem in the language/framework of different AI methods.
- Implement basic AI algorithms.
- Design and carry out an empirical evaluation of different algorithms on a problem
- formalization, and state the conclusions that the evaluation supports

REFERENCES:

1. "Introduction to Artificial Intelligence and Expert system" by Dan w. Patterson.

2. Elaine Rich and Kevin Kaight, "Artificial Intelligence", Tata McGraw Hill, 2nd Edition, 1991.

Course Code	Course Title	L	T	P	C
22222DSC17C	**Augmented Reality**	4	0	0	4

Course Objectives:

The main objectives of this course are to:

1. To understand the importance of augmented reality in Industry 4.0 with real-time examples
2. To describe the history and recent developments of AR
3. To provide the need on emerging technologies AR and VR
4. To discuss the revolution and impact of AR
5. To understand the applications of AR and VR

UNIT 1: Introduction to Augmented Reality

History of AR - Augmented reality characteristics – Difference between AugmentedReality and Virtual Reality – AR technological components – Technologies usedin AR– Feature Extraction – Hardware components – AR devices – Importance of AR - Real world uses of AR – AR types – Software tools available for AR

UNIT 2: Need of technologies for Augmented Reality

Hardware technology– virtual scenes– 3D objects– AR components - Display – HMD – Eyeglasses – Contact Lenses– significance of AR– AR powered devices– AR application development drawbacks – Compatibility - Performance – AR libraries– Motion tracking – Environmental understanding Anchors

UNIT 3: Technology Integration and Implementation of AR

Technology use and integration in industrial settings – Assistive training to faculty members – Planning and administration for implementation – AR implications – Practical data – AR Labs – Platforms to form AR content – Coordinated utilization of AR applications – Hands-on preparation

UNIT 4: Augmented Reality and Virtual Reality for Micro Learning

Micro learning techniques – Utilizing VR for learning – VR for Practical online assessment– VR info graphics – Virtual case considerations - Utilizing AR for learning – Accessible learning – sensible data – elevated learner engagement - VR technology – Components of VR – VR Hardware – VR applications – Civil Engineering – Real Estate – Biology and Medicine – Virtual Mall – VR in Education – Virtual Laboratory – Factory Planning –

Automobile Industry

UNIT 5: Tools and Applications of Augmented Reality

Tools available for Augmented Reality and Recognition– Software Tools– Google - Poly – Unity – software approaches – recognition types– native software solutions– ARKit – ARCore– software development kit - Cloud services - AR business applications– weather prediction– market prediction– smart cities -AR application for Education - AR application for Healthcare sector – Agriculture – Civil Engineering – Architecture – Archaeology – Crime and Security – Games – IoT – Use cases – Social Media – Gaming – Education– Healthcare– Shopping and Business

OUTCOMES:

Augmented reality (AR) can be used in the classroom to improve student learning outcomes in several ways:

Enhancing visual and spatial learning: AR allows students to see, manipulate, and interact with virtual objects and information in the real world, providing a more immersive and engaging learning experience.

Reference Book

1. Kaliraj P, Devi T, (2021). Innovating with Augmented Reality: Applications in Education and Industry(P. Kaliraj, Ed.) (1st ed.). Auerbach Publications. https://doi.org/10.1201/9781003175896

2. Course Designed by: Ms. M. Lissa and Prof. T. Devi

Course Code	Course Title	L	T	P	C
22222DSC17D	**Ruby On Rails**	4	0	0	4

OBJECTIVE:

Ruby on Rails is an open-source, object-oriented framework that's used to develop web applications.

It's written in the Ruby programming language, and developers turn to Ruby on Rails for its time-saving features and fast development

UNIT 1: Introduction to Ruby on RailsScaffolding

The Scaffold command - Overview of Models, Views, and Controllers (MVC) Adjusting the Templates Created by Scaffolding - Formatting in Rails - Working with Dynamic web pages Editing the text in the tab - Redirecting the homepage URL Editing the CSS - Version Control with Git Initializing a repository Commiting and Pushing changes - Creating, switching, and deleting branches Merging branch

Unit 2: Ruby Fundamentals

Ruby Data Types & Variables - String, Integer, FloatBoolean and Nil values -Properties of Ruby data types - Instance variables & Local variablesGlobal variables Built-in functions - Creating your own functions - Passing arguments and returning values -If/Else and Unless Statements While/Until Loops

Unit 3: Controllers and Views

Generating a Controller - Creating a New Rails Site for Flix - How Controller methods relate to viewsPrivate methods -The params hash - Views - Generating and creating ViewsWhen you don't need a View - Mapping Views to controller actions and routesDynamic Views - The rails routes command

Unit 4: Models & Forms

Models - Generating a Model How Migration Files work -Migratiing the Database Rolling back a migration - Rails Forms - Rails forms vs HTML formsHTTP Overview - Rails Form Helpers Rails forms: form_for, form_tag, and form_withConnecting a form to a Model

UNIT 5: Advanced Models

Model Validations - The purpose of validationsAdding basic validations - Preventing submission of empty formsCustomizing validations - Adding Error Messages - Model Methods - Built-in Model methods Adding methods to models - Model Relationships - has_one and belongs_to relationships has_and_belongs_to_many: Simple Many-to-Many Relationships - : Advanced Many-to-Many Relationships with Additional Metadata Polymorphic Relationships

OUTCOMES:

Cost-effective. The Ruby on Rails framework is 100% free and runs on Linux, which is an open-source framework. ...

- Built on Model-View-Controller (MVC) architecture:
- Easy to manage changes.
- Secure.

REFERENCES:

Title: Ruby on Rails Tutorial (Rails 6) Level: Beginner programmer | No experience with Rails.

- Title: Agile Web Development with Rails 6.
- Title: The Rails 5 Way (4th Edition)
- Title: Rails 5 Test Prescriptions: Build a Healthy Codebase.

Course code	Course Title	L	T	P	C
22222DSC17E	**Soft computing Techniques**	4	0	0	4

UNIT 1: Introduction to Soft Computing

Concept of computing systems, "Soft" computing versus "Hard" computing, Characteristics of Soft computing, Some applications of Soft computing techniques

UNIT 2:Fuzzy logic

Introduction to Fuzzy logic, Fuzzy sets and membership functions, Operations on Fuzzy sets, Fuzzy relations, rules, propositions, implications and inferences, Defuzzification techniques, Some applications of Fuzzy logic.

UNIT 3: Genetic Algorithms

Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques, Basic GA framework and different GA architectures, GA operators: Encoding, Crossover, Selection, Mutation, etc. Solving single-objective optimization problems using GAs.

UNIT 4: Artificial Neural Networks

Biological neurons and its working, Simulation of biological neurons to problem solving, Different ANNs architectures, Training techniques for ANNs, Applications of ANNs to solve some real-life problems.

UNIT 5: Hybrid Systems

Fuzzy Neural systems, Genetic Fuzzy systems, Genetic Neural system

Reference Books:

1. Fuzzy Logic: A Practical approach, F. Martin, Mc neill, and Ellen Thro, AP Professional, 2000.

2 Fuzzy Logic with Engineering Applications (3rd Edn.), Timothy J. Ross, Willey, 2010.

3. Foundations of Neural Networks, Fuzzy Systems, and Knowledge Engineering, Nikola K. Kasabov, MIT Press, 1998.

4. Fuzzy Logic for Embedded Systems Applications, Ahmed M. Ibrahim, Elsevier Press, 2004.

Course Outcomes:

1 Comprehend soft computing techniques and its applications.

2 Understand the artificial neural networks and its applications.

3 Analyze the single-objective optimization problems using GAs.

4 Develop the fuzzy logic sets and membership function and defuzzification techniques.

5 Design the hybrid system for solving the real-life problem of civil engineering

Course code	Course Title	L	T	P	C
22222DSC17F	**Quantum information and Computation**	4	0	0	4

UNIT 1:

Introduction: Elementary quantum mechanics: linear algebra for quantum mechanics, Quantum states in Hilbert space, The Bloch sphere, Density operators, generalized measurements, no-cloning theorem.

UNIT 2:

Quantum correlations: Bell inequalities and entanglement, Schmidt decomposition, super- dense coding, teleportation.

UNIT 3:

Quantum cryptography: quantum key distribution

UNIT 4:

Quantum gates and algorithms: Universal set of gates, quantum circuits, Solovay-Kitaev theorem, Deutsch-Jozsa algorithm, factoring

UNIT 5:

Programming a quantum computer: The IBM, coding a quantum computer using a simulator to carry out basic quantum measurement and state analysis.

OUTCOMES:

Knowledge: Know the characteristics of classical and quantum computing systems.

Skills: Be able to perform basic linear algebra operations. Possess: Have a basic knowledge of the practical use of quantum algorithms.

Text-books:

(1) Phillip Kaye, Raymond Laflamme et. al., An introduction to Quantum Computing, Oxford University press, 2007.

Chris Bernhardt, Quantum Computing for Everyone, the MIT Press,Cambridge, 2020

(2)David McMahon-Quantum Computing Explained-Wiley-Interscience , IEEE Computer Society (2008)

References:

(1) Quantum Computation and Quantum Information, M. A. Nielsen &I.Chuang, Cambridge University Press (2013).

(2) Quantum Computing, A Gentle Introduction, Eleanor G. Rieffel and Wolfgang H. Polak MIT press (2014)

SEMESTER II

Course code	Course Title	L	T	P	C
22222SEC21	Python Programming	4	0	0	4

AIM

To enable the student to be familiar with Python Programming.

OBJECTIVES:

On successful completion of the course the student should have understood the concepts in Python and its application.

Unit - I

Core Python: Introduction-features-Comparative study-Comments-Operators-Variables and Assignments-Numbers-String-List and Tuple-Dictionary-Statements and Iterative statements-list comprehensive-Errors and Exception-functions-Classes-Modules-Useful function. Basics: Syntax and Statements-Variable Assignments-Identifier-Style-Memory Management-Application Example. Objects: Introduction-Standard Type- Built-in-type-Internal type-Standard type operator and Built-in functions-Categorizing standard type-Unsupported type.

Unit – II

Numbers: Introduction- Integer-Floating Point-Complex numbers-Operators-Built-in-functions-Other numeric type-Sequence-Strings-Strings and Operator-String only operator-Built-in-Functions-Built-in-Methods-String Features-Unicode-Related Modules.

Unit – III

List-Operators-Built-in-Functions-Built-in-Methods-Features of List-Tuple: Introduction-Operators and Built-in-Functions-Features-Related Modules-Mapping type: Dictionaries-Operators-Built-in and Factory Functions-Built-in- Methods. Set type: Introduction-Operators-Built-in Function-Built-in Methods-Related Modules-Conditional and looping statement.

Unit – IV

File: Objects- Built in Functions-Methods-Attributes-Standard files-Command line Argument-File System-File Execution-Persistent Storage Modules-Related Module. Class: Introduction-Class and Instance- Method calls. Exception and Tools: Why use it?-Exception roles-Short story-Try/finally statement.

Unit – V

Regular Expression: Introduction-Special Symbols and characters-Regexes and Python-Examples of Regexes. Network Programming: Architecture-Socket. Internet Client

Programming- Transferring files-Email.GUI Programming: Introduction-Tinter and Python Programming: Introduction-Python DB-API-Non-Relational DB. Web Services: Introduction-Micro blogging with Twitter.

OUTCOMES:

- Create your first program in Python IDLE.
- Implement OOPs concepts in your programming.
- Use Arrays, and Data structures.
- Create an application with the support of graphics in Python.
- Implement error handling.

REFERENCES:

1. Chun, J Wesley, Core Python Programming, 2nd Edition, Pearson, 2227 Reprint 2210.
2. Wesley J Chun Core python Application Programming,3rd Edition,
3. Lutz, Mark, Learning Python, 5th Edition, O Rielly

Course code	Course Title	L	T	P	C
22222SEC22	Cryptography Network security	4	1	0	3

AIM:

To introduce about Internet Security in terms of measures to deter, prevent, detect, and correct security violations that involve the transmission of information

OBJECTIVES:

- To know the methods of conventional encryption.
- To understand the concepts of public key encryption and number theory
- To understand authentication and Hash function.
- To know the network security tools and system level security used.

UNIT I

CLASSICAL ENCRYPTION TECHNIQUES: Symmetric Cipher Model-substitution techniques-transposition technique-Rotor machine-Stenographically CIPHERS AND THE DATA ENCRYPTION STANDARD: Simplified DES-Block cipher principles-The data encryption standard-the strength of DES-Differential and linear cryptanalysis-Block cipher design principles-Block cipher modes of operation**.**

UNIT II

PUBLIC KEY CRYPTOGRAPHY AND RSA: Principles of public key cryptonymous-The RSA algorithmically MANAGEMENT OTHER PUBLIC KEY CRYPTOGRAMS: key management-Diffie-Hellman Key Exchange-Elliptic curve Arithmetic-Elliptic curve cryptography.

UNIT III

HASH ALGORITHM :MD5 Message Digest Algorithm-Secure Hash Algorithm-RIPENED-160-DIGITALISM SIGNATURE AND AUTHENTICATION PROTOCOLS: Digital Signatures-Authentication Protocols-Digital Signature Standard.

UNIT IV

AUTHENTICATION APPLICATION : Kerosene-X.509 Authentication Service-Recommended Reading and Microelectronics MAIL SECURITY: Pretty Good Privacy-S/MIME IP Security : IP Security Overview-IP security Architecture-Authentication Header- Encapsulating Security Payload- Combining Security Associations -Key Management SECURITY : Web security considerations – Secure Socket Layer and Transport Layer Security
– Secure Electronic Transactions.

UNIT V

INTRUDERS : Intruders – Intrusion detection – Password management. MALICIOUS SOFTWARE : Viruses and Related Threats – Virus countermeasures.

FIREWALLS: Firewalls Design Principles-Trusted Systems.

OUTCOMES:

Upon Completion of the course, the students should be able to:

- Compare various Cryptographic Techniques
- Design Secure applications
- Inject secure coding in the developed applications

REFERENCES:

1. "Cryptography and Network Security " – William Stallings – 3rd Edition Pesrson Education 2223.

2. "Network Security essentials Applications and Standards", William Stalings , Pearson Education 2227.

Course code	Course Title	L	T	P	C
22222SEC23	Open Source programming	4	0	0	3

AIM:

To improve the Programming Knowledge of VBScript, JavaScript, Perl & PHP.

OBJECTIVES:

- To have the knowledge of VBScript, JavaScript.
- To explore the use of Perl & PHP.

UNIT I:

VBScript –VBScript Programming Basics – Working with Operators – Controlling Program flow with VBScript- Working with Functions, Subroutines and Dialog boxes – Datatype Conversion Features – Putting it all together with VBScript – using the Script Debugger.

UNIT II:

The Basic of JavaScript: Overview of JavaScript – Object Orientation and JavaScript – General Syntactic Characteristics – Primitives, Operation and Expressions – Screen Output and Keyboard Input – Control Statements – Object Creation and Modification – Arrays – Functions – Constructors – Pattern Matching Using Regular Expressions. JavaScript and Html Documents: The JavaScript Execution Environment – The Document Object Model – Element Access in JavaScript – Events and Event Handling – Handling Events from Body Elements, Button Elements, Text Box and Password Elements – The DOM 2 Event Model – The navigator Object.

UNIT III:

The Basics of Perl: Origins and Uses of Perl – Scalars and their Operations – Assignment Statements and Simple Input and Output – Control Statements – Fundamentals of Arrays – Hashes – References – Functions – Pattern Matching – File Input and Output. Using Perl for CGI Programming: The Common Gateway Interface – CGI Linkage – Query String Format – The CGI .pm Module – Cookies.

UNIT IV:

Introduction to PHP: Origins and Uses of PHP – Overview of PHP – General syntactic characteristics – Primitives, Operation and Expressions – Output – Control Statements – Arrays – Functions – Pattern Matching – Form Handling – Files – Cookies – Session Tracking.

UNIT V:

Database Access through the Web: Relational Databases – An Introduction to the Structured Query Language – Architecture for Database Access – The MySQL Database System – Database Access with Perl and MySQL – Database Access with PHP and MySQL – Database Access with JDBC and MySQL .

OUTCOMES:

- Understand process of executing a PHP-based script on a webserver.
- Be able to develop a form containing several fields and be able to process the data provided on the form by a user in a PHP-based script.
- Understand basic PHP syntax for variable use, and standard language constructs, such as conditionals and loops.
- Understand the paradigm for dealing with form-based data, both from the syntax of HTML forms, and how they are accessed inside a PHP-based script.

REFERENCES:

1. UNIT I: Scot Johnson “Using Active Server Page”.
2. UNIT II, III, IV, V: Robert W.Sebesta, “Programming the World Wide Web” Third edition.
3. Internet & WWW How to program by Deital , Third edition.

Course code	Course Title	L	T	P	C
2222SEC24	Web Service	4	0	0	3

AIM:

To have thorough knowledge about web service and web security.

OBJECTIVES:

- To provide an idea on Processing XML.
- To understand the concepts of SOAP, UDDI.
- To understand the concepts of Web security.

UNIT I

Introduction – What are web services? -Why Web Services are important?– Web services and enterprises. XML Fundamentals: XML: The Lingua Franca of web services- XML Documents-XML namespaces - XML Schema - Processing XML

UNIT II

SOAP and WSDL: The SOAP Model- SOAP- SOAP Messages - SOAP encoding – SOAP RPC- Using alternative SOAP Encodings, Document, RPC, Literal, Encoded -SOAP web services and the REST Architecture- Looking back to SOAP 1.1 - WSDL– Using SOAP and WSDL UDDI: UDDI at a glance- The UDDI Business registry- UDDI under the covers – Accessing UDDI- How UDDI is playing out.

UNIT III

Conversations: Overview –Web services Conversation Language – WSCL Interface components – The Bar scenario conversations – Relationship between WSCL and WSDL Workflow: Business Process Management – Workflow and Workflow management systems.

UNIT IV

Transactions: ACID Transactions – Distributed Transactions and two phase commit – Dealing with Heuristic outcomes – Scaling transactions to web services – OASIS business transaction protocol – Other web services transaction Protocol .

UNIT V

Security: Everyday security basis – Security is an end to end product – Web service security issues – Types of Security attacks and threats - Web services security road map WS – Security.

OUTCOMES:

Upon Completion of the course, the students should be able to:

- Get an idea on Processing XML.
- Understand the concepts of SOAP, UDDI.
- Understand the concepts of Web security.

REFERENCES:

1. Developing Enterprise Web Services - An Architect's Guide – Sandeep Chatterjee, James Webber, Pearson Education– Second Indian Reprint 2225.

2. Understanding SOA with Web Services, Eric Newcomer, Greg Lomow, Pearson Education, First Indian Reprint 2225.

Course code	Course Title	L	T	P	C
22222SEC25L	Python Programming Lab	0	0	3	2

Objectives:

The main objective is to teach Computational thinking using Python.

• To know the basics of Programming

• To convert an algorithm into a Python program

• To construct Python programs with control structures.

• To structure a Python Program as a set of functions

1. Find the square root of a number (Newton's method)

2. Exponentiation (power of a number)

3. Find the maximum of a list of numbers

4. Linear search and Binary search

5. Selection sort, Insertion sort

6. Merge sort

7. First n prime numbers

8. Multiply matrices

9. Programs that take command line arguments (word count)

10. Find the most frequent words in a text read from a file

OUTCOMES:

1 understand and use variables.

2 work with common Python data types like integers, floats, strings, characters, lists, dictionaries, as well as pandas DataFrames.

3 use basic flow control, including for loops and conditionals.

Course code	Course Title	L	T	P	C
22222SEC26L	Open Source programming Lab	0	0	3	2

OBJECTIVE:

The course aims to introduce open source software concept to students.

Students will study and learn to setup open source account, OSS license, understand Project structure and enhance open source projects.

It will develop skill to make a significant contribution to open source community.

1. Prepare a web page in ASP which displays course submission form using objects.
2. Write a program for addition using VBScript.
3. Write a program for finding maximum number using JavaScript.
4. Develop a web page which display window shrinking using JavaScript
5. Write a program in JavaScript a)OnMouse move b)OnMouse out.
6. Write a Perl script using array find element in list.
7. Write a Perl script for simple manipulation.
8. Develop a PHP program and check message passing mechanism between pages.
9. Develop a PHP program to display student information using MYSQL table.
10. Develop a college application form using MYSQL table.

OUTCOMES:

1. Set up GitHub Account, Use git commands to manage files and support version control.
2. Apply a mix of Client, Server and Database technologies to solve Open Source Software issues/ to enhance projects.
3. Develop Server side programs using python with Database Servers- SQL, MongoDb.

Course code	Course Title	L	T	P	C
22222DSC27A	Discipline Specific Elective – II **GAME PROGRAMMING**	5	0	0	4

OBJECTIVES:

- To get subsequent understanding of game design and development, which includes the processes, mechanics, issues in game design, game engine development, modeling, techniques, handling situations, and logic.
- To create interactive games

UNIT I BASICS FOR GAME PROGRAMMING

Coordinate Systems, Ray Tracing, Modeling in Game Production, Vertex Processing, Rasterization, Fragment Processing and Output Merging, Illumination and Shaders, Parametric Curves and Surfaces, Shader Models, Image Texturing, Bump Mapping, Advanced Texturing, Character Animation, Physics-based Simulation.

UNIT II GAME DESIGN PRINCIPLES & THEORY

Game Logic, Game AI, Path Finding, Game Theory, Character development, Story Telling, Narration, Game Balancing, Core mechanics, Principles of level design, Genres of Games, Collision Detection.

UNIT III GAMING ENGINE REQUIREMENT & DESIGN

Renderers, Software Rendering, Hardware Rendering, and Controller based animation, Spatial Sorting, Level of detail, collision detection, standard objects, and physics.

UNIT IV GAMING PLATFORMS AND FRAMEWORKS

Flash, DirectX, OpenGL, Java, Python, XNA with Visual Studio, Mobile Gaming for the Android, iOS, Game engines - Adventure Game Studio, DX Studio, Unity.

UNIT V GAME DEVELOPMENT ENVIRONMENT

Developing 2D and 3D interactive games using OpenGL, DirectX – Isometric and Tile Based Games, Puzzle games, Single Player games, and Multi Player games.

OUTCOMES:

- Illustrate an understanding of the concepts behind game programming techniques.
- Implement game programming techniques to solve game development tasks.
- Construct a basic game engine using open-source programming libraries.

REFERENCES:

1. Andy Harris, “Beginning Flash Game Programming For Dummies”, For Dummies; Updated Edition, 2225.

2. David H. Eberly, “3D Game Engine Design, Second Edition: A Practical Approach to Real-Time Computer Graphics” Morgan Kaufmann, 2nd Edition, 2226

3. Dino Dini, “Essential 3D Game Programming”, Morgan Kaufmann, 1st Edition, 2212

4. Ernest Adams and Andrew Rollings, “Fundamentals of Game Design”, Prentice Hall 1st Edition,2226

5. Eric Lengyel, “Mathematics for 3D Game Programming and Computer Graphics”, 3rd Edition, Course Technology PTR, 2211

6. Jason Gregory, “Game Engine Architecture”, A K Peters, 2229.

7. JungHyun Han, “3D Graphics for Game Programming”, Chapman and Hall/CRC, 1st Edition, 2211

8. Mike McShaffrfy, “Game Coding Complete”, 3rd Edition, Charles River Media, 2229.

9. Jonathan S. Harbour, “Beginning Game Programming”, Course Technology PTR, 3rd Edition, 2229

10. Jeannie Novak, “Game Development Essentials”, 3rd Edition, Delmar Cengage Learning, 2211.

11. John Hattan, “Beginning Game Programming: A GameDev.net Collection”, Course Technology PTR, 1st Edition, 2229

12. Jim Thompson, Barnaby Berbank-Green, and Nic Cusworth, “Game Design: Principles, Practice, and Techniques - The Ultimate Guide for the Aspiring Game Designer”, 1st Edition, Wiley, 2227.

13. Roger E. Pedersen, “Game Design Foundations”, Edition 2, Jones & Bartlett Learning, 2229.

14. Scott Rogers, “Level Up!: The Guide to Great Video Game Design”, Wiley, 1st Edition, 2210.

Course code	Course Title	L	T	P	C
22222DSC27B	Discipline Specific Elective – II Multimedia and Graphics	5	0	0	4

AIM

To impart the fundamental concepts of Multimedia and Graphics.

OBJECTIVES

- To study the multimedia concepts and various I/O technologies.
- To study the graphics techniques and algorithms.
- To enable the students to develop their creativity

UNIT I

Introduction – Definition- Multimedia Hardware- Multimedia Software- MULTIMEDIA networking- Multimedia Applications- Multimedia Environments- Multimedia Computer Components- Multimedia Standards- Multimedia PC.

UNIT II

Multimedia Software : Basic Tools : Text Editing and Word Processing Tools – OCR Software – Painting and Drawing Tools – 3-D Modeling and Animation Tools – Image-Editing Tools – Sound Editing Tools – Animation, Video, and Digital Movie Tools – Helpful Accessories. Making Instant Multimedia : Linking Multimedia Objects – Office Suites - Word Processors – Spreadsheets – Databases – Presentation Tools – Multimedia Authoring Tools – Types of Authoring Tools – Card and Page-Based Authoring tools – Icon –Based Authoringtools – Time Based Authoring tools- Object – Oriented Authoring tools – Gross platformAuthoring Notes.

UNIT III

Multimedia Building blocks : Text : The Power of Meaning – About fonts and Faces Using Text in Multimedia – Computers and Text – Font Editing and Design Tools – Hypermediaand Hypertext. Sound: The Power of Sound – Multimedia System Sounds – MIDI versus Digital Audio – Making MIDI Audio – Audio File Formats –Working with Sound on the Macintosh – Toward Professional sound – Production Tips. Images: – Making Still Images – Color – Image File formats. Computer Animation - Using Digital Video in Multimedia Applications.

UNIT IV

Computer Graphics and output primitives: Concepts and applications, Random and Raster scan devices, Refresh Cathode ray tubes, LCD monitors, Laser, Printers, Keyboards, Mouse, Scanners, Graphics Software output primitives: Line drawing algorithm: DDA along with Bresenhan's. Circle generating algorithm, Midpoint algorithms: ellipse and other curves.

UNIT V

Two-dimensional Transformations: Translation, scaling, rotation, reflection, shear, matrix representation of all homogeneous coordinates composite transformation. Three dimensional concepts: 3D Display methods- parallel projection, perspective projection, Depth cueing. Three dimensional object representations: Polygon Surface, Tables, Plane Equation.

OUTCOMES:

- Gain proficiency in 3D computer graphics API programming
- Enhance the perspective of modern computer system with modeling, analysis and interpretation of
- 2D and 3D visual information.
- Able to understand different realizations of multimedia tools
- Able to develop interactive animations using multimedia tools
- Gain the knowledge of different media streams in multimedia transmission

REFRENCES:

1. Tay Vaugham, "Multimedia making it work", 4th Edition Tata McGraw – Hill Edition, 2220. (For Unit –I, II, III, Chapters-1,2,3,4).
2. Donald Hearn M. Paulin Baker " Computer Graphics" 1992 , PHI (For Unit –IV &V, Chapters-3, 5, 9).
3. Willam M. Newman , Robert F. Sproull " Principles of Interactive Graphics" 1979 McGraw Hill.

Course code	Course Title	L	T	P	C
22222DSC27C	**MIDDLEWARE TECHNOLOGIES.**	5	0	0	4

AIM :

To understand the design and implementation of a simple compiler.

OBJECTIVES:

The main objective of the course is to create a practical, wide-ranging discussion on Middle ware Technologies to help students understand what is going on so they can pick out the real issues from the imaginary issues and start building complex distributed systems with confidence. Upon completion of this course the students will be able to

- Understand Distributed systems design and implementation
- Understand existing Distributed Technologies
- Use Middle ware to Build Distributed Applications
- Understand Middle ware Interoperability
- Understand Web services architectures Course

UNIT I INTRODUCTION

Emergence of Middle ware – Objects, Web Services – Middleware Elements – Vendor

Architecture – Interoperability – Middleware in Distributed Applications – Types of Middleware – Transaction-Oriented Middleware – MOM – RPC.

UNIT II OBJECT ORIENTED MIDDLEWARE

OOM – Developing with OOM – Heterogeneity – Dynamic Object Request – Java RMI – COM+.

UNIT III COMPONENT OBJECT RESOURCE BROKER ARCHITECTURE (CORBA)

Naming – Trading – Life Cycle – Persistence – Security – CORBA.

UNIT IV WEB SERVICES

Introduction – XML Web Services standards – Creating Web Services – Extending Web Services – Messaging Protocol – Describing – Discovering – Securing.

UNIT V OTHER TYPES OF MIDDLEWARE

Real-time Middleware – RT CORBA – Multimedia Middleware – Reflective Middleware – Agent-Based Middleware – RFID Middleware.

Outcomes:

At the end of the course the student will be able to

- Learn how to use Middleware to Build Distributed Applications
- Implement Business Processes
- Learn about MiddleWare Technologies
- Implement Business Processes
- Learn application design and IT architecture

REFERENCES BOOKS

1. Chris Britton and Peter Eye, "IT Architecture and Middleware", Pearson Education, 2nd Edition, 2224.
2. Wolfgang Emmerich, "Engineering Distributed Objects", John Wiley, 2220.
3. Keith Ballinger, ".NET Web Services – Architecture and Implementation", Pearson Education, 2223. (Unit IV).
4. Qusay H. Mahmoud, "Middleware for Communications", John Wiley and Sons,2224.
5. Gerald Brose, Andreas Vogel, Keith Duddy, "JavaTM Programming with CORBATM: Advanced Techniques for Building Distributed Applications", Wiley, 3rd edition, January, 2224.
6. Michah Lerner, "Middleware Networks: Concept, Design and Deployment of Internet Infrastructure", Kluwer Academic Publishers, 2220.

Course code	Course Title	L	T	P	C
22222DSC27D	**Haskell programming**	5	0	0	4

OBJECTIVE:

It's open source, clear, simple and easy to maintain.

- It's great help for developers to increase their productivity.
- Unlike other programs, with Haskell the semantic gap between the developer and the language is minimal

UNIT 1:

Introduction to Haskell and the ghci interpreter - Defining functions: guards, pattern matching and recursion

UNIT 2:

Lists, strings and tuples - Types and polymorphism

UNIT 3:

Higher order functions on lists: map, filter, list comprehension - Computation as rewriting, lazy evaluation and infinite data structures

UNIT 4:

Conditional poly morp and type
classes User defined data types: lists,

UNIT 5:

nput/output and the ghc - compiler
Arrays

Outcomes:

Students will demonstrate the ability to

1. Reason about the correctness of programs.

2. Think in terms of higher-order functions.

3. Use data encapsulation and parametric polymorphism.

4. Give importance to the 'type checking' of values/functions and therefore develop

programs relatively faster.

REFERENCES BOOKS:

Real World Haskell.

- Learn You a Haskell for Great Good!
- Haskell: The Craft of Functional Programming.
- Beginning Haskell: A Project-Based Approach.
- Thinking Functionally with Haskell.

Course code	Course Title	L	T	P	C
22222DSC27E	**Natural Language Processing**	5	0	0	4

Learning Objectives:

1. Learn to analyse textual data
2. Learn various methods to represent text in vector form
3. Explore various application of NLP like Machine Translation, Text Summarization, Dialog system

UNIT 1: Introduction to NLP

Introduction to NLP - Text pre-processing -Regular Expression, tokenization - Stemming - Minimum Edit distance - N-Gram Language . N-Gram - N-Gram probability estimation and perplexity - Smoothing technique(Laplace/good Turing/Kneser-Ney/Interpolation

UNIT 2: Text Representation

Bag-of-word :Tf/IDF,Count vector - Vector space Model - Latent semantic Analysis -Word embedding - Word2Vec - Glove - fastText - Sentence embedding Technique: Doc2Vec

UNIT 3: Text classification and clustering

The text classification problem - Feature Selection - Naive Bayes text classification k- nearest neighbors - Support vector Machine - Flat Clustering - K-means algorithm - Hierarchical clustering

UNIT 4: MORPHOLOGY AND PART OF SPEECH TAGGING

Morphology - Part of speech Tagging - Rule-Based Part of Speech Tagging Markov Models - Hidden Markov Models - Viterbi algorithms - Maximum Entropy Models. - Sequence Processing with Recurrent Networks - Simple Recurrent Neural Networks - Applications of Recurrent Neural Networks - Deep Networks: Stacked and Bidirectional RNNs - Managing Context in RNNs: LSTMs and GRUs - Words, Subwords and Characters

UNIT 5: Text Parsing

Syntax Parsing - Grammar formalisms and treebanks . - Parsing with Context Free Grammars - Features and Unification - Statistical parsing and probabilistic CFGs (PCFGs) - Semantic Analysis - Lexical semantics and word-sense disambiguation. - Compositional semantics.

Learning Outcome:

- To Understand Document as Vector
- Various Supervised and Unsupervised learning Method
- Basic technique for language processing
- Text analysis
- Machine translation

Text Book:

- D. Jurafsky and J. Martin "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Third Edition draft
- C. Manning and H. Schutze, "Foundations of Statistical Natural Language Processing",MIT Press, 1999

Course code	Course Title	L	T	P	C
22222DSC27F	**Artificial Neural Networks**	5	0	0	4

Objectives:

1. The main objective of Neural Network Techniques to Improve Data Analysis Solutions is to strengthen the dialogue between the statistics and soft computing research communities in order to cross-pollinate both fields and generate mutual improvement activities.
2. Also introduce the neural networks for classification, regression and to give design methodologies for artificial neural networks;

UNIT 1:

Introduction to Artificial Intelligence System: Neural Network, Fuzzy logic, Genetic Algorithm. Fundamentals of Neural Networks: What is Neural Network, Model of Artificial Neuron, Learning rules and various activation functions.

UNIT 2

Neural Network Architecture: Single layer Feed-forward networks. Multilayer Feed-forward networks. Recurrent Networks. Back propagation Networks: Back Propagation networks, Architecture of Back-propagation(BP) Networks, Back-propagation Learning, Variation of Standard Back propagation algorithms.

UNIT 3:

Associative Memory: Autocorrelation, Autocorrelation, Wang et al's Multiple Training Encoding Strategy, Exponential BAM, Associative Memory for Real coded pattern pairs, Applications.

UNIT 4:

Adaptive Resonance Theory: Cluster Structure, Vector Quantization, Classical ART Network, Simplified ART Architecture,ART1 and ART2 Architecture and algorithms, Applications, Sensitivities of ordering of data.

UNIT 5:

Introduction about Fuzzy set theory: Fuzzy versus Crisp, Crisp and fuzzy sets, Crisp and Fuzzy relations.ntegration of Neural Network, Fuzzy logic and Genetic Algorithm: Hybrid system. Neural Networks, Fuzzy logic, and Genetic Algorithm Hybrids.

Learning Outcome:

On successful completion of this course, student will be able to

- Obtain the fundamentals and types of neural networks. The student will have a broad knowledge in developing the different algorithms for neural networks.
- Analyze neural controllers
- Have a broad knowledge in Fuzzy logic principles and will be able to determine different methods of Desertification.

Reference Books:

– Bishop, C. M. Neural Networks for Pattern Recognition. Oxford University Press. 1995.
– Neural Networks,Fuzzy Logic and Genetic Algorithms, by S. Rajasekaran and G.A. Vijayanagar Pai.
– Neuro-Fuzzy Systems, Chin Teng Lin, C. S. George Lee, PHI.
– Build_Neural_Network_With_MS_Excel_sample by Joe choong.

Course code	Course Title	L	T	P	C
22222RMC28	Research Methodology	3	0	0	2

AIM:

To give an exposure to development of research questions and the various statistical methods suitable to address them through available literature, with basic computational operators.

OBJECTIVES:

- To understand the approaches towards and constraints in good research.
- To identify various statistical tools used in research methodology
- To appreciate and compose the manuscript for publication
- To train in MATLAB platform for basic computational programming and analysis.

PREREQUISITIES:

Research methodology course in UG level or equivalent knowledge.

UNIT-I Introduction to research methodology

Objectives of research – type of research – Significance of research. Research methodology – Research and scientific method – Criteria of good research – Problems encountered by research in India.

UNIT-II Data base and Literature Survey

Articles – Thesis – Journals – Patents – Primary sources of journals and patens – Secondary sources – Listing of titles – Abstracts –Chemical Abstract Service – Reviews – Monographs – Literature search.

UNIT-III Data Analysis:

Precision and accuracy – Reliability – Determinate and random errors – Distribution of random errors –normal distribution curve – Statistical treatment of finite samples – T test and F test (ANOVA) co – Variance (ANCOVA) correlation and multiple regression.

UNIT-IV Thesis and paper writing:

Conventions in writing – General format – Page and chapter format – Use of quotations and footnotes – Preparations of tables and figures – Reference and Appendices.

UNIT-V Application on MATLAB:

Numerical Integration – Numerical integration, ordinary differential equations, partial differential equations, and boundary value problems - Fourier analysis – Fourier transforms, convolution.

OUTCOME:

> Ability to develop research questions and the various research strategies and compile research results in terms of journal manual scripts.

References:

1. C.R. Kothari, Research Methodology, New Age International publishers. New Delhi,2224.

2. R.A Day and A.L. Underwood, Quantitative analysis, Prentice Hall, 1999.

3. R. Gopalan, Thesis writing, Vijay Nicole Imprints Private Ltd., 2225.

4. A Guide to MATLAB: For Beginners and experienced Users by Brian R. Hunt (Editor), Ronald L. Lipsman, J. Rosenberg

5. Introduction to MATLAB for Engineers by William J. Palm III.

SEMESTER III

Course code	Course Title	L	T	P	C
22222SEC31	Data mining and warehousing	6	1	0	5

AIM:

To emphasis on the design aspects of Data mining and Data Warehousing.

OBJECTIVES:

- To introduce the concept of Data Mining with in detail coverage of basic tasks metrics issues and implication .Core topics like classification, clustering and association rules are exhaustively dealt with.
- To introduce the concept of Data Warehousing with special emphasis on architecture and design.

UNIT I

Introduction: Data mining-data mining functionalities-clasification-Task Primitives-Data processing: data cleaning-data integration and transformation-data reduction-data discretization and concepts.

UNIT II

Data mining concepts: Efficient and scalable mining methods-various kinds of association rules-from association mining to correlation analysis-constraint based association mining.

UNIT III

Classification and prediction: classification by decision tree-Bayesian classification-classification by backpropagation-prediction. Cluster analysis: types of data in Cluster analysis-partitioning methods –hierarchical methods.

UNIT IV

Data ware house: What is data warehousing-Multidimensional data model-data ware house architecture-Dataware house implementation-From data ware housing to data mining.

UNIT V

Multidimensional analysis: spatial data mining-Multimedia data mining-Text mining-Mining and world wide web-Data mining applications

OUTCOMES:

After completing this course, the student will be able to:

- Apply data mining techniques and methods to large data sets.
- Use data mining tools
- Compare and contrast the various classifiers.

REFERENCES:

1. Data Mining concept & Techniques", Jiaweri Han & Micheline , Morgan kauffman publications –2220.

2. "Data warehouse project mangement" sid Addman &Larissa T.moss, Addison

Course code	Course Title	L	T	P	C
22222SEC32	Grid and Cloud Computing.	6	1	0	4

AIM

To understand the technology application and tool kits for grid computing and to provide a strong foundation in Developing Cloud Services.

OBJECTIVES

- To understand the genecise of grid computing.
- To know the application of grid computing.
- To understanding the technology and tool kits to facilitated the grid computing
- To understand the concept of Cloud Computing.
- To get an idea about Sharing Files

UNIT I

Introduction - Definition - Scope of grid computing

UNIT II

Grid Computing Organizations and their roles – Grid Computing analog – Grid Computing road map

UNIT III

Understanding Cloud Computing: An introduction to Cloud Computing – Computing in the Cloud – Developing Cloud Services.

UNIT IV

Cloud Computing for the Family – Cloud Computing for the Community – Cloud Computing for the Corporation

UNIT V

Collaborating via Web-Based Communication Tools – Collaborating via Social Networks and Groupware – Collaborating Via Blogs and Wikis

OUTCOMES:

At the end of the course, the student should be able to

- Use the grid and cloud tool kits.
- Design and implement applications on the Grid.
- Compare the strengths and limitations of cloud computing
- Identify the architecture, infrastructure and delivery models of cloud computing
- Design Cloud Services and Set a private cloud

REFERENCES:

1. Joshy Joseph & Craig Fellenstein, "Grid Computing", PHI, PTR-2223.

2. Ahmar Abbas, "Grid Computing: A Practical Guide to technology and Applications", Charles River media – 2223.

3. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Pearson, 2229

Course code	Course Title	L	T	P	C
22222SEC33	.NET Programming	5	0	0	4

AIM

To cover the fundamental concepts of the .NET framework.

OBJECTIVES

- To gain knowledge in the concepts of the .NET framework and its technologies.
- To get experience in building sample applications of large-scale projects.

UNIT I

Visual basic.NET and the .NET Framework –The elements of Visual Basic .NET

UNIT II

Visual Basic .NET operators-software Design, conditional structures, and controls Flow-Methods.

UNIT III

Interfacing with the End user-Asp.NET Applications.

UNIT IV

Web Form Fundamentals – Web Controls – Validation and Rich Controls.

UNIT V

ADO.NET Data Access – Data Binding –Data List, DataGrid, and Repeater.

OUTCOMES:

- Create web-based distributed applications using ASP.NET, SQL Server and ADO.NET
- Utilize DirectX libraries in the .NET environment to implement 2D and 3D animations and game-related graphic displays and audio.
- Utilize the .NET environment to create Web Service-based applications and components.

REFERENCES:

1. The Complete Reference VB.NET – Jeffrey R-Shapiro- Tata McGrawHill Edition
2. The Complete Reference ASP.NET- Matthew MacDonald- Tata McGrawHill Edition
3. Visual Basic .Net Programming -Bible.
4. Visual Basic.Net Black Book- Steven Holzner.

Course code	Course Title	L	T	P	C
22222SEC34	Object Oriented System Design	5	0	0	4

AIM

To understand the concepts of object oriented analysis and design.

OBJECTIVES

- To understand the object oriented life cycle.
- To know how to identify objects, relationships, services & attributes through UML.
- To understand the use-case diagrams.
- To know the Object Oriented Design process.
- To know about software quality and usability.

UNIT I

Introduction: an overview of object oriented system development object basics-object oriented system development life cycle.

UNIT II

Methodology, modeling, &unified modeling language: object-oriented methodologies-UML.

UNIT III

Object-oriented analysis: object –oriented analysis process. Identifying use case –object analysis classification identifying object relation, attribute & methods.

UNIT IV

Object oriented designing: the object oriented designing process & design axioms-designing classes – access layer.

UNIT V

View layer –software Quality assurance- system usability & measuring user & satisfaction.

OUTCOMES:

- Understand the basic concepts to identify state & behavior of real world objects
- Able to learn the various object oriented methodologies and choose the appropriate one for solving the problem with the help of various case studies
- Understand the concept of analysis, design & testing to develop a document for the project
- Able to implement analysis, design & testing phases in developing a software project
- Able to understand the testing strategies and know about automated testing tools

REFERENCES:

1.”Object Oriented System and Development” by Alibahrami, mc Graw –hill international edition.

2. “The Unified Modeling Language User Guide”. - Grady Boocu, James Rambaugh and Ivar Jacobson

3. Instant UML – Pierre- Alain Muller- Wrox Press Ltd., Shroff Publishers and Distributors Pvt. Ltd.,

Course code	Course Title	L	T	P	C
22222SEC35L	.NET Programming Lab.	0	0	3	2

OBJECTIVES:

- Provide a consistent, object-oriented programming environment whether object code is stored and executed locally, executed locally but web-distributed, or executed remotely.
- Provide a code-execution environment that:
    - Minimizes software deployment and versioning conflicts.
    - Promotes safe execution of code, including code created by an unknown or semi-trusted third party.

1. Write a program in VB. Net to check whether given number is Odd or Even.
2. Write a program to find maximum from given numbers.
3. Write a program to find are of a circle
4. Design ASP.Net web form using Html Server Controls to enter job seeker's details.
5. Create an ASP.Net web form using Web control to enter E-Mail registration form.
6. Apply appropriate validation techniques in E-Mail registration form using
7. Validation controls.
8. Write an ASP.Net application to retrieve form data and display it the client browser in a table format.
9. Create a web application using ADO.Net that uses which performs basic data Manipulations:

   (i). Insertion (ii) Updating (iii) Deletion (iv) Selection

   Hint: Do operations using Ms-Access and SQL-Server

10. Create an application using Data grid control to access information's from table in SQL server.

Outcomes

Explain the three pillars of object oriented programming.

Write an object oriented program using custom classes.

Build and debug well-formed Web Forms with ASP

Perform form validation with validation controls.

Course code	Course Title	L	T	P	C
22222DSC36A	Discipline Specific Elective – III Information Security	5	0	0	4

AIM

To study the critical need for ensuring Information Security in Organizations

OBJECTIVES

- To understand the basics of Information Security
- To know the legal, ethical and professional issues in Information Security
- To know the aspects of risk management
- To become aware of various standards in this area
- To know the technological aspects of Information Security

UNIT I INTRODUCTION

History, what is Information Security, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC

UNIT II SECURITY INVESTIGATION

Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues

UNIT III SECURITY ANALYSIS

Risk Management : Identifying and Assessing Risk, Assessing and Controlling Risk

UNIT IV LOGICAL DESIGN

Blueprint for Security, Information Security Poicy, Standards and Practices, ISO 17799 / BS 7799, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity

UNIT V PHYSICAL DESIGN

Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access Control

Devices, Physical Security, Security and Personnel

OUTCOMES:

1 define what information is

2 appreciate the value of information to the modern organisation

3 understand the CIA triad of Confidentiality, Integrity and Availability

REFERENCES

1. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Vikas Publishing House, New Delhi, 2223

2. Micki Krause, Harold F. Tipton, " Handbook of Information Security Management",Vol 1-3 CRC Press LLC, 2224.

3. Stuart Mc Clure, Joel Scrambray, George Kurtz, "Hacking Exposed", Tata McGraw-Hill, 2223

4. Matt Bishop, " Computer Security Art and Science", Pearson/PHI, 2222.

Course code	Course Title	L	T	P	C
22222DSC36B	Discipline Specific Elective – III **Internet of Things**	5	0	0	4

OBJECTIVES:

- To understand the fundamentals of Internet of Things
- To learn about the basics of IOT protocols
- To build a small low cost embedded system using Raspberry Pi.
- To apply the concept of Internet of Things in the real world scenario

UNIT I INTRODUCTION TO IoT

Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology.

UNIT II IoT ARCHITECTURE

M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT referencearchitecture

UNIT III IoT PROTOCOLS

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus– Zigbee Architecture – Network layer – 6LowPAN - CoAP - Security

UNIT IV BUILDING IoT WITH RASPBERRY PI & ARDUINO

Building IOT with RASPERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi – Raspberry Pi Interfaces -Programming Raspberry Pi with Python - Other IoT Platforms - Arduino.

UNIT V CASE STUDIES AND REAL-WORLD APPLICATIONS

Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT – Software & Management Tools for IoT Cloud Storage Models & Communication APIs - Cloud for IoT - Amazon Web Services for IoT.

OUTCOMES:

- Upon completion of the course, the student should be able to:
- Analyze various protocols for IoT
- Develop web services to access/control IoT devices.
- Design a portable IoT using Rasperry Pi
- Deploy an IoT application and connect to the cloud.
- AnaLyze applications of IoT in real time scenario

REFERENCES:

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2215

2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2211.

3. Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2214.

4. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press, 2212.

5. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2212

Course code	Course Title	L	T	P	C
22222DSC36C	Discipline Specific Elective – III **M-Marketing**	5	0	0	4

OBJECTIVES

- Understand Mobile Business strategies.
- To understand Mobile marketing tools and techniques.
- To know Mobile technologies.

UNIT I Introduction

Mobile Marketing Campaign, Fortune 500 and Mobile Marketing, consumers engagement with mobile, Terminologies.

UNIT II Businesses Vs mobile marketing

classic mistakes in mobile marketing, laying foundation for successful mobile marketing campaign, understanding technology behind mobile marketing – Android, iOS, Windows Phone.

UNIT III

Strategic thinking about Mobile marketing campaign, Mobile Marketing Tools – setting up mobile website for different firms, using SMS, MMS and apps to drive customers to business and other ways to attract customers.

UNIT IV Location Based Marketing

LBS, NFC, Bluetooth and LBA, 2D codes, Tablet, Other Mobile Applications, Business Firms connecting to customers using Mobile – case study, Mobile Marketing for B2B companies, Mobile E-commerce to Drive Revenue.

UNIT V Mobile Payments

Present and Future Mobile Technology, Mobile Application Development.

OUTCOMES

- Upon Completion of the course, the students should be able to:
- Analyze various mobile marketing strategies.
- Market Mobile based Applications.
- Apply various tools in mobile marketing.

REFERENCE BOOKS:

1. Go Mobile: Location Based Marketing, Apps, Mobile Optimized Ad Campaigns, 2D codes and other Mobile Strategies to Grow your Business, Jeanne Hopkins, Jamie Turner, John Wiley&Sons Inc., 2212.

2. M- Commerce, Paul Skeldon, Crimson Publishing, 2212.

3. M-Commerce Technologies, Services and Business Models, Norman Sadeh , Wiley 2222.

4. Mobile Commerce, Opportunities, Applications and Technologies of Wireless Business, Paul Mary, Tom Jell, Cambridge University Press, 2221.

Course code	Course Title	L	T	P	C
22222DSC36D	**Software Forensics**	5	0	0	4

Course Objective:

1. To correctly define and cite appropriate instances for the application of computer forensics Correctlycollect and analyze computer forensic evidence
2. Identify the essential and up-to-date concepts, algorithms, protocols, tools, and methodology ofComputer Forensics

UNIT 1: Cyber Crime and computer crime

Introduction to Digital Forensics, Definition and types of Cybercrime, electronic evidence and handling, electronic media, collection, searching and storage of electronic media, introduction to internet crimes, hacking and cracking, credit card and ATM frauds, web technology, cryptography, emerging digital crimes and modules.

UNIT 2: Basics of Computer

Computer organization, components of computer- input and output devices, CPU, Memory hierarchy, types of memory, storage devices, system software, application software, basics of computer languages.

UNIT 3: Computer Forensics

Definition and Cardinal Rules, Data Acquisition and Authentication Process, Windows Systems-FAT12, FAT16, FAT32 and NTFS, UNIX file Systems, mac file systems, computer artifacts, Internet Artifacts, OS Artifacts and their forensic applications

UNIT 4: Forensic Tools and Processing of Electronic Evidence

Introduction to Forensic Tools, Usage of Slack space, tools for Disk Imaging, Data Recovery, Vulnerability Assessment Tools, Encase and FTK tools, Anti Forensics and probable counters, retrieving information,

UNIT 5:

process of computer forensics and digital investigations, processing of digital evidence, digital images, damaged SIM and data recovery, multimedia evidence, retrieving deleted data: desktops, laptops and mobiles, retrieving data from slack space, renamed file, ghosting, compressed files.

OUTCOMES:

conduct digital investigations that conform to accepted professional standards and are based on the investigative process: identification, preservation, examination, analysis, and reporting;

- cite and adhere to the highest professional and ethical standards of conduct, including impartiality and the protection of personal privacy;
- identify and document potential security breaches of computer data that suggest violations of legal, ethical, moral, policy, and/or societal standards;

Text & References:

1. C. Altheide& H. Carvey Digital Forensics with Open Source Tools, Syngress, 2011. ISBN:9781597495868.
2. Selected readings from various sources as assigned
3. Online Course management System: https://esu.desire2learn.com/

Course code	Course Title	L	T	P	C
22222DSC36E	**Information System Management**	5	0	0	4

UNIT – I

Information Technology: Need for information technology; information technology firms;what they are and how they do things; Opportunities the IT industries offer.

UNIT – II

Information Systems: Concepts and overview of information systems; A systematic framework for information systems; Components of information systems; information systems design, analysis and management

UNIT – III

Database Management Systems for information Systems: Data resources, structure and functional aspects.

UNIT – IV

Graphic database, data storage and hypermedia; Data design issues and output designs.

UNIT – V

Internet and systems [SIS] for Sustainable Development: concepts and theory of SIS, Role of Sis for Sustainable Development, Sustainable Development Planning and Decision making based on SIS.

OUTCOMES:

LO1. Understand the leadership role of Management Information Systems in achieving business competitive advantage through informed decision making.

LO2. Analyze and synthesize business information and systems to facilitate evaluation of strategic alternatives.

Text Books

1. HiltyL.M.Seifert E., Treibert R[2004] information Systems for sustainable Development, Idea Group Publishing, Hershey, PA, USA

2. O'Brien, J.A.1999: Management Information Systems, New York: Irwin – McgrawHill.

References:-

1. http://www.umich.edu/~linet/chinadata/geoim99/Proceedings/Chen Xiuwan.PD.

2. www. Gisdevelopment.net/policy/gii/gii0022b.htm.

Course code	Course Title	L	T	P	C
22222DSC36F	**Social Media Mining**	5	0	0	4

Unit I: DATA MINING FOUNDATIONS

Introduction – Data mining functionalities – Classification of Data mining systems – Preprocessing – Association Rules and Sequential Patterns – Supervised Learning – Unsupervised Learning -Partially Supervised Learning – Association Rule Mining – Classification – Clustering.

Unit II: ANALYZING THE SOCIAL WEB

Introduction – Nodes, Edges, and Network Measures – Network Structure and Measures – Network Visualization.

Unit III

Social Information Filtering – Social Media in the Public Sector- Privacy.

Unit **IV:**

Community Analysis – Detection – Evolution – Evaluation – Information Diffusion in social media -Herd behavior – Information Cascades – Diffusion of Innovations – Epidemics.

Unit V: APPLICATIONS

Influence and Homophile – Recommendation in Social Media – Classical Recommendation Algorithms – Recommendation using Social Context – Evaluating Recommendations – Behavior Analytics- Individual and Collective Behavior.

Course Outcomes:

1. Students will study to collect user-generated information from social media platforms.
2. Extract valuable data from consumers for identifying patterns and trends
3. Perform social media monitoring and arrive business conclusions for application.
4. Detection of spammers and bots in social media platform.
5. Exploring the research perspective of social media data.

Text Books:

– Reza Zafarani, Mohammad Ali Abbasi and Huan Liu, “Social Media Mining – An Introduction”, Cambridge University Press, 2014.

– Matthew A.Russell, “Mining the social web”, 2nd edition- O’Reilly Media, 2013.

– Jennifer Golbeck, Analyzing the social web, Morgan Kaufmann, 2013.

– Social Media Data Mining and Analytics Paperback ,by Gabor Szabo , GungorPolatkan , P. Oscar Boykin , AntoniosChalkiopoulos ,Wiely Publisher 2018

– Advanced Data Mining Tools and Methods for Social Computing ,Sourav De, SandipDey, Siddhartha Bhattacharyya, Surbhi Bhatia,Elsiever,2022.

SEMESTER IV

Course code	Course Title	L	T	P	C
22222SEC41	Human Computer Interaction.	6	0	0	4

AIM:

To have a thorough knowledge about Human Computer Interaction.

OBJECTIVES

- To understand the concept of HCI Ergonomics and WIMP interface.
- To learn about Heuristic process and Evaluation techniques.

UNIT I

The interaction: Introduction - Models of interaction - Frameworks and HCI - Ergonomics - Interaction Styles - Elements of WIMP interface - Interactivity - The Contex of theinteraction - Paradigm: Introduction - Paradigms for interaction.

UNIT II

Interaction Design basics: Introduction - what is design? - User focus - Scenarios - Navigation design - Screen design and layout - Interaction and prototyping - HCI in the software process: Introduction - The software lifecycle - Usability engineering – interactive design and prototyping – Design rationale.

UNIT III

Design rules: Introduction - Principles to support usability - Standards – Guidelines- Golden rules and heuristics - HCI patterns - Implementation Support: Introduction -elements of windowing systems - Programming the application - Using toolkits- User interface management systems.

UNIT IV

Evaluation techniques: What is evaluation - Goals of evaluation - Evaluation through expert analysis - Evaluation through user participation - Choosing an evaluation method - Universal Design: Introduction - Universal design principles - Multi-modal interaction - Designing for diversity.

UNIT V

User Support: Instruction - Requirements of user support - Approaches to user support - Adaptive help system - Designing user support systems.

OUTCOMES:

Upon completion of the course, the student should be able to:

- Design effective dialog for HCI.
- Design effective HCI for individuals and persons with disabilities.
- Assess the importance of user feedback.
- Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Websites.

REFERENCES:

1. "**Human-computer Interaction**" - Alan Dix - Pearson Education - 2224.

Course code	Course Title	L	T	P	C
22222SEC42	Software Project Management	6	0	0	4

UNIT I INTRODUCTION TO PROJECT MANAGEMENT

Project Definition – Contract Management – Activities Covered By Software Project Management – Overview Of Project Planning – Stepwise Project Planning.

UNIT II PROJECT EVALUATION

Strategic Assessment – Technical Assessment – Cost Benefit Analysis – Cash Flow Forecasting – Cost Benefit Evaluation Techniques – Risk Evaluation.

UNIT III ACTIVITY PLANNING

Objectives – Project Schedule – Sequencing And Scheduling Activities – Network Planning Models – Forward Pass – Backward Pass – Activity Float – Shortening Project Duration – Activity On Arrow Networks – Risk Management – Nature Of Risk – Types Of Risk – Managing Risk – Hazard Identification – Hazard Analysis – Risk Planning And Control.

UNIT IV MONITORING AND CONTROL

Creating Framework – Collecting The Data – Visualizing Progress – Cost Monitoring – Earned Value – Prioritizing Monitoring – Getting Project Back To Target – Change Control – Managing Contracts – Introduction – Types Of Contract – Stages In Contract Placement – Typical Terms Of A Contract – Contract Management – Acceptance.

UNIT V MANAGING PEOPLE AND ORGANIZING TEAMS

Introduction – Understanding Behavior – Organizational Behaviour: A Background – Selecting The Right Person For The Job – Instruction In The Best Methods – Motivation – The Oldman–Hackman Job Characteristics Model – Working In Groups – Becoming A Team – Decision Making – Leadership – Organizational Structures – Stress – Health And Safety – Case Studies.

Outcomes:

Identify the different project contexts and suggest an appropriate management strategy.

Practice the role of professional ethics insuccessful software development. Identify and describe the key phases of project management.

Determine an appropriate project management approach through an evaluation of the business context and scope of the project.

REFERENCES:

1. Bob Hughes and MikeCotterell “Software Project Management”, Third Edition, TATA McGraw Hill Edition 2224.
2. Ramesh, Gopalaswamy: "Managing Global Projects ", Tata McGraw Hill, 2221.
3. Royce.” Software Project Theory”, Pearson Education, 1999.
4. P.Jalote “Software Project Management In Practice”, Pearson Education, 2220.

Course code	Course Title	L	T	P	C
22222SEC43	Big Data	6	0	0	5

OBJECTIVES:

- To explore the fundamental concepts of big data analytics
- To learn to analyze the big data using intelligent techniques.
- To understand the various search methods and visualization techniques.
- To learn to use various techniques for mining data stream.
- To understand the applications using Map Reduce Concepts.

UNIT I INTRODUCTION TO BIG DATA

Introduction to BigData Platform – Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error.

UNIT II MINING DATA STREAMS

Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.

UNIT III HADOOP

History of Hadoop- The Hadoop Distributed File System – Components of Hadoop- Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFSBasics-Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features

UNIT IV HADOOP ENVIRONMENT

Setting up a Hadoop Cluster - Cluster specification - Cluster Setup and Installation - Hadoop Configuration-Security in Hadoop - Administering Hadoop – HDFS - Monitoring-Maintenance-Hadoop benchmarks- Hadoop in the cloud

UNIT V FRAMEWORKS

Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and ZooKeeper - IBM InfoSphere BigInsights and Streams. Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications

OUTCOMES:

- The students will be able to:
- Work with big data platform
- Analyze the big data analytic techniques for useful business applications.
- Design efficient algorithms for mining the data from large volumes.
- Analyze the HADOOP and Map Reduce technologies associated with big data analytics
- Explore on Big Data applications Using Pig and Hive
- Understand the fundamentals of various bigdata analysiss techniques

REFERENCES

1. Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2227.

2. Tom White “ Hadoop: The Definitive Guide” Third Edition, O’reilly Media, 2212.

3. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGrawHill Publishing, 2212

4. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2212.

5. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2212.

6. Glenn J. Myatt, “Making Sense of Data”, John Wiley & Sons, 2227

7. Pete Warden, “Big Data Glossary”, O’Reilly, 2211.

8. Jiawei Han, Micheline Kamber “Data Mining Concepts and Techniques”, Second Edition, Elsevier, Reprinted 2228.

9. Da Ruan,Guoquing Chen, Etienne E.Kerre, Geert Wets, Intelligent Data Mining, Springer,2227

10. Paul Zikopoulos ,Dirk deRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corrigan , Harness the Power of Big Data The IBM Big Data Platform, Tata McGraw Hill Publications, 2212

11. Michael Minelli (Author), Michele Chambers (Author), Ambiga Dhiraj (Author) , Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses,Wiley Publications,2213

12. Zikopoulos, Paul, Chris Eaton, Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, Tata McGraw Hill Publications, 2211

Course code	Course Title	L	T	P	C
22222DSC44A	**Design and Analysis of Algorithm**	6	0	0	4

Course Objectives

Upon completion of this course, students will be able to do the following:

- Analyze the asymptotic performance of algorithms.
- Write rigorous correctness proofs for algorithms.
- Demonstrate a familiarity with major algorithms and data structures.
- Apply important algorithmic design paradigms and methods of analysis.
- Synthesize efficient algorithms in common engineering design situations.

UNIT I INTRODUCTION

Notion of an Algorithm — Fundamentals of Algorithmic Problem Solving — Important Problem Types — Fundamentals of the Analysis of Algorithmic Efficiency –Asymptotic Notations and their properties. Analysis Framework — Empirical analysis — Mathematical analysis for Recursive and Non-recursive algorithms — Visualization

UNIT II BRUTE FORCE AND DIVIDE-AND-CONQUER

Brute Force — Computing an — String Matching — Closest-Pair and Convex-Hull Problems — Exhaustive Search — Travelling Salesman Problem — Knapsack Problem — Assignment problem. Divide and Conquer Methodology — Binary Search — Merge sort — Quick sort — Heap Sort — Multiplication of Large Integers — Closest-Pair and Convex — Hull Problems.

UNIT III DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE

Dynamic programming — Principle of optimality — Coin changing problem, Computing a Binomial Coefficient — Floyd?s algorithm — Multi stage graph — Optimal Binary Search Trees — Knapsack Problem and Memory functions. Greedy Technique — Container loading problem — Prim?s algorithm and Kruskal?s Algorithm — 0/1 Knapsack problem, Optimal Merge pattern — Huffman Trees.

UNIT IV ITERATIVE IMPROVEMENT

The Simplex Method — The Maximum-Flow Problem — Maximum Matching in Bipartite Graphs, Stable marriage Problem.

UNIT V COPING WITH THE LIMITATIONS OF ALGORITHM POWER

Lower — Bound Arguments — P, NP NP- Complete and NP Hard Problems. Backtracking — n-Queen problem — Hamiltonian Circuit Problem — Subset Sum Problem. Branch and Bound — LIFO Search and FIFO search — Assignment problem — Knapsack Problem — Travelling Salesman Problem — Approximation Algorithms for NP-Hard Problems
— Travelling Salesman problem — Knapsack problem.

Course Outcomes

Students who complete the course will have demonstrated the ability to do the following:

- Argue the correctness of algorithms using inductive proofs and invariants.
- Analyze worst-case running times of algorithms using asymptotic analysis.
- Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize divide-and-conquer algorithms. Derive and solve recurrences describing the performance of divide-and-conquer algorithms.
- Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize dynamic-programming algorithms, and analyze them.

REFERENCE BOOKS:

1. 1. Introduction to Algorithms, by Thomas H. Cormen ▭

- 2. 2. Computer Algorithms, by Horowitz and Sahni

Course code	Course Title	L	T	P	C
22222DSC44B	**Computer Ethics**	6	0	0	4

Unit – 1 Introduction and overview

Development of computer system- Social impacts of the development.

Unit – 2 Computer ethics

Definition of computer ethics and its relationship with other ethics, e.g., cyber ethics and professional ethics-Why we study computer ethics.

Unit - 3 Ethical analysis

Definition of ethical analysis-Examples of ethical theories-Applying ethical analysis in practice.

Unit - 4

Impact of computer technology on freedom of expression

Controlling access to information on the cyber world-Anonymity on the cyber world.

Unit – 5 Privacy in the Internet age

Privacy definition-Perspectives on privacy-Online privacy concerns.

OUTCOMES:

- Respect the integrity of the computing systems.
- Always identify the user accurately.
- Respect copyrights and licenses.
- Respect the intellectual property of others.

REFERENCE:

Aycock J, Somayaji A and Sullins J The ethics of coexistence Proceedings of the IEEE 2014 International Symposium on Ethics in Engineering, Science, and Technology, (1-4)

Rutherfoord R and Rutherfoord J Privacy and ethical concerns in internet security Proceedings of the 2010 ACM conference on Information technology education, (131-134)

Course code	Course Title	L	T	P	C
22222DSC44C	**Web Mining**	6	0	0	4

Course Objective:

The objective of this course is to introduce basic concepts, tasks, methods, and techniques in data mining. The emphasis is on various data mining problems and their solutions with application on the web. Students will develop an understanding of the data mining process and issues, learn various techniques for data mining, and apply the techniques in solving data mining problems using data mining tools and systems. The course will also introduce major web mining techniques and develop knowledge and skills to discover useful information from data effectively. More specifically, web usage mining techniques for Web site management, user profiling, and personalization, as well as Web content and structure mining techniques, such as Web information retrieval and link analysis, aiming at supporting search engines will be explained and discussed.

UNIT :1

Introduction. What is Data Mining, What kind of data can be mined, What kind of patterns can be mined. Data Preprocessing. Descriptive Data characterization, Data cleaning, Data integration and transformation, Data Reduction.

UNIT : 2

Classification: Basic Concepts, Decision Trees, and Model Evaluation, General Approach to Solving a Classification Problem, Decision Tree Induction, Model Over fitting, Evaluating the Performance of a Classifier Classification: Alternative Techniques: Rule-Based Classifier, Nearest-Neighbor Classifiers, Bayesian Classifiers, Artificial Neural Network (ANN), Support Vector Machine (SVM), Ensemble Methods, Class Imbalance Problem Cluster Analysis: Basic Concepts and Algorithms: Overview, K-means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation .

UNIT :3

Cluster Analysis: Additional Issues and Algorithms: Characteristics of Data, Clusters, and Clustering Algorithms, Prototype-Based Clustering, Density-Based Clustering, Graph Based Cluster in, Scalable Clustering Algorithms .

UNIT :4

Association Analysis: Basic Concepts and Algorithms: Problem Definition, Frequent Item set Generation, Rule Generation, Compact Representation of Frequent Item sets, Alternative Methods for Generating Frequent Item sets, FP-Growth Algorithm, Evaluation of Association Patterns Information Retrieval and Web Search: Basic Concepts of Information Retrieval, Information Retrieval Models: Boolean, Vector Space, Statistical Language Model. Evaluation Measures, Text and Web Page Pre-Processing, Inverted Index and Its Compression, Latent Semantic Indexing, Web Search, Meta-Search, Web Spamming.

Unit :5

Social Network Analysis, Co-Citation and Bibliographic Coupling, Page Rank, HITS Algorithm. Web Crawling: A Basic Crawler Algorithm, Breadth-First Crawlers, Preferential Crawlers, Universal, topical Crawlers.

OUTCOMES:

WEB MINING tasks like data characterization and classification, **statistical models of target classes can be built**. In other words, such statistical models can be the outcome of a data mining task. Alternatively, data mining tasks can be built on top of statistical models.

Recommended or required reading:

Introduction to Data Mining: International Edition PangNing Tan, Michael Steinbach, Vipin Kumar, Pearson, 2005.

Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data, Bing Liu, Springer, 2011

Mining of Massive Datasets, Anand Rajaraman and Jeffrey Ullman, Cambridge University Press, 2011.

Han, J. and Kamber, M., Data Mining: Concepts and Techniques, 2nd Edition, Morgan Kaufmann, 2001

Course code	Course Title	L	T	P	C
22222DSC44D	**Sensor Networks**	6	0	0	4

UNIT – I:

OVERVIEW OF WIRELESS SENSOR NETWORKS Single Node Architecture Hardware Components Network Characteristics unique constraints and challenges, Enabling Technologies for Wireless Sensor Networks Types of wireless sensor networks.

UNIT – II:

ARCHITECTURES - Network Architecture Sensor NetworksScenarios Design Principle, Physical Layer and Transceiver Design Considerations, Optimization Goals and Figures of Merit, Gateway Concepts, Operating Systems and Execution Environments introduction to Tiny OS and nesC Internet to WSN Communication.

UNIT – III:

NETWORKING SENSORS - MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts – SMAC, BMAC Protocol, IEEE 802.15.4 standard and ZigBee, the Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols EnergyEfficient Routing, Geographic Routing.

UNIT – IV:

INFRASTRUCTURE ESTABLISHMENT - Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

UNIT – V:

SENSOR NETWORK PLATFORMS AND TOOLS [9 Hours] Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node level software platforms, Node level Simulators, State centric programming.

OUTCOMES:

1 Describe the overview of wireless sensor networks and enabling technologies for

wireless sensor networks

2. Apply the design principles of WSN architectures and operating systems for

simulating environment situations.

ESSENTIAL READING BOOKS :

1. Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", John Wiley, 2005.

2. Feng Zhao & Leonidas J.Guibas, “Wireless Sensor Networks An Information Processing Approach", Elsevier, 2007.

3. Waltenegus Dargie , Christian Poellabauer, “Fundamentals of Wireless Sensor Networks Theory and Practice”, John Wiley & Sons Publications, 2011

RECOMMONDED READING BOOKS :

1. Kazem Sohraby, Daniel Minoli, & Taieb Znati, “Wireless Sensor NetworksTechnology, Protocols, and Applications”, John Wiley, 2007.

2. Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003

WEB LINKS FOR REFERENCE

https://nptel.ac.in/courses/106/105/106105160/

https://onlinecourses.swayam2.ac.in/arp19_ap52/preview 3. https://cse.iitkgp.ac.in/~smisra/course/wasn.html

Course code	Course Title	L	T	P	C
22222DSC44E	**Graphics and Computer Vision**	6	0	0	4

Unit :1

Basic concepts in Computer Graphics – Types of Graphic Devices – Interactive Graphic inputs – Raster Scan and Random Scan Displays. Line Drawing Algorithm- DDA, Bresenham's algorithm – Circle Generation Algorithms –Mid point circle algorithm, Bresenham's algorithm- Scan Conversion-frame buffers – solid area scan conversion – polygon filling algorithms

Unit :2

FIRST INTERNAL EXAM III Two dimensional transformations. Homogeneous coordinate systems – matrix formulation and concatenation of transformations. Windowing concepts – Window to Viewport Transformation- Two dimensional clipping-Line clipping – Cohen Sutherland, Midpoint Subdivision algorithm .

Unit :3

Polygon clipping-Sutherland Hodgeman algorithm, Weiler Atherton algorithm, Three dimensional object representation Polygon surfaces, Quadric surfaces – Basic 3D transformations .

Unit :4

Projections – Parallel and perspective projections – vanishing points. Visible surface detection methods– Back face removal- Z-Buffer algorithm, A-buffer algorithm, Depth-sorting method, Scan line algorithm.

Unit :5

Image processing – Introduction - Fundamental steps in image processing – digital image representations – relationship between pixels – gray level histogram –spatial convolution and correlation – edge detection – Robert, Prewitt, Sobel.

Outcomes:

1 Identify and interpret appropriate sources of information relating to computer vision.
2 Apply knowledge of computer vision to real life scenarios. Reflect on the relevance of current and future computer vision applications.

REFERENCES:

Computer vision: algorithm and applications by Richard Szeliski. ...

- Practical deep learning for cloud, mobile & edge by Siddha Ganju, Meher Kasam, and Anirudh Koul. ...
- Concise computer vision: an introduction into theory and algorithms by Reinhard Klette.

Course code	Course Title	L	T	P	C
22222DSC44F	**Agile Frameworks**	6	0	0	4

Objectives :

- Multi-objective driven.
- Early, frequent iteration.
- Complete analysis, design, build and test in each step.
- User orientation.
- Systems approach, not merely algorithm orientation.
- Open-ended basic systems architecture.

UNIT1:

Fundamentals of Agile - The Genesis of Agile, Introduction and background, Agile Manifesto and Principles, Overview of Scrum, Extreme Programming, Feature Driven development, Lean Software Development, Agile project management, Design and development practices in Agile projects, Test Driven Development, Continuous Integration, Refactoring, Pair Programming, Simple Design, User Stories, Agile Testing, Agile Tools

UNIT2:

Agile Scrum Framework Introduction to Scrum, Project phases, Agile Estimation, Agile Testing The Agile lifecycle and its impact on testing, Test-Driven Development (TDD), xUnit framework and tools for TDD, Testing user stories - acceptance tests and scenarios, Planning andmanaging testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools to support the Agile tester.

UNIT3:

Agile Testing, The Agile lifecycle and its impact on testing, Test-Driven Development (TDD), xUnit framework and tools for TDD, Testing user stories - acceptance tests and scenarios, Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools to support the Agile tester.

UNIT 4:

Agile Software Design and Development, Agile design practices, Role of design Principles including Single Responsibility Principle, Open Closed Principle, Liskov Substitution Principle, Interface Segregation Principles, Dependency Inversion Principle in Agile Design, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version contr

UNIT 5:
Agile Communication, Differentiate between metrics that should be shared internally vs. externally. , Create a BVIR to communicate project status to the relevant team/stakeholders effectively. , Correctly determine the status of the current in-progress project. , Effectively implement tools to communicate across remote teams. , Build a communication strategy for an internal team and for external parties. , Build trust using Agile techniques between team members to encourage transparency in communication.

OUTCOMES:
1 Increased speed and agility in delivering products or services,
2 improved customer satisfaction, reducing cycle time, improving quality, and reducing waste. and reduced costs.

REFERENCES:

[1] Turk, Daniel, and Robert France. "Assumptions Underlying Agile Software Development Processes." *Journal of Software and Systems Modeling* 17 (2003): 19-25. Print.

[2] Heeager, Lise Tordrup . "INTRODUCING AGILE PRACTICES IN A DOCUMENTATION-DRIVEN SOFTWARE DEVELOPMENT PRACTICE: A CASE STUDY." *Journal of Information Technology Case and Application Research* 14.1 (2012): 3-24. Print.

[3] Abdelshafi, Ibrahim. "Primavera Gets Agile: A Successful Transition to Agile Develo." *IEEE Software* 22.3 (2005): 36-42. Print.

Course code	Course Title	L	T	P	C
22222PRW44	Project work	0	0	15	10

Each student will develop and implement individually developed application software based on any of the latest technologies

Research Integrated Curriculum

The relationship between teacher and learner is completely different in higher education from what it is in school. At the higher level, the teacher is not there for the sake of the student, both have their justification in the service of scholarship. For the students who are the professionals ofthe future, developing the ability to investigate problems, make judgments on the basis of sound evidences, take decisions on a rational basis and understand what they are doing and why is vital. Research and inquiry is not just for those who choose to pursue an academic career. It is central to professional life in the twenty-first century.

It is observed that the modern world is characterized by heightened levels of complexity and uncertainty. Fluidity, fuzziness, instability, fragility, unpredictability, indeterminacy, turbulence, changeability, contestability: these are some of the terms that mark out the world of the twenty-first century. Teaching and research is correlated when they are co-related. Growing out of the research on teaching- research relations, the following framework has been developed and widely adopted to help individual staff, course teams and whole institutions analyse their curricula and consider ways of strengthening students understanding of and through research. Curricula can be:

Research – Led: Learning about current research in the discipline

Here the curriculum focus is to ensure that what students learn clearly reflects current and ongoing research in their discipline. This may include research done by staff teaching them.

Research – Oriented: Developing research skills and techniques

Here the focus is on developing student's knowledge of and ability to carry out the research methodologies and methods appropriate to their discipline(s)

Research – Based: Undertaking research and inquiry

Here the curriculum focus is on ensuring that as much as possible the student learns in research and or inquiry mode (i.e. the students become producers of knowledge not just consumers). The strongest curricula form of this is in those special undergraduate programmes for selected students, but such research and inquiry may also be mainstreamed for all or many students.

Research- Tutored: engaging in research discussions

Here the focus is on students and staff critically discussing ongoing research in the discipline.

All four ways of engaging students with research and inquiry are valid and valuable and curricula can and should contain elements of them.

Moreover, the student participation in research may be classified as,

Level 1: Prescribed Research

Level 2: Bounded Research

Level 3: Scaffolded Research

Level 4: Self actuated Research

Level 5: Open Research

Taking into consideration the above mentioned facts in respect of integrating research into the M.C.A., curriculum, the following Research Skill Based Courses are introduced in the curriculum.

Semester	RSB Courses	Credits
I	Research Led Seminar	1
II	Research Methodology	2
II	Participation in Bounded Research	2
III	Design Project/ Socio Technical Project (Scaffolded Research)	2
IV	Project Work	10

Blueprint for assessment of student's performance in Research Led Seminar Course

- **Internal Assessment:** **40 Marks**
  - Seminar Report (UG)/Concept Note(PG) : 5 X 4= 22 Marks
  - Seminar Review Presentation : 10 Marks
  - Literature Survey : 10 Marks
- **Semester Examination :** **60Marks**

(Essay type Questions set by the concerned resource persons)

Blueprint for assessment of student's performance in Socio Technical Project

- **Continuous Internal Assessment through Reviews:** **40 Marks**
  - Review I : 10 Marks
  - Review II : 10 Marks
  - Review III : 22 Marks

- **Evaluation of Socio Technical Practicum Final Report:** **40 Marks**
- **Viva- Voce Examination:** **22 Marks**
- **Total:** **100 Marks**

Blueprint for assessment of student's performance in Research Methodology Courses

Continuous Internal Assessment: **22 Marks**

- Research Tools(Lab) : 10 Marks
- Tutorial: 10 Marks

Model Paper Writing: **40 Marks**

- Abstract: 5 Marks
- Introduction: 10 Marks
- Discussion: 10 Marks
- Review of Literature: 5 Marks
- Presentation: 10 Marks

Semester Examination: **40 Marks**

Total: **100 Marks**

PRIST DEEMED TO BE UNIVERSITY
NAAC ACCREDITED
THANJAVUR – 613 403 - TAMILNADU

SCHOOL OF ARTS & SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

M.Sc., (Computer Science)

REGULATION 2022 – COURSE STRUCTURE

Graduate Attributes :

- Information Literacy
- Problem Analysis
- Design/development of solutions
- Modern tool usage
- Professional and Ethical understanding
-

Program Objectives (Po):

- **PO1:** To apply and continuously acquire knowledge, both theoretical and applied, related to core areas of computer science.
- **PO2 :**To demonstrate the ability to work effectively as a team member and/or leader in an ever-changing professional environment.
- **PO3 :**To work productively as computer professionals (in traditional careers, graduate school, or academia) by: demonstrating effective use of oral and written communication, working competently as a member of a team unit, adhering to ethical standards in the profession. **Program Outcomes (POs)**
- **PO1:**To communicate computer science concepts, designs, and solutions effectively and professionally;
- **PO2:**To apply knowledge of computing to produce effective designs and solutions for specific problems;
- **PO3:** Toidentify, analyse, and synthesize scholarly literature relating to the field of computer science;
- **PO4:**To use software development tools, software systems, and modern computing platforms.
- **PO5:**To an understanding of professional, ethical, legal, security and social issues and responsibilities

- **PO6:**To do capable of evaluating personal and professional choices in terms of codes of ethics and ethical theories and understanding the impact of their decisions on themselves, their professions, and on society

- **PO7:** To apply design and development principles in the construction of software systems of varying complexity. **Program Specific Outcomes (PSO)**

- **PSO1:** Demonstrate understanding of the principles and working of the hardware and software aspects of computer systems.

- **PSO2:**Understanding the structure and development methodologies of software systems. Possess professional skills and knowledge of software design process. Familiarity and practical competence with a broad range of programming language and open source platforms.

- **PSO3:**Acquainted with the contemporary issues, latest trends in technological development and thereby innovate new ideas and solutions to existing problems.

Course Outcomes:

CO1 -J2EE programming:

- Understand the format and use of objects.
- Understand basic input/output methods and their use.
- Understand object inheritance and its use.
- Understand development of JAVA applets vs. JAVA applications.
- Understand the use of various system libraries.
-

CO2 -Relational Data Base Management System:

- Identify what students will know and be able to do if they master the material.
- Understand the basic concepts of the database and data models.
- Design a database using ER diagrams and map ER into Relations and normalize the reltions.
- Acquire the knowledge of query evaluation to monitor the performance of the DBMS.
- Develop a simple database applications using normalization.

CO3 -Discrete Mathematics:

- The common 2-year sequence works well for many disciplines.
- Topics can be introduced ""just-in-time"" for many disciplines.
- Since all students take the same sequence, advising is relatively easy
- Ability study of **mathematical structures** that are countable or otherwise distinct and separable.
- Examples of **structures** that are **discrete** are combinations, graphs, and logical statements. **Discrete structures** can be finite or infinite.

CO4 -J2EE programming Lab:

- ThestudentsabletoDesign and develop GUI applications using Abstract Windowing Toolkit (AWT)
- Swing and Event Handling
- Web applications and Designing

- Enterprise based applications for business logic In depth manual testing teaching with case studies.
- Programmer training by creating standardized, reusable modular components and by enabling the tier to handle many aspects of programming automatically.

CO5 :RDBMS Lab:

- The students able to Design and develop Normalize a database
- Can Declare and enforce integrity constraints on a database using a state-of-the-art.\
- Programming PL/SQL including stored Procedures.
- Can Design GUI applications
- Sharing of data and data integrity.
- Reducing Data Redundancy. **Discipline Specific Elective I:**

CO6 : a) WAP & XML:

- To Identify advance concepts of **WAP browser** for mobile devices such as mobile phones that uses the mobile protocol.
- **XML/WML** is used to design wap pages for mobile devices.
- To develop a animated GIF, Java AWT, Frames, ActiveX Controls, Shockwave, movie clips, audio.
- To Designed for large bandwidth (compared to wireless access) and low delay

CO7: b) Computer Architecture:

- Analyze processor Performance improvement using instruction level parallelism.
- Learn the function of each element of a memory hierarchy.
- Study various data transfer techniques in digital computer.
- Articulate design issues in the development of processor or other components that satisfy design requirements and objectives.
- Learn microprocessor architecture and study assembly language programming

CO8: Research Led Seminar:

- It is clear that the lowest value the students place on the link between *research* and teaching is that research led teaching .
- Helps develop skills in data collection and complex analysis.
- This in turn being connected with technical, procedural and theoretical learning *outcomes* at the required level.
- Promoting the values of enquiry and deep approaches to learning.
- The motivation and development of students as a consequence of exposure to expert subject matter.

CO9 : Python Programming:

- Presence of Third Party Modules.
- Extensive Support Libraries.
- Open Source and Community Development
- Able to determine the methods to create and manipulate **Python** programs.
- Can Identify the commonly used operations involving file systems and regular expressions
-

CO10: Cryptography & Network Security:

- Develop basic skills of secure **network** architecture and explain the theory behind the **security** of different **cryptographic** algorithms.
- Describe common**network** vulnerabilities and attacks, defence mechanisms against **network** attacks, and **cryptographic** protection mechanisms.
- Compare various Cryptographic Techniques
- Design Secure applications
- Inject secure coding in the developed applications **CO11 :Software Engineering:**
- Graduates of the *program* are expected to demonstrate the problem
- An ability to identify, formulate, and solve complex *engineering* problems by applying principles of *engineering*, science, and mathematics.
- To Explain methods of capturing, specifying, visualizing and analyzing software requirements.
- To understand concepts and principles of software design and usercentric approach and principles of effective user interfaces.
- To Understand the nature of software life cycle.

CO12 Python Programming Lab:

- Able to determine the methods to create and manipulate Python programs.
- By utilizing the data structures like lists, dictionaries, tupelos and sets.
- Identify the commonly used operations involving file systems and regular expressions
- Duck typing and huge standard library
- Presence of third-party modules.
- Extensive support libraries(NumPy for numerical calculations, Pandas for data analytics etc).

CO13 UNIX Lab:

- To introduce Basic Unix general purpose Commands To learn network Unix commands.
- To learn C programming in Unix editor environment.
- To learn shell script and sed concepts.
- To learn file management and permission advance commands.
- To learn awk, grap, perl scripts.

Discipline Specific Elective II:

CO14 a)Operating Ststem:

- To understand the main components of an OS & their functions.
- To study the process management and scheduling.
- To understand various issues in Inter Process Communication (IPC) and the role of OS in IPC.
- To Understand the concepts and implementation Memory management policies and virtual memory.
- To understand the working of an OS as a resource manager, file system manager, process manager, memory manager and I/O manager and methods used to implement the different parts of OS.

CO15 b)Artificial Intelligence:

- To impart basic proficiency in representing difficult real life problems in a state space representation so as to solve them using AI techniques like searching and game playing
- To introduce advanced topics of AI such as planning, Bayes networks,
- Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.
- Develop intelligent algorithms for constraint satisfaction problems and also design intelligent systems for Game Playing
- Attain the capability to represent various real life problem domains using logic based techniques and use this to perform inference or planning.
- Formulate and solve problems with uncertain information using Bayesian approaches.

CO16: Research Methodology:

- These students able todemonstrate knowledge of **research** processes (reading, evaluating, and developing)
- Can identify, explain, compare, and prepare the key elements of a **research** proposal/report.
- To compare and contrast quantitative and qualitative **research** paradigms
- Ability to develop research questions and the various research strategies
- Compile research results in terms of journal manual scripts

CO17 Participation in Bounded Research:

- To understand the general definition of research design.
- To be able to identify the overall process of designing a research study from its inspecti on to its report.
- Familiar with how to write a good introduction to an education , research study and the components that comprise such an introduction.
- To kmow the type of descriptive statistics ty[ically reported in educational research studies.
- Able to identify a research problem stated in astudy.

CO18 Open Source programming:

- Develop **open source programming** products which are normally free to download, although it does incur running costs such as storage and computing power.
- Even those rare paid-for **open source** products still tend to be far cheaper than closed **source** alternatives
- Understand process of executing a PHP-based script on a webserver.

- Be able to develop a form containing several fields and be able to process the data provided on the form by a user in a PHP-based script.
- Understand basic PHP syntax for variable use, and standard language constructs, such as conditionals and loops

CO19 .Net Programming:

- To Dmonstrate advanced knowledge of networking understands the key protocols which support the Internet.
- Be familiar with several common **programming** interfaces for **network** communication.
- Create web-based distributed applications using ASP.NET, SQL Server and ADO.NET
- Utilize DirectX libraries in the .NET environment to implement 2D and 3D animations and game-related graphic displays and audio.
- Utilize the .NET environment to create Web Service-based applications and components.

CO20 .Net Programming Lab:

- The students are able to develop *programs* using *C#* based on object oriented concepts
- Write the ROBUST, EXTENSIBLE and EFFICIENT *programs* by using *c#* code and ASP.Net
- Create dynamic web pages for further development.
- It provides re-usability.
- Less Coding and Increased Reuse of Code:

CO21 Open Source programming Lab:

- Thesestudents able to develop efficient open source programmes for rapidly developing network world
- Reliability and auditability. Integrated management.
- Simple license management

Discipline Specific Elective III

CO22 Wireless communication Network:

- These students able to understand and develop wireless communication and its infrastructure.
- Understand design considerations for wireless communication networks Understand the fundamentals of wireless networks.
- Learn and analyze the different wireless technologies.
- Evaluate Ad-hoc networks and wireless sensor networks.
- Understand and evaluate emerging wireless technologies and standards

C023 Real time Operating System:

- Ability to estimate if a system takes distributed system characteristic into account in a reasonable way.
- Knowing the basic structures (e.g. client-server) and knowing the existing middleware frameworks.
- Ability to estimate framework suitability for different applications.
- Ability to implement a simple distributed software laboratory work with socket and RMI interfaces.
- Understanding the mathematical principles behind validity of algorithms solving the problems of distribution.

- Understanding the problems that will arise if atomicity and timing issues are not handled in a distributed application.

CO24 Societal project (Mini Project):
- These students will learn to real world project developing skill.
- Group discussion.
- Cost effective development
- Breaking problem
- Reassembling problem

CO25 Internship:
- Develop communication, interpersonal and other critical skills in the job interview process.
- Explore career alternatives prior to graduation.
- Integrate theory and practice.
- Assess interests and abilities in their field of study.
- Learn to appreciate work and its function in the economy.
- Develop work habits and attitudes necessary for job success.

CO26 Software Testing:
- Apply modern **software testing** processes in relation to **software** development and project management.
- Create **test** strategies and plans, design **test** cases, prioritize and execute them. To develop, implement black box and white box testing cases.
- To understand use of Flow graphs and computing cyclomatic complexity using various methods.
- To understand and implement Automated software testing techniques for Web testing, Performance testing, and GUI testing.
- To develop, implement, and demonstrate the learning through a project that meet stated specifications.

CO27 Human Computer Interaction:
- Design effective dialog for HCI.
- Design effective HCI for individuals and persons with disabilities.
- Assess the importance of user feedback.
- Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Websites.

Discipline Specific Elective IV:
CO28 a) Multimedia And Its Application:

To customize the specific parts of the Multimedia Applications (Power Point) software.

 To prepare visuals by making arrangements on the slide master, and placeholders, etc.

- An understanding of multimedia development in the business world, and how successful development is contingent on detailed client specifications, user and audience research, and design decisions taken during the planning phase.
- An understanding of the content of learning materials available from e-skills UK and how these can be used with learners to develop multimedia products
- To work with learners to plan and create a multimedia product that includes animation, audio and video

CO29 b) Middleware technology:

- In business, it helps streamline processes and improves efficiency in terms of organization.
- It facilitates communication between systems,
- It is able to maintain the integrity of information across a multitude of systems within a network.
- Understand Middleware Interoperability.

CO30 Project work:

- Can be able to develop plans with relevant people to achieve the **project's** goals.
- Break **work** down into tasks and determine handover procedures.
- Identify links and dependencies, and schedule to achieve deliverablehandoverE
- Estimate and cost the human and physical resources required, and make plans to obtain the necessary resources.
- It supports students to show their talent.

CO31 Program Exit Examination:

- The exam is supposed to measure the learning outputs of the program as a whole not a individual course.
- The primary purpose of the exit exams is to assess students' educational achievement in the courses in their major area of program study.
- The exam is supposed to measures the learning outputs of the program as a whole not the individual courses.

COURSE STRUCTURE – 2022R

Semester I

Course Code	Course Title	L	T	P	C
	Semester I				
22220SEC11	J2EE Programming	6	0	0	4
2220SEC12	RDBMS	6	0	0	4
22212SEC13	Discrete Mathematics	6	0	0	4
22220SEC14L	J2EE programming Lab	0	0	3	2
22220SEC15L	RDBMS Lab	0	0	3	2
22220DSC16_	Discipline Specific Elective - I	6	0	0	4
22220RLC17	Research Led Seminar	-	-	-	1
22220DSC16C	Internet and HTML Programming	6	0	0	4
22220DSC16D	Parallel Processing	6	0	0	4
22220DSC16E	IT Infrastructure and cloud security	6	0	0	4

22220DSC16F	Service Oriented Architecture and We b Services	6	0	0	4
	Total	**24**	**0**	**6**	**21**

Course Code	Course Title	L	T	P	C
22220SEC21	Python Programming	5	0	0	4
22220SEC22	Cryptography & Network Security	5	0	0	4
22220SEC23	Software Engineering	5	0	0	4
22220SEC24L	Python Programming Lab	0	0	3	2
22220SEC25L	UNIX Lab	0	0	3	2
22220DSC26_	Discipline Specific Elective – II	5	0	0	4
22220RMC27	Research Methodology	4	0	0	2
22220BRC28	Participation in Bounded Research	-	-	-	2
22220DSC26C	Rapid Application Devel opment ing Us Python	5	0	0	4
22220DSC26D	Client-Server Computing	5	0	0	4
22220DSC26E	Computer Vision	5	0	0	4
22220DSC26F	Graphical Programming and Virtua l	5	0	0	4

	Instrumentation				
	Total	**24**	**0**	**6**	**24**

SEMESTER III

Course Code	**Course Title**	**L**	**T**	**P**	**C**
22220SEC31	Open Source programming	6	0	0	6
22220SEC32	.Net Programming	6	0	0	5
22220SEC33L	Open Source prog ramming Lab	0	0	3	2
22220SEC34L	.Net Programmin g Lab	0	0	3	2
22220DSC35_	Discipline Specifi c Elective – III	5	0	0	4
222___OEC	Open Elective Co urse	4	0	0	3
22220SRC37	Societal project (Mini Project)	0	0	0	2
22220DSC35C	Data Analysis and Bu siness Intelligence	5	0	0	4

22220DSC35D	Fundamentals of PHP	5	0	0	4
22220DSC35E	Open Source Technologies	5	0	0	4
22220DSC35F	Machine Learning	5	0	0	4
	Total	**21**	**0**	**6**	**24**

SEMESTER IV

Course Code	**Course Title**	**L**	**T**	**P**	**C**
22220SEC41	Software Testing	6	0	0	6
22220SEC42	Human Computer Interaction	6	0	0	5
22220DSC43_	Discipline Specific Elective - IV	4	0	0	4
22220PRW44	Project work	0	0	0	10
22220PEE	Programme Exit Examination	-	-	-	2

22220DSC43C	Telecommunication Networks and optimization	4	0	0	4
22220DSC43D	Image Processing	4	0	0	4
22220DSC43E	Mobile Communication	4	0	0	4
22220DSC43F	Resource Management Techniques	4	0	0	4
	Total	14	0	0	**27**
	Total credits for the program				**96**

Discipline Specific Electives

Semester	Discipline Specific Elective Courses
I	a) 22220DSC16A - WAP and XML b) 22220DSC16B - Advanced Computer Architecture c) Parallel Processing d) IT Infrastructure and cloud security e) Service Oriented Architecture and Web Services f) Internet and HTML Programming
II	a) 22220DSC26A - Artificial Intelligence b) 22220DSC26B - Distributed Operating System

	c) Rapid Application Development Using Python d) Client-Server Computing e) Computer Vision f) Graphical Programming and Virtual Instrumentation
III	a)20220DSC35A - Real time Operating Systems b)22220DSC35B - Wireless Communication Network c) Data Analysis and Business Intelligence d) Fundamentals of PHP e) Machine Learning f) Open Source Technologies
IV	a) 22220DSC43A - Multimedia and its application b) 22220DSC43B - Middleware Technology c) Telecommunication Networks and optimization d) Image Processing e) Mobile Communication f) Resource Management Techniques

Open Electives

Semester	Open Elective Courses
III	a) 222ENOEC – Writing for the Media b) 222MAOEC-Applicable Mathematics Techniques c) 222PHOEC-Bio-medical Instrumentation d) 222CHOEC-Green Chemistry e) 222BCOEC-Herbal Medicines f) 222CMOEC- Financial Service

CREDIT DISTRIBUTION

SEMESTER	AEC	SEC	DSC	OEC	RESEARCH	OTHERS	TOTAL
I	4	12	4		1		**21**
II		16	4		4		**24**
III		15	4	3	2		**24**
IV		11	4		10	2	**27**
TOTAL	**4**	**59**	**12**	**2**	**15**	**2**	**96**

Course Code	Course Title	L	T	P	C
22220SEC11	**J2EE Programming**	**6**	**0**	**0**	**4**

AIM:

To enable the students to develop standalone programming and Internet based application

OBJECTIVES:

- To learn java programming concepts under Client Sever environment To develop Database Application in Java .
- To learn java programming concepts like reflection, native code interface, threads etc To develop network programs in java.
- To understand concepts needed for distributed and multi-tier applications.
- To understand issues in enterprise application development.

UNIT I

Fundamentals of OOPS-Overview of java language-Data type–Variables and arraysClass Fundamentals-declaring objects-constructor-overloading methods-inner classes-method overriding.

UNIT II

Applet class-Applet architecture-Html applet tag-Passing parameters in applet-AWT classes-Window fundamentals-AWT controls- Handling events by extending AWT components.

UNIT III

Java Database Connectivity: JDBC/ODBC Bridge-The connectivity model being usedThe java.sql Package-The JDBC Exception Classes- JDBC working with user interface-Database connectivity- Data manipulation-Data Navigation-Data Storage.

UNIT IV

RMI: What is Distributed Object System? -Distributed object Technologies-RMI for distributed computing-RMI Architecture- RMI Registry service-Creating RMI ApplicationsSteps involved in running the RMI Applications-Removing objects from a Registry.

UNIT V

Java and XML: Generating an XML Document- Java Servlets– Java Server Pages

REFERENCES:

1. “JAVA2 COMPLETE REFERENCE” Fourth Edition, 2001, Herbert Schieldt.

(For UNIT- I & II: Chapters 2, 3, 6, 7, 8, 19, 21, 22)

2. WEB ENABLED COMMERCIAL APPLICATION DEVELOPMENT USING….JAVA 2.0- IVAN BAYROSS. (For UNIT III& IV: Chapters 11, 13).

3. THE COMPLETE REFERENCE J2EE - KEOGH

(For UNIT – V: Chapters 9, 10, 11)

Course Code	Course Title	L	T	P	C
2220SEC12	RDBMS	6	0	0	4

AIM :

To provide an in-depth knowledge of Relational database system using Oracle.

OBJECTIVES:

- To understand about SQL Queries.
- To learn about Oracle Web Application.
- To impart knowledge in transaction processing, concurrency control techniques and recovery Procedures.

UNIT-I

Introduction- File systems versus Database systems – Data Models – DBMS Architecture – Data Independence –Introduction Relational Model and E-R model.

UNIT-II

Introduction to SQL - Basic structure and Basic operations of SQL – Set operations - Aggregate functions – Nested squires – Join expressions and views–Functions and procedure – Triggers

UNIT-III

Relational query languages - Relational algebra – Tuple relational calculus – Domain relational calculus – Relational database design - Functional dependency – Normalization – 1NF,2NF,3NF and BCNF

UNIT-IV

Transaction management - Transaction Processing –Properties of Transactions - Serializability – concurrency control lock based protocols – Deadlock handling Time Stamp based protocol - Validation Techniques - Recovery system - Log Based Recovery.

UNIT-V Data base System Architecture – Centralized client-server Architecture- Server system Architecture – Parallel Data bases – Distributed data bases – Distributed Data storage – Distributed transaction – commit protocol – Concurrency control in Distributed Database.

COURSE OUTCOMES:

- Understand the basic concepts of the database and data models.
- Design a database using ER diagrams and map ER into Relations and normalize the relations.
- Acquire the knowledge of query evaluation to monitor the performance of the DBMS. Develop a simple database applications using normalization.

Acquire the knowledge about different special purpose databases and to critique how they differ from traditional database systems.

REFERENCES:

1. Abraham Silberschatz, Henry F.Korth and S.Sundarshan "Database System Concepts", Fifth Edition, McGraw Hill, 2010.

2. C.J. Date, "An Introduction to Database Systems", Eight Edition, Pearson Education Delhi, 2003.

Course Code	Cours e Title	L	T	P	C
22212SEC13	Discrete Mathematics	6	0	0	4

AIM:

To provide in-depth knowledge of Mathematical logics, Boolean Algebra.

OBJECTIVES:

- To understand the concept of Set Theory and Functions.
- To solve the Recurrence Relations using Generating functions.

UNIT I

Sets, Relations &Functions : Property of binary relations, Equivalence, Compatibility, Partial ordering relations, Hasse diagram, Functions, Inverse function, Compositions of functions, Recursive functions.

UNIT II

Mathematical logic : Logic operators, Truth tables, Theory of inference and deduction, Mathematical Calculus, Predicate Calculus, Predicates and Qualifiers.

UNIT III Groups &Subgroups : Group axioms, Permutation groups, Cosets, Normal subgroups, Semi groups, Free semi groups, Monoids, Sequential Machines, Error Correcting Codes, Modular arithmetic Grammars.

UNIT IV

Lattices & Boolean Algebra: Axiomatic definition of Boolean algebra as algebra as algebraic structures with two operations, Basic results truth values and truth tables, The algebra of propositional functions, Boolean algebra of truth tables.

UNIT V

Combinatorics& Recurrence Relations : Disjunctive and sequential counting, Combinations and permutations, Enumeration without repetition, Recurrence Relation, Fibonacci relation, Solving recurrence relation by Substitution, Solving non recurrence relation by conversion to linear recurrence relation.

REFERENCES:

1. Trenbly J.P &Manohar. P. “Discrete Mathematical Structures with Applications to Computer Science”.

2. Kolman, Busy & Rose “ Discrete Mathematical Structures “PHI

3. K.D Joshi “ Foundations of Discrete Mathematics” , Wiley Eastern Limited.

1. Seymour Lipschutz& March Lipson Tata McGraw Hill.
2. C.L.Liu“ Elements of Discrete Mathematics “ Tata McGraw Hill.

Course Code	Course Title	L	T	P	C
22220SEC14L	J2EE programming Lab	0	0	3	2

1. Load an image on to applet. As the user selects portions of this image, rectangular regions corresponding to the selection should be highlighted by enveloping them in rectangles (use mouse events). Also the user can change the colors of selected regions.

2. Create an application, which consists of a dialog box that could be used to obtain an user name and a password to connect to some on line service. The dialog box consists of two fields user name, password and two buttons of Ok & Cancel for accepting user input.

3. Write a java program, which will make balls of various colors to move within the frame windows.

4. Write a JSP Program to manipulate the following information:

a. Last Date Visited

b. Last Time Visited

c. Number of Visited

4.Create Mark List Program using JDBC with UI Concept.

5.Create a SERVLET Program with JDBC.

6.Create a JSP Program to display a message.

7.Create a conversation using RMI concept.

Course Code	Course Title	L	T	P	C
22220SEC15L	RDBMS Lab	0	0	3	2

1. Creating, Updating and Inserting into databases and simple queries.

2. Uses of Select statement – for queries using
   (i) AND,OR,NOT Operations, WHERE clause
   (ii) UNION, INTERSECTION , MINUS
   (iii) Sorting and Grouping

3. Nested queries using SQL
   (i) Sub queries
   (ii) Join

4. Built-in functions of SQL

5. Creation of simple forms

6. Use of indexes, creating views and querying in views

7. Cursors, triggers and stored procedures and functions

8. Case Studies

   i. Student Evaluation systems
   ii. Pay-roll system
   iii. Income tax calculation iv. Seat reservation problems
   v. Mark sheet preparation

Course Code	Course Title	L	T	P	C
22220DSC16A	- WAP and XML	0	0	3	2

Aim:

To provide a web – like experience on small portable devices..

Objectives:

- To bring internet content and advanced data services to digital cellular phones and other terminal
- To create a global wireless protocol specification that will work across differing wireless network technologies.
- Xml was designed to carry data with focus on what data is.
- Xml tags are not predefined like HTML tags are.

UNIT-I

Overview of wap: wap&wireless world- wap application architecture – wap internal Structure –Wap versus web-setting up wap: available software products –wap resources –the development tool kit

UNIT-II

Wap gateways: definition –functionality of a wap gateways the web model versus wap model – positioning of a wap gateway in the network-selecting a wap gateway Basic WML: extensible mark-up language- WML structure -a basic WML card-text formatting-navigation –advance display features

UNIT-III

Interacting with the user: making a selection-events-variable-input parameter passing-WML script-need for WML script-lexical structures-variable & literal-operators-automatic Data type conversion-control constructs-functions using the standard libraries-pragmas-dealing with errors.

Unit-IV

Xml-introduction to Xml-an eagle's eye-view of xml-xml definition –life of an xml document-related technologies-an introduction to xml application-xml application-xml for xml-first xml document structuring data: xmlizing the data-the advantages of the xml formatpreparing style sheet for document display.

Unit-V

Attributes, empty tags and xsl: attribute versus element- empty tags- xsl- well formed Xml Document- foreign language and non – roman text- non roman scripts, character set, fonts and glyphs- legacy character set –Unicode character set- procedure to write xml in Unicode.

<u>TEXT BOOK:</u>

Unit-1, 2,3: Professional WAP with XML, WML scripts – Charles Arehat.

Unit-4, 5: XML TM BIBLE – Elliottevusty Harold

Course Title
Advanced Computer Architecture

Aim:

To provide depth knowledge about computer design and memory of computer.

OBJECTIVES:

The student should be made to:

- Understand the micro-architectural design of processors
- Learn about the various techniques used to obtain performance improvement and power savings in current processors

UNIT I FUNDAMENTALS OF COMPUTER DESIGN

Review of Fundamentals of CPU, Memory and IO – Trends in technology, power, energy and cost, Dependability - Performance Evaluation

UNIT II INSTRUCTION LEVEL PARALLELISM

ILP concepts – Pipelining overview - Compiler Techniques for Exposing ILP – Dynamic Branch Prediction – Dynamic Scheduling – Multiple instruction Issue – Hardware Based Speculation – Static scheduling - Multi-threading - Limitations of ILP – Case Studies.

UNIT III DATA-LEVEL PARALLELISM

Vector architecture – SIMD extensions – Graphics Processing units – Loop level parallelism.

UNIT IV THREAD LEVEL PARALLELISM

Symmetric and Distributed Shared Memory Architectures – Performance Issues – Synchronization – Models of Memory Consistency – Case studies: Intel i7 Processor, SMT & CMP Processors

UNIT V MEMORY AND I/O

Cache Performance – Reducing Cache Miss Penalty and Miss Rate – Reducing Hit Time – Main Memory and Performance – Memory Technology. Types of Storage Devices – Buses – RAID – Reliability, Availability and Dependability – I/O Performance Measures.

OUTCOMES:

At the end of the course, the student should be able to:

- Evaluate performance of different architectures with respect to various parameters
- Analyze performance of different ILP techniques
- Identify cache and memory related issues in multi-processors

TEXT BOOK:

1. John L Hennessey and David A Patterson, "Computer Architecture A Quantitative Approach",

Morgan Kaufmann/ Elsevier, Fifth Edition, 2012.

REFERENCES:

1. Kai Hwang and Faye Briggs, "Computer Architecture and Parallel Processing", McGraw Hill International Edition, 2000.

2. Sima D, Fountain T and Kacsuk P, "Advanced Computer Architectures: A Design Space Approach", Addison Wesley, 2000.

22220DSC16C	**Internet and HTML Programming**	6	0	0	4

Course Objective: To provide programming techniques for different scripting languages like HTML, HTML5, Java Script etc.

Course Outcomes:

After completion of this course students will able to –

- To develop static web pages through HTML, HTML5 and JavaScript.
- To implement different constructs and programming techniques provided by Java Script.

UNIT I: OVERVIEW OF INTERNET AND INTRANET

Understanding internet and its need, concept of intranet, difference between internet and intranet, a brief history, internet applications, Internet Service Providers (ISP) concept of client and server, concept of a web browser and web server, communicating on the internet, concept of domain-Physical domain, virtual domain, registering a domain, need of IP addressing, process to assign IP addresses, World Wide Web.

UNIT II: INTRODUCTION TO HTML

Introduction: Overview of HTML, need of HTML, Use of it, HTML Tags: concept of Tag, types of HTML tags, structure of HTML program Text formatting through HTML: Paragraph breaks, line breaks, background and BGcolor attributes. Emphasizing material in a web page: Heading styles, drawing lines, text styles. Text styles and other text effects-centering, spacing, controlling font size & color Lists: Using unordered, ordered, definition lists Adding Graphics To HTML Documents: Using Image tag, attributes of Image tag, changing width & height of image

UNIT III: TABLES, FRAMES AND LINKING DOCUMENTS

Handling Tables: To define header rows & data rows, use of table tag and its attributes. Use of caption tag Linking Documents: Concept of hyperlink, types of hyperlinks, linking to the beginning of document, linking to a particular location in a document, Images as hyperlinks Frames: Introduction To frames, using frames & frameset tags, named frames how to fix the size of a frame, targeting named frames.

Introduction to CSS: Introducing CSS, font attributes, color and background attributes, text attributes, border attributes, margin related attributes, list attributes Using class and span tag , External Style Sheets

UNIT IV: INTRODUCTION TO HTML5

Features of HTML5: MIME Types, diving in, Detection techniques, Modernizr: An HTML5 Detection
Library, Canvas, Canvas Text, Video: Video Formats, Local Storage, Web Workers, Offline Web

Applications Geolocation, Input Types, Placeholder Text, Form Autofocus, Microdata Elements of HTML5: The Doctype, the Root Element, The <head> Element New Semantic Elements in HTML5,

Handling of Unknown Elements by the Browsers Headers, Articles, Dates and Times, Navigation, Footers. Drawing Surface: Introduction to Canvas, Simple Shapes, Canvas Coordinates, paths, Text, Gradients, Images. Video on the web: Video Containers, Video Codecs, Audio Codecs

UNIT V: USING FORM OBJECTS

Forms Used By Web Site: Form object, properties of form elements, methods of form element, form object's Method Different elements : text, password, button, submit, reset, checkbox, Radio, Text Area, select & option, Other built-in Object-String object, math object, date object User defined objects: creation, instances, objects within objects.

TEXT BOOKS

- Web Enabled Commercial Application Development Using HTML, DHTML,
- JavaScript, Perl CGI by Ivan Bayross (bpb publication)

HTML5 by Mark Pilgrim O'Reilly publication

22220DSC16D	**Parallel Processing**	6	0	0	4

AIM:

The course is designed to introduce issues involved in parallel programming along with some analysis of parallel algorithms. Programming exercises will involve the use of MPI, OpenMP, Cuda, OpenCL and/or Pthreads.

Course Objectives:

This is a graduate level course on parallel computing with the objective to familiarize students with the fundamental concepts, techniques and tools of parallel computing. Participation in this course will enable you to better use parallel computing in your application area, and will prepare you to take advanced courses in more specific areas of parallel computing.

Course Outcome:

- At the end of the course the students will be able to do following: Understand the evolution of High Performance Computing (HPC) with respect to laws
- and the contemporary notion that involves mobility for data, hardware devices and
- software agents Understand, appreciate and apply parallel and distributed algorithms in problem
- Solving. * Evaluate the impact of network topology on parallel/distributed algorithm
- formulations and traffic their performance. * Gain hand-on experience with the agent-based and Internet-based parallel and
- distributed programming techniques. *Master skills to measure the performance of parallel and distributed programs.

Unit-1

Introduction: Parallel Processing – Shared Memory Multiprocessing – Distributed Shared Memory – Message Passing Parallel Computers.

Unit-2

Processes & Shared Memory Programming: Processes - Shared Memory Programming – General Model Of Shared Memory Programming – Forking-Creating Processes – Joining Processes - Process Model Under UNIX.

Unit-3

Scheduling : Loop Scheduling – Variations On Loop Scheduling – Self- Scheduling – Variations On Self-Scheduling – Indirect Scheduling – Block Scheduling.

Unit-4

Thread-Based Implementation

Thread Management – The POSIX Thread Application Programmer Interface- Synchronization Primitives in POSIX- Example With Threads – Attributes Of Threads – Mutual Exclusion With Threads – Mutex Usage Of Threads – Thread Implementation – Events And Condition Variables – Deviation Computation With Threads – Java Threads.

Unit-5

Programming Using the Message Passing Paradigm- Principles of Message-Passing Programming. The Building Blocks: Send and Receive Operations. MPI: The Message Passing Interface. Topologies and Embedding. Overlapping Communication with Computation. Collective Communication and Computation Operations.

Text Books:

1 Introduction To Parallel Programming - By Steven Brawer.

2 Introduction to Parallel Computing, Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, By Pearson Publication.

3 Introduction To Parallel Processing – By M.Sasikumar, Dinesh Shikhare And P. Ravi Prakash.

22220DSC16E	**IT Infrastructure and cloud security**	6	0	0	4

Course Objective

- Cloud Foundations: Understand the core concepts, benefits, and models of cloud computing.
- Amazon Web Services: Gain proficiency in AWS services, architecture, and security.
- Microsoft Azure: Master Azure services, infrastructure, and cloud solutions.
- Cloud Security & Migration: Learn essential security practices and migration strategies.
- Big Data & Analytics: Understand the handling and analysis of big data in a cloud environment.
- Capstone Project: Apply learned skills to real-world scenarios, reinforcing your knowledge.

Course Outcomes

- Develop competency in AWS solutions
- Learn Azure DevOps
- Work on capstone projects for practical learning
- Deep dive into Big Data hands-on practices
- Learn more about cloud migration strategies
- Gain practical knowledge through GCP hands-on tasks

UNIT-I:

Overview of Computing Paradigm

Recent trends in Computing Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing Evolution of cloud computing Business driver for adopting cloud computing.

Introduction to Cloud Computing Cloud Computing (NIST Model) Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers Properties, Characteristics & Disadvantages Pros and Cons of Cloud Computing, Benefits of Cloud Computing, Cloud computing vs. Cluster computing vs. Grid computing Role of Open Standards

UNIT-II:

Cloud Computing Architecture Cloud computing stack Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services Service

Models (XaaS) Infrastructure as a Service(IaaS) , Platform as a Service(PaaS), Software as a Service(SaaS) Deployment Models Public cloud, Private cloud, Hybrid cloud, Community cloud

UNIT-III:

Infrastructure as a Service(IaaS) Introduction to IaaS IaaS definition, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM) Resource Virtualization Server, Storage, Network Virtual Machine (resource) provisioning and manageability, storage as a service, Data storage in cloud computing(storage as a service)

Examples Amazon EC2 Renting, EC2 Compute Unit, Platform and Storage, pricing, customers Eucalyptus Platform as a Service(PaaS) Introduction to PaaS What is PaaS, Service Oriented Architecture (SOA) Cloud Platform and Management Computation Storage Examples Google App Engine Microsoft Azure Software as a Service (PaaS) Introduction to SaaS, Web services, Web 2.0, Web OS, Case Study on SaaS

UNIT-IV:

Service Management in Cloud Computing Service Level Agreements(SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling: Benefitting enormously Managing Data Looking at Data, Scalability & Cloud Services Database & Data Stores in Cloud Large Scale Data Processing

UNIT-V:

Cloud Security Infrastructure Security Network level security, Host level security, Application level security Data security and Storage Data privacy and security Issues, Jurisdictional issues raised by Data location Identity & Access Management, Access Control, Trust, Reputation, Risk, Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations

REFERENCES:

- Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
- Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011
- Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012
- Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010

22220DSC16F	**Service Oriented Architecture and Web Services**	6	0	0	4

COURSE OBJECTIVES:

- To learn fundamentals of XML.
- To provide an overview of Service Oriented Architecture and Web services and their importance.
- To learn web services standards and technologies.
- To learn service-oriented analysis and design for developing SOA based applications.

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to:
CO1: Able to build applications based on XML.
CO2: Know the service orientation concepts, benefits of SOA.

UNIT – I: Evolution and Emergence of Web Services - Evolution of distributed computing, Core distributed computing technologies – client/server, CORBA, JAVA RMI, Microsoft DCOM, MOM, Challenges in Distributed Computing, role of J2EE and XML in distributed computing, emergence of Web Services and Service Oriented Architecture (SOA). Introduction to Web Services – The definition of web services, basic operational model of web services, tools and technologies enabling web services, benefits and challenges of using web services.

UNIT – II: Web Services Architecture – Web services Architecture and its characteristics, core building blocks of web services, standards and technologies available for implementing web services, web services communication, basic steps of implementing web services. Describing Web Services – WSDL introduction, nonfunctional service description, WSDL1.1 Vs WSDL 2.0, WSDL document, WSDL elements, WSDL binding, WSDL tools, WSDL port type, limitations of WSDL.

UNIT – III: Brief Over View of XML – XML Document structure, XML namespaces, Defining structure in XML documents, Reuse of XML schemes, Document navigation and transformation. SOAP: Simple Object Access Protocol, Inter-application communication and wire protocols, SOAP as a messaging protocol, Structure of a SOAP message, SOAP envelope, Encoding, Service Oriented Architectures, SOA revisited, Service roles in a SOA, Reliable messaging, The enterprise Service Bus, SOA Development Lifecycle, SOAP HTTP binding, SOAP communication model, Error handling in SOAP

UNIT – IV: Registering and Discovering Services: The role of service registries, Service discovery, Universal Description, Discovery, and Integration, UDDI Architecture, UDDI Data Model, Interfaces, UDDI Implementation, UDDI with WSDL, UDDI specification, Service Addressing and Notification, Referencing and addressing Web Services, Web Services Notification.

UNIT – V: SOA and web services security considerations, Network-level security mechanisms, Application-level security topologies, XML security standards, Semantics and Web Services, The semantic interoperability problem, The role of metadata, Service metadata, Overview of .NET and J2EE, SOA and Web Service Management, Managing Distributed System, Enterprise management Framework, Standard distributed management frameworks, Web service management, Richer schema languages, WSMetadata Exchange.

REFERENCES:

1. Thomas Erl, “Service Oriented Architecture: Concepts, Technology and Design”, Pearson Education, 2005.
2. Sandeep Chatterjee and James Webber, “Developing Enterprise Web Services: An Architect's Guide”, Prentice Hall, 2004.
3. James McGovern, Sameer Tyagi, Michael E Stevens and Sunil Mathew, “Java Web Services Architecture”, Elsevier, 2003.
4. Ron Schmelzer et al. \ XML and Web Services., Pearson Education, 2002.
5. Frank P.Coyle, \XML, Web Services and the Data Revolution., Pearson Education, 2002
6. Thomas Erl, “Service Oriented Architecture: Concepts, Technology, and Design”, Pearson Education, 2005.

SEMESTER II

Course Title
Python Programming

AIM

To enable the student to be familiar with Python Programming.

OBJECTIVES:

On successful completion of the course the student should have understood the concepts in Python and its application.

Unit - I

Core Python: Introduction-features-Comparative study-Comments-Operators-Variables and Assignments-Numbers-String-List and Tuple-Dictionary-Statements and Iterative statements-list comprehensive-Errors and Exception-functions-Classes-Modules-Useful function. Basics: Syntax and Statements-Variable Assignments-Identifier-Style-Memory ManagementApplication Example. Objects: Introduction-Standard Type- Built-in-type-Internal type-Standard type operator and Built-in functions-Categorizing standard type-Unsupported type.

Unit – II

Numbers: Introduction- Integer-Floating Point-Complex numbers-Operators-Built-infunctions-Other numeric type-Sequence-Strings-Strings and Operator-String only operator-Builtin-Functions-Built-in-Methods-String Features-Unicode-Related Modules.

Unit – III

List-Operators-Built-in-Functions-Built-in-Methods-Features of List-Tuple: IntroductionOperators and Built-in-Functions-Features-Related Modules-Mapping type: DictionariesOperators-Built-in and Factory Functions-Built-in- Methods. Set type: Introduction-OperatorsBuilt-in Function-Built-in Methods-Related Modules-Conditional and looping statement.

Unit – IV

File: Objects- Built in Functions-Methods-Attributes-Standard files-Command line Argument-File System-File Execution-Persistent Storage Modules-Related Module. Class: Introduction-Class and Instance- Method calls. Exception and Tools: Why use it?-Exception roles-Short story-Try/finally statement.

Unit – V

Regular Expression: Introduction-Special Symbols and characters-Regexes and Python-Examples of Regexes. Network Programming: Architecture-Socket. Internet Client

Programming- Transferring files-Email.GUI Programming: Introduction-Tkinter and Python.DB Programming: Introduction-Python DB-API-Non-Relational DB. Web Services: IntroductionMicroblogging with Twitter.

REFERENCES:

1. Chun, J Wesley, Core Python Programming, 2nd Edition, Pearson, 2007 Reprint 2010.
2. Wesley J Chun Core python Application Programming,3rd Edition, 3.

   Lutz, Mark, Learning Python, 5th Edition, O Rielly

Course Title
Cryptography & Network Security

AIM:

To introduce about Internet Security in terms of measures to deter, prevent, detect, and correct security violations that involve the transmission of information

OBJECTIVES:

- To know the methods of conventional encryption.
- To understand the concepts of public key encryption and number theory To understand authentication and Hash function.
- To know the network security tools and system level security used.

UNIT I

CLASSICAL ENCRYPTION TECHNIQUES: Symmetric Cipher Model-substitution techniques-transposition technique-Rotor machine-Steganography.BLOCK CIPHERS AND THE DATA ENCRYPTION STANDARD: Simplified DES-Block cipher principles-The data encryption standard-the strength of DES-Differential and linear cryptanalysis-Block cipher design principles-Block cipher modes of operation**.**

UNIT II

PUBLIC KEY CRYPTOGRAPHY AND RSA: Principles of public key cryptosystemThe RSA algorithm.KEY MANAGEMENT OTHER PUBLIC KEY CRYPTOSYSTEMS: key management-Diffie-Hellman Key Exchange-Elliptic curve Arithmetic-Elliptic curve cryptography.

UNIT III

HASH ALGORITHM :MD5 Message Digest Algorithm-Secure Hash AlgorithmRIPEMD-160-HMAC.DIGITAL SIGNATURE AND AUTHENDICATION PROTOCOLS: Digital Signatures-Authentication Protocols-Digital Signature Standard.

UNIT IV

AUTHENTICATION APPLICATION : Kerberos-X.509 Authentication ServiceRecommended Reading and Websites.ELECTRONIC MAIL SECURITY: Pretty Good PrivacyS/MIME IP Security : IP Security Overview-IP security Architecture-Authentication

Header- Encapsulating Security Payload- Combining Security Associations-Key Management.WEB SECURITY : Web security considerations – Secure Socket Layer and Transport Layer Security – Secure Electronic Transactions.

UNIT V

INTRUDERS : Intruders – Intrusion detection – Password management. MALICIOUS SOFTWARES : Viruses and Related Threats – Virus countermeasures.

FIREWALLS: Firewalls Design Principles-Trusted Systems.

OUTCOMES:

Upon Completion of the course, the students should be able to:

- Compare various Cryptographic Techniques
- Design Secure applications
- Inject secure coding in the developed applications

REFERENCES:

1. "Cryptography and Network Security " – William Stallings – 3rd Edition Pesrson Education 2003.

2. "Network Security essentials Applications and Standards", William Stalings , Pearson Education 2007.

Course Title
Software Engineering

AIM:

To introduce the methodologies involved in the development and maintenance of Software (i.e) over its entire life cycle.

OBJECTIVES:

- To be aware of Softwares Different Life Cycle models.
- Requirements dictation process.
- Verification Validation techniques.
- Project planning and Management.

UNIT I

Introduction - definitions - size factors - quality and productivity factors - managerial issues. Planning a software project - introduction - defining the problem - developing a solution strategy - planning the development process - planning an organizational structure - other planning activities.

UNIT II

Software cost estimation - cost factors - cost estimation techniques staffing level estimation - estimating soft- ware maintenance costs. Software requirements definition - software requirement specification - formal specification techniques - languages and processors for requirements.

UNIT III

Software design - fundamental design concepts - modules and modularization criteria - design notations - design techniques - detailed design considerations - real time and Distributed system design - test plans - milestones, walkthrough and inspections - design guidelines.

UNIT IV

Implementations issues - structured coding techniques - coding style - standards and guidelines - documentation guidelines -data abstraction - exception handling - concurrency mechanisms.

UNIT V

Verification and validation techniques - quality assurance - walkthrough and inspections - static analysis - symbolic execution - UNIT testing and debugging - system testing - formal verification. Software maintenance - enhancing maintainability during development - managerial aspects - configuration management - source code metrics - other maintenance tools and techniques.

OUTCOMES:

- Get an insight into the processes of software development
- Able to understand the problem domain for developing SRS and various models of software
- engineering
- Able to Model software projects into high level design using DFD,UML diagrams
- Able to Measure the product and process performance using various metrics
- Able to Evaluate the system with various testing techniques and strategies

REFERENCES:

1. Software Engineering Concepts - Richard Fairley TMH
2. Roger S.pressman, "Software engineering", 5th edition, 2001, MGH publishers.
3. Marlim L.Shoeman, "Software Ezngineering", 1983,MGH Publishers.

Course Title	
Python Programming Lab	

1. Find the square root of a number (Newton's method)

2. Exponentiation (power of a number)

3. Find the maximum of a list of numbers

4. Linear search and Binary search

5. Selection sort, Insertion sort

6. Merge sort

7. First n prime numbers

8. Multiply matrices

9. Programs that take command line arguments (word count)

10. Find the most frequent words in a text read from a file

Course Title
UNIX Lab

1.Write a menu driven shell program for the following :

a. List of files.

b. Processes of users.

c. Today's Date

d. Users of system.

e. Quit of Unix

2. Write a shell program which accepts the name of a file from the standard input and tests to find the file access permissions, such as read, write and execute.

3. Write a shell program which accepts the name of a file from the standard input and perform the following

a. Accept five names in a file.

a. Sorts the names in existing file.

b. Lists unsorted and sorted file.

c. Quit

4. Write a menu driven shell program to copy, edit, rename and delete a file.

5.Write a menu driven shell program to perform the following task

a. Write a sentence in file.

b. Search for a given word or pattern in an existing file.

c. Quit.

6. Write a shell program to prepare electricity bill for domestic consumers.

For first 100 units – Rs. 0.75 / Unit

For next 100 units – Rs. 1.50 / Unit

Above 200 units – Rs. 3.00 / Unit

Prepare the bill for the following format.

7. Write a shell program to display the result PASS or FAIL using the information given below student name ,student reg.no., mark1,mark2,mark3,mark4 the minimum pass for each subject is 50.

8. Merge the contents of the file file1,file2 and store in another file.

Course Title
Artificial Intelligence

Aim:

To Acquire Knowledge on various AI Techniques and Expert Systems.

Objective:

- To learn AI Basic Concepts
- To understand Expert Systems Architectural-Components
- To study Expert System development process
-

UNIT I

The AI definition - AI Techniques- Problems, Problem Space and search- Defining the problem as a state space search- Problem Characteristics- Heuristic Search Techniques- Generate and Test- hill Climbing- Best First Search- Problem reduction - Constraint Satisfaction- means - ends analysis.

UNIT II

Game Playing- Min-Max Procedure- Adding Alpha-Beta Cutoffs- Additional Refinements- Searching AND/OR Graphs - Using Predicate Logic- Representing Simple Facts and Logic- Representing instance and IS a relationships- Computable functions and predicates- Use of the predicate calculus in AI Resolution- natural deduction.

UNIT III

Representing knowledge using rules- Procedural versus declarative knowledge- Logic Programming- Forward versus Backward Reasoning- Resolving within AND/OR Graphs matching- control knowledge-Symbolic Reasoning under uncertainty- Non-monotonic reasoning- Implementation issues- - Fuzzy Logic.

UNIT IV

Expert Systems- Architectural-Components- Explanation facilities- Knowledge acquisition.

UNIT V

Expert System development process- Non-formal representation of knowledge- Semantic networks- Frames- Scripts- Expert System Tools.

OUTCOMES:

At the end of the course, the student should be able to:

- Identify problems that are amenable to solution by AI methods.
- Identify appropriate AI methods to solve a given problem.
- Formalize a given problem in the language/framework of different AI methods.
- Implement basic AI algorithms.
-

REFERENCE BOOK:

1. For Units I, II, III: Elaine Rich and Kevin Kaight, **"Artificial Intelligence",** Tata McGraw Hill, 2nd Edition, 1991.
2. For Units IV, V: David W. Rolston, **"Principles of Artificial Intelligence and Expert Systems Development",** McGraw Hill.

Course Title
Distributed Operating System

Aim:

To understand the concept of distributed computing

Objectives

- It is easy for users to access remote resources and to share them with others in a controlled way.
- Ideally this arrangement is drastically more fault tolerant and more powerful than many combinations of stand –alone computer systems..

UNIT-I:

Introduction to distributed system-what is a distributed system-goals-h/w concepts- s/w concepts – design issues. Communication in distributed systems: layered protocols – asynchronous transfer mode network.

UNIT-II:

The client/server model-remote procedure call- group communication. Synchronization in distributed systems: clock synchronous-mutual exclusion-election algorithm-atomic transaction-deadlock in distributed system.

UNIT-III:

Process & processors in distributed system: Threads system-models-processor allocation-scheduling in distributed system-fault tolerance-real time distributed system.File system: distributed file system design-distributed file system implementation-trends in distributed file system.

UNIT-IV:

Distributed shared memory: Introduction to distributed shared memory- consistency models-page based distributed shared memory-shared variable distributed shared memory-object based distributed shared memory-comparison.

UNIT-V:

Naming facility in distributed operating system-security in distributed operating system.

Case studies: Amoeba-V-system-Mach-Chorus-DCE-comparison.

REFERENCE BOOK:

"**Distributed Operating System**" – Andrew S.Tanenbaum.

"**Distributed Operating Systems**" – Pradeep K.Sinha.

Course Title
Research Methodology

AIM:

To give an exposure to development of research questions and the various statistical methods suitable to address them through available literature, with basic computational operators.

OBJECTIVES:

- To understand the approaches towards and constraints in good research.
- To identify various statistical tools used in research methodology
- To appreciate and compose the manuscript for publication
- To train in MATLAB platform for basic computational programing and analysis.

OUTCOME:

Ability to develop research questions and the various research strategies and compile research results in terms of journal manual scripts.

PREREQUISITIES:

Research methodology course in UG level or equivalent knowledge.

UNIT-I Introduction to research methodology

Objectives of research – type of research – Significance of research. Research methodology – Research and scientific method – Criteria of good research – Problems encountered by research in India.

UNIT-II Data base and Literature Survey

Articles – Thesis – Journals – Patents – Primary sources of journals and patens – Secondary sources – Listing of titles – Abstracts –Chemical Abstract Service – Reviews – Monographs – Literature search.

UNIT-III Data Analysis:

Precision and accuracy – Reliability – Determinate and random errors – Distribution of random errors –normal distribution curve – Statistical treatment of finite samples – T test and F test (ANOVA) co – Variance (ANCOVA) correlation and multiple regression.

UNIT-IV Thesis and paper writing:

Conventions in writing – General format – Page and chapter format – Use of quotations and footnotes – Preparations of tables and figures – Reference and Appendices.

UNIT-V Application on MATLAB:

Numerical Integration – Numerical integration, ordinary differential equations, partial differential equations, and boundary value problems - Fourier analysis – Fourier transforms, convolution.

References:

1. C.R. Kothari, Research Methodology, New Age International publishers. New Delhi,2004.

2. R.A Day and A.L. Underwood, Quantitative analysis, Prentice Hall, 1999.

3. R. Gopalan, Thesis writing, Vijay Nicole Imprints Private Ltd., 2005.

4. A Guide to MATLAB: For Beginners and experienced Users by Brian R. Hunt (Editor), Ronald L. Lipsman, J. Rosenberg

5. Introduction to MATLAB for Engineers by William J. Palm III.

22220DSC26C	**Rapid Application Development Using Python**	5	0	0	4

Course Objective:

• Learn the syntax and semantics of Python programming language.
• Illustrate the process of structuring the data using lists, tuples and dictionaries.
• Demonstrate the use of built-in functions to navigate the file system.
• Implement the Object Oriented Programming concepts in Python.
• Appraise the need for working with various documents like Excel, PDF, Word and Others.

Course Outcomes:

• Demonstrate proficiency in handling of loops and creation of functions.
• Identify the methods to create and manipulate lists, tuples and dictionaries.
• Discover the commonly used operations involving regular expressions and file system.
• Interpret the concepts of Object-Oriented Programming as used in Python.
• Determine the need for scraping websites and working with CSV, JSON and other file formats.

UNIT– 1

Python Basics, Entering Expressions into the Interactive Shell, The Integer, Floating-Point and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program, Flow control, Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit(), Functions, def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling

UNIT – 2

Lists, The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, Example Program: Magic 8 Ball with a List, List-like Types: Strings and Tuples,References, Dictionaries and Structuring Data, The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things, Manipulating Strings, Working with Strings, Useful String Methods, Project: Password Locker.

UNIT – 3

Pattern Matching with Regular Expressions, Finding Patterns of Text Without Regular Expressions, Finding Patterns of Text with Regular Expressions, More Pattern Matching with Regular Expressions, Greedy and Nongreedy Matching, The findall() Method, Character Classes, Making Your Own Character Classes, The Caret and Dollar Sign Characters, The Wildcard Character, Review of Regex Symbols, Case-Insensitive Matching, Substituting Strings with the sub() Method.

UNIT– 4

Classes and objects, Programmer-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying, Classes and functions, Time, Pure functions, Modifiers, Prototyping versus planning, Classes and methods, Object-oriented features, Printing objects, Another example, A more complicated example, The init method, The __str___method, Operator overloading, Type-based dispatch, Polymorphism, Interface and implementation,Inheritance, Card objects, Class attributes, Comparing cards, Decks, Printing the deck, Add, remove, shuffle and sort, Inheritance, Class diagrams, Data encapsulation

UNIT– 5

Web Scraping, Project: MAPIT.PY with the webbrowser Module, Downloading Files from the Web with the requests Module, Saving Downloaded Files to the Hard Drive, HTML, Parsing HTML with the BeautifulSoup Module, Project: "I'm Feeling Lucky" Google Search,Project: Downloading All XKCD Comics, Controlling the Browser with the selenium Module, Working with Excel Spreadsheets, Excel Documents, Installing the openpyxl Module, Reading Excel Documents, Project: Reading Data from a Spreadsheet, Writing Excel Documents, Project: Updating a Spreadsheet, Setting the Font Style of Cells, Font Objects, Formulas, Adjusting Rows and Columns, Charts, Working with PDF and Word Documents, PDF Documents, Project: Combining Select Pages from Many PDFs, Word Documents, Working with CSV files and JSON data, The csv Module, Project: Removing the Header from CSV Files, JSON and APIs.

Reference Books:

1. Gowrishankar S, Veena A, "Introduction to Python Programming", 1st Edition, CRC Press/Taylor & Francis, 2018. ISBN-13: 978-0815394372

2. Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", 1st Edition, O'Reilly Media, 2016. ISBN-13: 978-1491912058

3. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd, 2015. ISBN-13: 978-8126556014 4. Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365

22220DSC26D	**Client-Server Computing**	5	0	0	4

Course Outcomes:

Knowledge of Advanced UNIX system programming.
 Concept of Computer networks Functions of Operating System.

Course Objectives

- Explain Client-Server software, Context Switching and Protocol Software, I/o.
   Define System Calls, Basic I/O Functions available in UNIX Illustrate socket interface, TCP, UDP in detail.
- Compare various client Software and various algorithms issue related to server software design.

UNIT I CLIENT/SERVER COMPUTING:- DBMS concept and architecture, Single system image, Client Server architecture, mainframe-centric client server computing, downsizing and client server computing, preserving mainframe applications investment through porting, client server development tools, advantages of client server computing.

UNIT II COMPONENTS OF CLIENT/SERVER APPLICATION:- The client: services, request for services, RPC, windows services, fax, print services, remote boot services, other remote services, Utility Services & Other Services, Dynamic Data Exchange (DDE), Object Linking and Embedding (OLE), Common Object Request Broker Architecture (CORBA). The server: Detailed server functionality, the network operating system, available platforms, the network operating system, available platform, the server operating system.

UNIT III CLIENT/SERVER NETWORK:- connectivity, communication interface technology, Interposes communication, wide area network technologies, network topologies (Token Ring, Ethernet, FDDI, CDDI) network management, Client-server system development: Software, Client–Server System Hardware: Network Acquisition, PC-level processing unit, Macintosh, notebooks, pen, UNIX workstation, x-terminals, server hardware.

UNIT IV DATA STORAGE:- magnetic disk, magnetic tape, CD-ROM, WORM, Optical disk, mirrored disk, fault tolerance, RAID, RAID-Disk network interface cards. Network protection devices, Power Protection Devices, UPS, Surge protectors. Client Server Systems Development: Services and Support, system administration, Availability, Reliability, Serviceability, Software Distribution, Performance, Network management, Help Disk, Remote Systems Management Security, LAN and Network Management issues.

UNIT V CLIENT/SERVER SYSTEM DEVELOPMENT:- Training, Training advantages of GUI Application, System Administrator training, Database Administrator training, End-user training. The future of client server Computing Enabling Technologies, The transformational system.

References:

1. Patrick Smith & Steave Guengerich, “Client / Server Computing”, PHI
2. Dawna Travis Dewire, “Client/Server Computing”, TMH
3. Majumdar & Bhattacharya, “Database management System”, TMH
4. Korth, Silberchatz, Sudarshan, “Database Concepts”, McGraw Hill
5. Elmasri, Navathe, S.B, “Fundamentals of Data Base System”, Addison Wesley

22220DSC26E	**Computer Vision**	5	0	0	4

Course objectives:

To introduce students the fundamentals of image formation; To introduce students the major ideas, methods, and techniques of computer vision and pattern recognition; To develop an appreciation for various issues in the design of computer vision and object recognition systems; and To provide the student with programming experience from implementing computer vision and object recognition applications.

Course Outcomes:

After completing the course you will be able to:

- identify basic concepts, terminology, theories, models and methods in the field of computer vision,
- describe known principles of human visual system,
- describe basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition, suggesta design of a computer vision system for a specific problem

UNIT I IMAGE PROCESSING FOUNDATIONS

Review of image processing techniques – classical filtering operations – thresholding techniques – edge detection techniques – corner and interest point detection – mathematical morphology – texture.

UNIT II SHAPES AND REGIONS

Binary shape analysis – connectedness – object labeling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments.

UNIT III HOUGH TRANSFORM

Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location – speed problem – ellipse detection – Case study: Human Iris location – hole detection – generalized Hough Transform (GHT) – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation.

UNIT IV 3D VISION AND MOTION

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline-based motion – optical flow – layered motion.

UNIT V APPLICATIONS

Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians.

REFERENCES:

D. L. Baggio et al., ―Mastering OpenCV with Practical Computer Vision Projects‖, Packt Publishing, 2012.

E. R. Davies, ―Computer & Machine Vision‖, Fourth Edition, Academic Press, 2012. Jan Erik Solem, ―Programming Computer Vision with Python: Tools and algorithms for analyzing images‖, O'Reilly Media, 2012.

Mark Nixon and Alberto S. Aquado, ―Feature Extraction & Image Processing for Computer Vision‖, Third Edition, Academic Press, 2012.

R. Szeliski, ―Computer Vision: Algorithms and Applications‖, Springer 2011.

Simon J. D. Prince, ―Computer Vision: Models, Learning, and Inference‖, Cambridge University Press, 2012.

22220DSC26F	Graphical Programming and Virtual Instrumentation	5	0	0	4

Course Objective:

At the end of the unit, the student will be able to 1. Understand the concepts of Virtual Instrumentation.
2. Understand graphical programming.
3. Understand difference between Virtual Instruments and Traditional Instruments.

Course Outcomes:

At the end of the course, the student will be a CO1: Understand Graphical programming.
CO2: Understand the Data Acquisition concept.
CO3: Develop Virtual Instruments for the Real-Time applications

UNIT-1

Graphical System Design: Introduction, Graphical system design model, Design flow with GSD, Virtual Instrumentation, Virtual instrument and traditional instrument, Hardware and software in virtual instrumentation, Virtual instrumentation for Test, control & design, Graphical system design using LABVIEW, Graphical programming & textual programming.

UNIT-2

Introduction to LabVIEW: Introduction, advantages of LABVIEW software environment, palettes, front panel controls & indicators, Block diagram, Data flow program. Repetition and Loops: For loops, while loops, structure tunnels, terminals inside or outside loops, shift registers, feed-back nodes, control timing, case structure.

UNIT-3

Arrays: Introduction, arrays in LABVIEW, creating one - dimensional array controls, indicators and constants, creating two dimensional arrays, creating multidimensional arrays, initializing array, deleting, inserting, and replacing elements, rows, columns, and pages with in arrays, arrays functions.

UNIT-4

Plotting Data: Types of waveforms, waveform graphs, waveform charts, XY graphs, Intensity graphs & charts, Digital waveform graphs, 3D graphs, customizing graphs & charts, configuring a graph or chart, Displaying special planners on the XY graph.

UNIT-5

File Input/ Output: File formats, file write &read, generating filenames automatically, String handling: string functions, LABVIEW string formats, parsing of strings. Instrument Control: Introduction, GPIB communication, Hardware specification, software architecture, Instrument I/O assistant, VISA, Instrument drivers, serial port communications, using other interfaces.

Text Books:

1. "Virtual Instrumentation using LABVIEW", Jovitha Jerome, PHI, 2010
2. "Virtual Instrumentation using LABVIEW", Sanjay Gupta, Joseph John, TMH, McGraw Hill Second Edition, 2011.

Reference:

"Learning with LabView", Robert H Bishop, Prentice Hall, 2009.

SEMESTER III

Course Code	Course Title	L	T	P	C
22220SEC31	Open Source programming	6	0	0	6

AIM:

To improve the Programming Knowledge of VBScript, JavaScript, Perl & PHP.

OBJECTIVES:

 To have the knowledge of VBScript, JavaScript. To explore the use of Perl & PHP.

UNIT I:

VBScript –VBScript Programming Basics – Working with Operators – Controlling Program flow with VBScript- Working with Functions, Subroutines and Dialog boxes – Data type Conversion Features – Putting it all together with VBScript – using the Script Debugger.

UNIT II:

The Basic of JavaScript: Overview of JavaScript – Object Orientation and JavaScript – General Syntactic Characteristics – Primitives, Operation and Expressions – Screen Output and Keyboard Input – Control Statements – Object Creation and Modification – Arrays – Functions – Constructors – Pattern Matching Using Regular Expressions. JavaScript and Html Documents: The JavaScript Execution Environment – The Document Object Model – Element Access in JavaScript – Events and Event Handling – Handling Events from Body Elements, Button Elements, Text Box and Password Elements – The DOM 2 Event Model – The navigator Object.

UNIT III:

The Basics of Perl: Origins and Uses of Perl – Scalars and their Operations – Assignment Statements and Simple Input and Output – Control Statements – Fundamentals of Arrays – Hashes – References – Functions – Pattern Matching – File Input and Output. Using Perl for CGI Programming: The Common Gateway Interface – CGI Linkage – Query String Format – The CGI .pm Module – Cookies.

UNIT IV:

Introduction to PHP: Origins and Uses of PHP – Overview of PHP – General syntactic characteristics – Primitives, Operation and Expressions – Output – Control Statements – Arrays – Functions – Pattern Matching – Form Handling – Files – Cookies – Session Tracking.

UNIT V:

Database Access through the Web: Relational Databases – An Introduction to the Structured Query Language – Architecture for Database Access – The MySQL Database System – Database Access with Perl and MySQL – Database Access with PHP and MySQL – Database Access with JDBC and MySQL .

OUTCOMES:

- Understand process of executing a PHP-based script on a webserver.
- Be able to develop a form containing several fields and be able to process the data provided on the form by a user in a PHP-based script.
- Understand basic PHP syntax for variable use, and standard language constructs, such as conditionals and loops.
- Understand the paradigm for dealing with form-based data, both from the syntax of HTML forms, and how they are accessed inside a PHP-based script.

REFERENCES:

1. UNIT I: Scot Johnson "Using Active Server Page".
2. UNIT II, III, IV, V: Robert W.Sebesta, "Programming the World Wide Web" Third edition.

Course Code	Course Title	L	T	P	C
22220SEC32	.Net Programming	6	0	0	5

AIM

To cover the fundamental concepts of the .NET framework.

OBJECTIVES

- To gain knowledge in the concepts of the .NET framework and its technologies.
- To get experience in building sample applications of large-scale projects.

UNIT I

Visual basic.NET and the .NET Framework –The elements of Visual Basic .NET

UNIT II

Visual Basic .NET operators-software Design, conditional structures, and controls FlowMethods.

UNIT III

Interfacing with the End user-Asp.NET Applications.

UNIT IV

Web Form Fundamentals – Web Controls – Validation and Rich Controls.

UNIT V

ADO.NET Data Access – Data Binding –Data List, DataGrid, and Repeater.

OUTCOMES:

- Create web-based distributed applications using ASP.NET, SQL Server and ADO.NET
- Utilize DirectX libraries in the .NET environment to implement 2D and 3D animations and game-related graphic displays and audio.
- Utilize the .NET environment to create Web Service-based applications and components.

REFERENCES:

1. The Complete Reference VB.NET – Jeffrey R-Shapiro- Tata McGrawHill Edition 2. The Complete Reference ASP.NET- Matthew MacDonald- Tata McGrawHill Edition

3. Visual Basic .Net Programming -Bible.

4. Visual Basic.Net Black Book- Steven Holzner**.**

Course Code	Course Title	L	T	P	C
22220SEC33L	Open Source programming Lab	0	0	3	

1 Prepare a web page in ASP which displays course submission form using objects.
2 Write a program for addition using VBScript.
3 Write a program for finding maximum number using JavaScript.
4 Develop a web page which display window shrinking using JavaScript
5. Write a program in JavaScript a)OnMouse move b)OnMouse out.
6. Write a Perl script using array find element in list.
7. Write a Perl script for simple manipulation.
8. Develop a PHP program and check message passing mechanism between pages.
9. Develop a PHP program to display student information using MYSQL table.
10. Develop a college application form using MYSQL table.

Course Code	Course Title	L	T	P	C
22220SEC34L	.Net Programming Lab	0	0	3	2

1. Write a program in VB. Net to check whether given number is Odd or Even.
2. Write a program to find maximum from given numbers.
3. Write a program to find are of a circle
4. Design ASP.Net web form using Html Server Controls to enter job seeker's details.
5. Create an ASP.Net web form using Web control to enter E-Mail registration form.
6. Apply appropriate validation techniques in E-Mail registration form using
7. Validation controls.
8. Write an ASP.Net application to retrieve form data and display it the client browser in a table format.
9. Create a web application using ADO.Net that uses which performs basic data Manipulations:

   (i). Insertion (ii) Updating (iii) Deletion (iv) Selection

   Hint: Do operations using Ms-Access and SQL-Server
10. Create an application using Data grid control to access information's from table in SQL server.

Course Code	Course Title	L	T	P	C
22220DSC35C	Data Analysis and Business Intelligence	5	0	0	4

AIM

The chief aim of data analytics is to apply statistical analysis and technologies on data to find trends and solve problems. Data analytics has become increasingly important in the enterprise as a means to analyze and shape business processes, and to improve decision-making and business results.

OBJECTIVES

Expecting to build a solid foundation of business analytics, this course has been designed to impart knowledge of machine learning and statistical methods for data analysis. The course shall also provide sufficient knowledge of python programming language to use for machine learning algorithm and python/R programming for statistical methods. A brief introduction of neural networks and deep learning will also be covered

UNIT 1

Foundation of Data Analytics: - Introduction ,Evolution , Concept and Scopes

, Data , Big Data, Metrics and Data classification, Data Reliability & Validity,

Problem Solving with Analytics, Different phases of Analytics in the business and Data science domain, Descriptive Analytics, Predictive Analytics and

Prescriptive Analytics , Different Applications of Analytics in Business, Text

Analytics and Web Analytics, Skills for Business Analytics , Concepts of Data Science, Basic skills required for understanding Data Science

UNIT II

Descriptive Analytics: Describing and summarizing data sets, measures of central tendency, dispersion, skewness, kurtosis, Correlation. Probability:

Measures of probability, conditional probability, independent event, Bayes' theorem, random variable, discrete (binomial, Poisson, geometric, hypergeometric, negative binomial) and continuous (uniform, exponential, normal, gamma). Expectation and variance, markov inequality, chebyshev's inequality, central limit theorem.

UNIT III

Exploratory data analysis: Data visualization using matplotlib, seaborn libraries, creating graphs (bar/line/pie/boxplot/histogram, etc.), summarizing data, descriptive statistics, univariate analysis (distribution of data), bivariate analysis (cross tabs, distributions and relationships, graphical analysis

UNIT IV

Introduction to SQL and Business Intelligence: Learning SQL query structure with examples, Data management and query system OLTP and OLAP and Their data models, Data warehousing, ETL and data integration Dashboard creation using Tableau, Concepts of

Business intelligence (BI), the relevance of BI in application to analytics industry and different domains.

UNIT V

Descriptive Analytics: Describing and summarizing data sets, measures of central tendency, dispersion, skewness, kurtosis, Correlation. Probability:

Measures of probability, conditional probability, independent event, Bayes' theorem, random variable, discrete (binomial, Poisson, geometric, hypergeometric, negative binomial) and continuous (uniform, exponential, normal, gamma). Expectation and variance, markov inequality, chebyshev's inequality, central limit theorem. Inferential Statistics: Sampling & Confidence Interval, Inference & Significance. Estimation and Hypothesis Testing, Goodness of fit, Test of Independence, Permutations and Randomization Test, ttest/z-test (one sample, independent, paired), ANOVA, chi-square.

References: 1. Kumar, U.D. :Business Analytics – The Science of Data – Driven Decision Making, Wiley. 2. Gert, H.N., Thorlund, L. and Thorlund, J. :Business Analytics for Managers – Taking Business Intelligence Beyond

Reporting, Wiley. 3. Johnson, R.A., Miller, I. and Freund, J. :Probability and

Statistics for Engineers, Pearson. 4. Jose, J. and Lal, S.P. :Introduction to Computing & problem solving with Python, Khanna Publishers.

Course Code	**Course Title**	**L**	**T**	**P**	**C**
22220DSC35C	FUNDAMENTALS OF PHP	5	0	0	4

AIM

PHP (Hypertext Preprocessor) is known as a general-purpose scripting language that can be utilized to create intuitive and dynamic websites. It was among the pioneer server-side language that can be integrated into HTML, making it easier to include functionality to web pages without requiring to call external data.

Outcomes

- How to use PHP's built-in server to serve static resources.
- How to use PHP to add some dynamic aspects to our pages.
- How to use HTML forms.
- The difference between GET and POST requests.

UNIT I Introduction to PHP

Evaluation of Php, Basic Syntax, Defining variable and constant, Php Data type, Operator and Expression. Decisions and loop Making Decisions, Doing Repetitive task with looping, Mixing Decisions and looping with Html.

UNIT II Function

What is a function, Define a function, Call by value and Call by reference, Recursive function, String Creating and accessing, String Searching & Replacing String, Formatting String, String Related Library function

UNIT III Array

Anatomy of an Array, Creating index based and Associative array Accessing array, Element Looping with Index based array, Looping with associative array using each () and foreach(), Some useful Library function. Handling Html Form with Php Capturing Form, Data Dealing with Multi-value filed, and Generating File uploaded form, redirecting a form after submission.

UNIT IV Working with file and Directories

Understanding file& directory, Opening and closing, a file, Coping, renaming and deleting a file, working with directories, Creating and deleting folder, File Uploading & Downloading.

UNITV Session and Cookie

Introduction to Session Control, Session Functionality What is a Cookie, Setting

Cookies with PHP. Using Cookies with Sessions, Deleting Cookies, Registering Session variables, Destroying the variables and Session. 8. Database Connectivity with MySql Introduction to RDBMS, Connection with MySql Database, Performing basic database operation(DML) (Insert, Delete, Update, Select),

Setting query parameter, Executing queryJoin (Cross joins, Inner joins, Outer Joins, Self joins.)
9. Exception Handling Understanding Exception and error, Try, catch, throw. Error tracking and debugging

REFERENCES

- The Joy of PHP Programming: A Beginner's Guide – by Alan Forbes.
- PHP & MySQL Novice to Ninja – by Kevin Yank.
- Head First PHP & MySQL – by Lynn Beighley& Michael Morrison.
- PHP: A Beginner's Guide – by VikramVaswani.
- Murach's PHP & MySQL – by Joel Murach& Ray Harris.

Course Code	Course Title	L	T	P	C
22220DSC35D	Fundamentals of PHP	5	0	0	4

OBJECTIVES:

To provide a basic idea of Open source technology, their software development process to understand the role and future of open source software in the industry along with the impact of legal, economic and social issues for such software.

OUTCOMES

To recognize the benefits and features of Open Source Technology and to interpret, contrast and compare open source products among themselves

UNIT- I

Introduction – Why Open Source – Open Source –Principles, Standards
Requirements, Successes – Free Software – FOSS – Internet Application Projects

UNIT- II

Open source – Initiatives, Principles, Methodologies, Philosophy, Platform,
Freedom, OSSD, Licenses – Copy right, Copy left, Patent, Zero Marginal
Technologies, Income generation opportunities, Internalization

UNIT- III

Case Studies – Apache, BSD, Linux, Mozilla (Firefox), Wikipedia, Joomla, GCC, Open Office.

UNIT- IV

Open Source Project –Starting, Maintaining –Open Source – Hardware, Design, Teaching & Media

UNIT- V

Open Source Ethics – Open Vs Closed Source – Government – Ethics – Impact of Open source
Technology – Shared Software – Shared Source **TEXT BOOK:**

1. KailashVadera, Bhavyesh Gandhi, “Open Source Technology”, Laxmi Publications Pvt Ltd 2012, 1st Edition.

REFERENCES

1. Fadi P. Deek and James A. M. McHugh, “Open Source: Technology and Policy”, Cambridge Universities Press 2007.

Course Code	Course Title	L	T	P	C
22220DSC35E	**Open Source Technologies**	**5**	**0**	**0**	**4**

AIM

To make the computers smarter, more intelligent. The more direct objective in this aspect is to develop systems (programs) for specific practical learning tasks in application domains. (2) To develop computational models of human learning process and perform computer simulations.

OBJECTIVES

To Learn about Machine Intelligence and Machine Learning applications To understand the theoretical and practical aspects of Probabilistic Graphical Models To understand how to perform evaluation of learning algorithms and model selection

COURSE OUTCOMES:

At the end of the course, the students will be able to: Have a good understanding of the fundamental issues and challenges of machine learning: Have an understanding of the strengths and weaknesses of many popular machine learning approaches. Be able to design and implement various machine learning algorithms in a range of real-world applications. Use a tool to implement typical clustering algorithms for different types of applications Design and implement an HMM for a sequence model type of application

UNIT – I INTRODUCTION:

Machine Learning - Machine Learning Foundations –Overview – Design of a Learning system - Types of machine learning –Applications Mathematical foundations of machine learning - random variables and probabilities - Probability

Theory – Probability distributions -Decision Theory- Bayes Decision Theory - Information Theory

UNIT – II SUPERVISED LEARNING: Linear Models for Regression - Linear Models for Classification – Naïve Bayes - Discriminant Functions -Probabilistic Generative Models -Probabilistic Discriminative Models - Bayesian Logistic Regression. Decision Trees - Classification Trees- egression Trees - Pruning. Neural Networks -Feed-forward Network Functions - Back- propagation. Support vector machines - Ensemble methods- Bagging- Boosting

UNIT – III UNSUPERVISED LEARNING: Clustering- K-means - EM Algorithm- Mixtures of Gaussians. The Curse of Dimensionality Reduction - Factor analysis - Principal Component Analysis - Probabilistic PCA- Independent components analysis

UNIT – IV PROBABILISTIC GRAPHICAL MODELS:

Graphical Models - Undirected graphical models - Markov Random Fields - Directed Graphical Models -Bayesian Networks - Conditional independence properties - Inference – Learning-Generalization - Hidden Markov Models - Conditional random fields(CRFs)

UNIT – V ADVANCED LEARNING:

Sampling –Basic sampling methods – Monte Carlo. Reinforcement Learning-
KArmed Bandit-Elements - Model-Based Learning- Value Iteration- Policy
Iteration. Temporal Difference Learning- Exploration Strategies- Deterministic and Nondeterministic Rewards and Actions Computational Learning Theory - Mistake bound analysis, sample complexity analysis, VC dimension. Occam learning, accuracy and confidence boosting

REFERENCES

1. Christopher Bishop, “Pattern Recognition and Machine Learning” Springer,

2007. 2. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.
3. EthemAlpaydin, “Introduction to Machine Learning”, MIT Press,

Third Edition, 2014. 4. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.

Course Title
Real time Operating Systems

Aim:

A real time operating system is intended to serve real time applications that process data as it comes in, typically without buffer delays.

objectives:

- To understand the basics of operating systems tasks and basic OS architectures and
- develop these to RTOS
- To understand concepts of task scheduling
- To understand problems and issues related with multitasking
- To learn strategies to interface memory and I/O with RTOS kernels
- To impart skills necessary to develop software for embedded computer systems using
- a real-time operating system.

Unit I

Operating system objectives and functions, Virtual Computers,Interaction of O.S. & hardware architecture, Evolution of operating systems.Architecture of OS (Monolithic, Microkernel, Layered, Exo-kernel and Hybrid kernel structures).Batch,Multi programming, Multitasking, Multiuser,distributed& real – time O.S.

Unit II

Uniprocessor Scheduling: Types of scheduling:Scheduling algorithms: FCFS, SJF, Priority, Round Robin NIX Multi-level feedback queue scheduling,Thread scheduling, Multiprocessor Scheduling concept concurrency: Principles of Concurrency, Mutual Exclusion. H/W Support, software approaches, Semaphores and Mutex, Message Passing techniques.

Unit III

Deadlock: Principles of deadlock, Deadlock Prevention,Deadlock Avoidance, Deadlock Detection, An Integrated Deadlock Strategies.memory Management requirements,Memorypartitioning:Fixed, dynamic, partitioning.

Unit IV

Memory allocation Strategies (First Fit, Best Fit, Worst Fit,Next Fit), Fragmentation, Swapping, Segmentation, Paging,Virtual Memory, Demand paging.

Unit V

Page Replacement Policies (FIFO,Thrashing, Working Set Model.Operating System Design issues, I/O Buffering, Disk Scheduling (FCFS, SCAN, C-SCAN, SSTF), Disk Caches .

Text Books:

1.C.M. Krishna and G.Shin, Real Time Systems, McGraw-Hill International Edition, 1997.

2.Jean JLabrosse, Embedded Systems Building Blocks Complete and Ready-to-use

Modules in C, CMP books, 2/e, 1999.

References:

1. Jean J Labrosse , Micro C/OS-II, The Real Time Kernel, CMP Books, 2011

2. Sam Siewert, V, Real-Time Embedded Components and Systems: With Linux and RTOS

(Engineering), 2015

3. Tanenbaum, Modern Operating Systems, 3/e, Pearson Edition, 2007.

4. VxWorks: Programmer's Guide 5.4, Windriver, 1999

Course Title
Wireless Communication Network

AIM

To promote the international exchange of information related to Wireless Communication systems.

OBJECTIVES:

- To understand the concepts of Transmission fundamentals.
- To study the functions of TCP/IP suite.
- To describe communication protocols , data transmission modes and satellite communication.

UNIT I

Introduction – Transmission fundamentals.

UNIT II

Communication Networks – Protocols and TCP/IP suite.

UNIT III

Wireless communication Technology – Antennas and propagation – signal encoding technique – spread spectrum – coding & Error control.

UNIT IV

Wireless networking: satellite communication – cellular wireless networks – cordless systems and wireless local loop – mobile IP and wireless Access protocol.

UNIT V

Wireless LANs: Wireless LAN Technology – WiFi and IEEE802.11 –wireless LAN standard – Bluetooth and IEEE 802.15.

OUTCOMES:

Upon Completion of the course, the students should be able to:

- Understand the concepts of Transmission fundamentals.

- Study the functions of TCP/IP suite.
- Describe communication protocols , data transmission modes and satellite communication

REFERENCES:

1. William Stallings "wireless communication & Networks", Second Edition.
2. Blake "wireless communication Technology"
3. Kavehpahlavan,Prashant Krishnamurthy "Principles of Wireless network".

SEMESTER IV

Course Code	Course Title	L	T	P	C
22220SEC41	Software Testing	6	0	0	6

AIM:
To introduce the methodologies involved in the development and maintenance of Software

OBJECTIVES

To be aware of

- Different Life Cycle models software development
- Various Testing methods in software development process

UNIT I

Principles of testing – Software Development lifecycle models.

UNIT II

Testing: White box testing – Black box testing – Integration testing – System acceptance.

UNIT III

Performance – Regression – Internationalization – Adhoc.

UNIT IV

Test planning – Test management – Test process – Test reporting.

UNIT V

Test Metrics and Measurements.

OUTCOMES:

- Test the software by applying testing techniques to deliver a product free from bugs

- Evaluate the web applications using bug tracking tools.
- Investigate the scenario and the able to select the proper testing technique
- Explore the test automation concepts and tools
- Deliver quality product to the clients by way of applying standards such as TQM, Six Sigma
- Evaluate the estimation of cost, schedule based on standard metrics

REFERENCES:

1. "Software Testing principles and practices " bysrinivasanDesikangopalswamy Ramesh.

2." Effective methods for software testing" by William E.perry, Third Edition.

Course Code	Course Title	L	T	P	C
22220SEC42	Human Computer Interaction	6	0	0	5

AIM:

To have a thorough knowledge about Human Computer Interaction.

OBJECTIVES

 To understand the concept of HCI Ergonomics and WIMP interface.
To learn about Heuristic process and Evaluation techniques.

UNIT I

The interaction: Introduction - Models of interaction - Frameworks and HCI - Ergonomics - Interaction Styles - Elements of WIMP interface - Interactivity - The Contex of the interaction - Paradigm: Introduction - Paradigms for interaction.

UNIT II

Interaction Design basics: Introduction - what is design? - User focus - Scenarios - Navigation design - Screen design and layout - Interaction and prototyping - HCI in the software process: Introduction - The software lifecycle - Usability engineering – interactive design and prototyping – Design rationale.

UNIT III

Design rules: Introduction - Principles to support usability - Standards – Guidelines-Golden rules and heuristics - HCI patterns - Implementation Support: Introduction -elements of windowing systems - Programming the application - Using toolkits- User interface management systems.

UNIT IV

Evaluation techniques: What is evaluation - Goals of evaluation - Evaluation through expert analysis - Evaluation through user participation - Choosing an evaluation method - Universal Design: Introduction - Universal design principles - Multi-modal interaction - Designing for diversity.

UNIT V

User Support: Instruction - Requirements of user support - Approaches to user support - Adaptive help system - Designing user support systems.

OUTCOMES:

Upon completion of the course, the student should be able to:

- Design effective dialog for HCI.
- Design effective HCI for individuals and persons with disabilities.
- Assess the importance of user feedback.
- Explain the HCI implications for designing multimedia/ ecommerce/ elearning Websites.

REFERENCES:

1. "**Human-computer Interaction**" - Alan Dix - Pearson Education - 2004.

Course Code	Course Title	L	T	P	C
22220 DSC 43 _	MULTIMEDIA SYSTEMS	4	0	0	4

AIM:

To enable the students to learn the multimedia Systems and its applications.

OBJECTIVES:

- To making multimedia presentation.
- To learn the Multimedia animation.
- To study about multimedia and Internet concepts

UNIT-I:

Introduction – Definition- Multimedia Hardware- Multimedia Software- MULTIMEDIA networking- Multimedia Applications- Multimedia Environments- Multimedia Computer Components- Multimedia Standards- Multimedia PC.

UNIT-II:

Multimedia Information Systems: Limitations in workstation operating systems. Middleware System Services Architecture: Goals of Multimedia System Services- Multimedia System Services Architecture Text: Elements of Text- Using Text in Multimedia Applications- Graphics: Element of Graphics- Images and Color- Graphics file and Application Formats- Obtaining Images for Multimedia use- Using Graphics on Multimedia Applications.

UNIT-III:

Digital Audio Representation and Processing: Uses of Audio in Computer Applications- Digital Representations of sound- Transmission of Digital Sound- Digital Audio Signal Processing, Video Technology: Raster Scanning Principles- Sensors for TV Cameras- Color fundamentals- Color Video- Digital Video and Image Compression: Evaluating Compression System- Video CompressionTechniques- JPEG Image Compression Standard- MPEG motion Video Compression Standard.

UNIT-IV:

Multimedia Communications Systems: Applications Network Services- Network Protocols. Multimedia Conferencing: Teleconferencing systems- Requirements for Multimedia Communications- Multimedia Conferencing Architectures.

UNIT-V:

Multimedia and Internet: Internet- Client/Server Technology-

Communications protocol- Internet Addressing- Internet Functions- HTML and Web Authoring. Multimedia development Team: Team Approach- Assembling multimedia Production Team- Multimedia Development Process: Multimedia Project- Structured Multimedia development- casting multimedia project.

OUTCOMES:

- Enhance the perspective of modern computer system with modeling, analysis and interpretation of 2D and 3D visual information.
- Able to understand different realizations of multimedia tools
- Able to develop interactive animations using multimedia tools
- Gain the knowledge of different media streams in multimedia transmission

REFERENCE BOOK:

1. **For Unit I:** TayVaugham, "**Multimedia making it work**", 4th Edition Tata McGraw – Hill Edition, 2000.
2. **For Units II,III,IV:** John F.KoegelBuferd, "Multimedia Systems", Published by Addison Wesley Longman, 3rd Edition year 2000.
3. **For Unit V:** David Hillman, "Multimedia Technology and Applications", Galgotia Publications Pvt. Ltd., year 1998.

Cours e Code	Course Title	L	T	P	C
22220DSC43_	MIDDLEWARE TECHNOLOGY	4	0	0	

Aim:

To faster interaction between different aspects of an application or even between applications themselves.

Objectives

- To provide a simple environment to manage complex, heterogeneous and distributed infrastructures.
- It can be defined as a layer that is placed above an operating system or networking software and below the application tier.

UNIT I INTRODUCTION

Emergence of Middleware – Objects, Web Services – Middleware Elements – Vendor

Architecture – Interoperability – Middleware in Distributed Applications – Types of Middleware – Transaction-Oriented Middleware – MOM – RPC.

UNIT II OBJECT ORIENTED MIDDLEWARE

OOM – Developing with OOM – Heterogeneity – Dynamic Object Request – Java RMI –COM+.

UNIT III COMPONENT OBJECT RESOURCE BROKER ARCHITECTURE (CORBA)

Naming – Trading – Life Cycle – Persistence – Security – CORBA.

UNIT IV WEB SERVICES

Introduction – XML Web Services standards – Creating Web Services – Extending Web

Services – Messaging Protocol – Describing – Discovering – Securing.

UNIT V OTHER TYPES OF MIDDLEWARE

Real-time Middleware – RT CORBA – Multimedia Middleware – Reflective Middleware

– Agent-Based Middleware – RFID Middleware.

REFERENCES BOOKS

1. Chris Britton and Peter Eye, “IT Architecture and Middleware”, Pearson Education, 2nd Edition, 2004.
2. Wolfgang Emmerich, “Engineering Distributed Objects”, John Wiley, 2000.
3. Keith Ballinger, “.NET Web Services – Architecture and Implementation”, Pearson
   Education, 2003. (Unit IV).
4. Qusay H. Mahmoud, “Middleware for Communications”, John Wiley and Sons,2004.
5. Gerald Brose, Andreas Vogel, Keith Duddy, “JavaTM Programming with CORBATM: Advanced Techniques for Building Distributed Applications”, Wiley, 3rd edition, January, 2004.
6. Michah Lerner, “Middleware Networks: Concept, Design and Deployment of Internet
   Infrastructure”, Kluwer Academic Publishers, 2000.

Course Code	Course Title	L	T	P	C
22220DSC43C	Telecommunication Networks and optimization	4	0	0	4

AIM

The purpose of a telecommunication system is to exchange information among users of the system.

OUTCOMES

Radio network optimization is performed to improve the performance of the network with existing resources. The goal is to better utilize existing network resources, to solve existing and potential problems and to identify possible solutions for future planning.

UNIT I - CHARACTERIZATION OF COMMUNICATION SIGNALS AND SYSTEMS

Signal space representation of waveforms, Digital modulation schemes: PAM, QAM, CPFSK, CPM, Power spectrum of digitally modulated signals.

UNIT II - DESIGN OF OPTIMUM RECEIVERS

Signal design for band-limited channels, Optimum receivers for channels with ISI and AWGN: ML and MLSE receivers.

UNIT III - CARRIER AND SYMBOLSYNCHRONIZATION

Carrier and symbol synchronization, carrier phase estimation: Decision directed loops, symbol timing estimation: Types of symbol timing estimation

UNIT IV - EQUALIZATION

Linear Equalization: MSE Criterion, Decision Feedback equalizers, Adaptive equalization: Zero-forcing algorithm, LMS algorithm, Adaptive decision-feedback equalizer.

UNIT V – DIGITAL COMMUNICATION THROUGH FADING MULTIPATH CHANNEL

Characterization of fading multipath channels, Diversity techniques for fading multipath channels, Trellis coded modulation for fading channels.Channel models for multiple antenna systems, capacity of MIMO channels

REFERENCES

1. John. G, Proakis, MasoudSalehi "Digital Communications", McGraw Hill, 5e, reprint 2015. 2. Bernard Sklar, Pabitra Kumar Ray, “Digital Communications – Fundamentals and Applications”, Pearson Publications, 2e, 2009

Course Code	Course Title	L	T	P	C
22220DSC43D	Image Processing	4	0	0	4

COURSE OBJECTIVES:

To Learn about Machine Intelligence and Machine Learning applications

To understand the theoretical and practical aspects of Probabilistic Graphical Models

COURSE OUTCOMES:

At the end of the course, the students will be able to: Have a good understanding of the fundamental issues and challenges of machine learning: Have an understanding of the strengths and weaknesses of many popular machine learning approaches. Be able to design and implement various machine learning algorithms in a range of real-world applications. Use a tool to implement typical clustering algorithms for different types of applications Design and implement an HMM for a sequence model type of application

AIM

To understand how to perform evaluation of learning algorithms and model selection

UNIT – I INTRODUCTION:

Machine Learning - Machine Learning Foundations –Overview – Design of a Learning system - Types of machine learning –Applications Mathematical foundations of machine learning - random variables and probabilities - Probability

Theory – Probability distributions -Decision Theory- Bayes Decision Theory - Information Theory

UNIT – II SUPERVISED LEARNING:

Linear Models for Regression - Linear Models for Classification – Naïve Bayes - Discriminant Functions -Probabilistic Generative Models -Probabilistic Discriminative Models - Bayesian Logistic Regression. Decision Trees - Classification Trees- egression Trees - Pruning. Neural Networks -Feed-forward Network Functions - Back- propagation. Support vector machines - Ensemble methods- Bagging- Boosting

UNIT – IIIUNSUPERVISED LEARNING:

Clustering- K-means - EM Algorithm- Mixtures of Gaussians. The Curse of Dimensionality Reduction - Factor analysis - Principal Component Analysis - Probabilistic PCA- Independent components analysis

UNIT – IV PROBABILISTIC GRAPHICAL MODELS:

Graphical Models - Undirected graphical models - Markov Random Fields - Directed Graphical Models -Bayesian Networks - Conditional independence properties - Inference – Learning- Generalization - Hidden Markov Models - Conditional random fields(CRFs)

UNIT – V ADVANCED LEARNING:

Sampling –Basic sampling methods – Monte Carlo. Reinforcement Learning- KArmed Bandit-Elements - Model-Based Learning- Value Iteration- Policy Iteration. Temporal Difference Learning- Exploration Strategies- Deterministic and Nondeterministic Rewards and Actions Computational Learning Theory - Mistake bound analysis, sample complexity analysis, VC dimension. Occam learning, accuracy and confidence boosting

REFERENCES:

1. Christopher Bishop, “Pattern Recognition and Machine Learning” Springer,

2007. 2. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.

Course Code	Course Title	L	T	P	C
22220DSC43E	Mobile Communication	4	0	0	

AIM

Mobile Communication is the use of technology that allows us to communicate with others in different locations without the use of any physical connection (wires or cables). Mobile communication makes our life easier, and it saves time and effort.

OUTCOMES

The student will be able to understand the new trends in mobile/wireless communications networks. understand multiple radio access techniques. analyse various routing algorithms used in mobile/wireless networks. identify the issues in transport and application layers.

UNIT I INTRODUCTION

Introduction to Mobile Computing — Applications of Mobile Computing- Generations of Mobile Communication Technologies-MAC Protocols — SDMA- TDMA- FDMA- CDMA

UNIT II MOBILE TELECOMMUNICATION SYSTEM

GSM — Architecture — Protocols — Connection Establishment — Frequency Allocation — Routing — Mobility Management — Security –GPRS- UMTS- Architecture

UNIT III WIRELESS NETWORKS

Wireless LANs and PANs — IEEE 802.11 Standard — Architecture — Services — Blue Tooth- Wi-Fi — WiMAX

UNIT IV MOBILE NETWORK LAYER

Mobile IP — DHCP — AdHoc– Proactive and Reactive Routing Protocols — Multicast Routing- Vehicular Ad Hoc networks (VANET) –MANET Vs VANET — Security

UNIT V MOBILE TRANSPORT AND APPLICATION LAYER

Mobile TCP– WAP — Architecture — WDP — WTLS — WTP –WSP — WAE — WTA Architecture — WML

REFERENCES

A Brief History of Everything Wireless:PetriLauniainen was the vice president at Nokia, and CTO at Nokia's former Brazilian research laboratory, INDT and has more than twenty years of experience in RF and wireless communication technologies.

Course Code	Course Title
22220DSC43F	**Resource Management Techniques**

AIM

- Be familiar with resource management techniques.
- Learn to solve problems in linear programming and Integer programming.
- Be exposed to CPM and PERT.

OUTCOMES

Upon Completion of the course, the students should be able to:

- Solve optimization problems using simplex method.
- Apply integer programming and linear programming to solve real-life applications. Use PERT and CPM for problems in project management

Unit I

LINEAR PROGRAMMING
Principal components of decision problem – Modeling phases – LP formulation and graphic solution – Resource allocation problems – simplex method – sensitivity analysis.

Unit II

DUALITY AND NETWORKS
Definition of dual problems – primal – Dual relationships – Dual simplex method post optimality analysis – Transportation and assignment model – Shortest route problem.

Unit IV

CLASSICAL OPTIMISATION THEROY

Unconstrained external problems, Newton – Ralphson method – Equality constraints - Jacobean methods – Lagrangian method – Kuhn – Tucker conditions – Simple problems.

Unit V

OBJECT SCHEDULOING:

Network diagram representation – Critical path method – Time charts and resource leveling -PERT.

Reference Books:

1. Paneerselvam, ‘Operations Research’ Prentice Hall of India, 2002.
2. Anderson ‘Quantitative Methods for Business’, 8th Edition, Thomson Learning, 2002.
3. Winston ‘Operations Research for Business’, Thomson Learning, 2003.
4. Vohra, ’Quantitative Techniques in Management’, Tata McGraw Hill, 2002.
5. Anandsarma, ‘Operation Research’ Himalaya Publishing House, 2003.

Course Title
Open Elective – Applicable Mathematical Techniques

Aim:

- To acquaint with the basic concept of Interpolation.

Objectives:

- Understand the basic concept of Interpolation.
- To enhance the knowledge about Assignment Problems, Replacement Problems, Decision Analysis and Game Theory.

Outcomes:

- Students using OR techniques in business tools for decision making
- Students develop Assignment problem and Replacement problems
- Understand the concept of decision analysis and game theory
- Students gets the knowledge about interpolation

UNIT I

Interpolation with unequal intervals: Newton's, Lagrage's, and inverse interpolation

UNIT II

Assignment Problems

UNIT III

Replacement Problems

UNIT IV

Decision Analysis

UNIT V

Game Theory

References

Unit I, “Numerical Methods in Science and Engineering” M.K.Venkatraman

Units II to V, “Operations Research”, Kantiswarup, P.K. Gupta and Manmohan

Course Title
Open Elective - Herbal Medicine

Aim:

- Be able to advise and educate effectively to create a comprehensive wellness plan incorporating herbal, dietary and lifestyle recommendations integrating selfawareness and lessons of nature

Objective

- Possess knowledge of traditional herbal systems as well as an understanding of the principles and practices of modern Western herbalism
- Demonstrate the ability to critically analyze herbal research and contribute to the current body of herbal literature

- Know how to integrate knowledge of raw materials, formulation, and herbal pharmacy for product development purposes
- Know how to effectively educate individuals and groups about herbs o Be able to demonstrate basic skills in herb identification, harvesting, and preparation
  o Be able to address potential safety concerns including herb-drug interactions

Outcomes

- Accurately gather information regarding past and current health status while differentiating between phenomena and the client's interpretation of phenomena
- Synthesize the above information to create a comprehensive assessment of health inputs and processes
- Work with clients to develop individualized goals and a plan for health and wellness

Unit I

Tribal medicine – methods of disease diagnosis and treatment – Plants in folk religion – Aeglemarmelos, Ficusbenghalensis, Curcuma domestica, Cyanodondactylon and Sesamumindicum.

Unit II

Traditional knowledge and utility of some medicinal plants in Tamilnadu – Solanumtrilobatum, Cardiospermumhalicacabum, Vitexnegundo, Adathodavasica, Azadirachtaindica, Gloriosasuperba, Eclipta alba, Aristolochiaindica and Phyllanthusfraternus.

Unit III

Plants in day today life – Ocimum sanctum, Centellaasiatica, Cassia auriculata, Aloe vera. Nutritive and medicinal value of some fruits (Guava, Sapota, Orange, Mango, Banana, Lemon, Pomegranate) and vegetables - Greens (Moringa, Solanumnigrum Cabbage).

Unit IV

Allergens – types – sources – active principles – Chemical nature – Cell modifiers – Lectins – mutagens, teratogens – Allergic reactions with known examples.

Unit V

Cardiovascular diseases – blood pressure – cardiac drugs of plant origins – alkaloids, anticoagulants – basic mechanism of action. Pulmonary / respiratory disorders – asthma – bronchitis – common cold – allergy – Remedy from plants.

References

1. Tribal medicine – D.C. Pal & S.K. Jain Naya Prakash, 206, BidhanSarani, Calcutta , 1998
2. Contribution to Indian ethnobotany – S.K. Jain, 3rd edition, Scientific publishers, B.No. 91, Jodhpur, India. 2001
3. A Manual of Ethnobotany – S.K.Jain, 2nd edition, 1995.
4. Kumar, N.C., An Introduction to Medical botany and Pharmacognosy. Emkay Publications, New Delhi. 1993.

Course Title
Green Chemistry

Objectives:

To learn about the environmental status, public awareness in evolution, principles involved in green chemistry, bio-catalytic reactions, global warming and its control measures, availability of green analytical methods.

Unit I - Introduction

Introduction-Current status of chemistry and the Environment-Evolution of the Environmental movement: Public awareness - Dilution is the solution to pollutionPollution prevention.

Unit II - Principles

Green Chemistry – Definition – Principles of Green Chemistry - Why is this new area of Chemistry getting to much attention - Why should chemist pursue the Goals of Green Chemistry - The roots of innovation – Limitations.

Unit III - Bio Catalytic Reactions

Green Chemistry Using Bio Catalytic Reactions – Introduction - Fermentation and Bio transformations - Production of Bulk and fine chemicals by microbial fermentationAntibiotics – Vitamins - Bio catalyses synthesis of industrial chemicals by bacterial constructs - Future Tends.

Unit IV - Green House Effect

Green house effect and Global Warming – Introduction - How the green house effect is produced - Major sources of green house gases - Emissions of CO_2 - Impact of green house effect on global climate - Control and remedial measures of green house effect - Global warming a serious threat - Important points.

Unit V - Green Analytical Methods

Future trends in Green Chemistry - Green analytical methods, Redox reagents, Green catalysts; Green nano-synthesis, Green polymer chemistry, Exploring nature, Biomimetic, Proliferation of solvent-less reactions; Non-covalent derivatization, Biomass conversion, emission control **Outcomes:**

- To understand the environmental status and evolution.
- To know about the Pollution and its prevention measures.
- To familiarize the green chemistry.
- To learn about the bio-catalytic reactions.
- To understand about the vitamins and antiobiotics.
- To expertise the global warming and its effects.
- To learn about the control and remedial measures of green house effect.
- To know about the various analytical green methods

Course Title
Project work

Each student will develop and implement individually developed application

software based on any of the latest technologies.

Research Integrated Curriculum

The relationship between teacher and learner is completely different in higher education from what it is in school. At the higher level, the teacher is not there for the sake of the student, both have their justification in the service of scholarship. For the students who are the professionals of the future, developing the ability to investigate problems, make judgments on the basis of sound evidences, take decisions on a rational basis and understand what they are doing and why is vital. Research and inquiry is not just for those who choose to pursue an academic career. It is central to professional life in the twenty-first century.

It is observed that the modern world is characterized by heightened levels of complexity and uncertainty. Fluidity, fuzziness, instability, fragility, unpredictability, indeterminacy, turbulence, changeability, contestability: these are some of the terms that mark out the world of the twenty-first century. Teaching and research is correlated when they are co-related. Growing out of the research on teaching- research relations, the following framework has been developed and widely adopted to help individual staff, course teams and whole institutions analyse their curricula and consider ways of strengthening students understanding of and through research. Curricula can be:

Research – Led: Learning about current research in the discipline

Here the curriculum focus is to ensure that what students learn clearly reflects current and ongoing research in their discipline. This may include research done by staff teaching them.

Research – Oriented: Developing research skills and techniques

Here the focus is on developing student's knowledge of and ability to carry out the research methodologies and methods appropriate to their discipline(s)

Research – Based: Undertaking research and inquiry

Here the curriculum focus is on ensuring that as much as possible the student learns in research and or inquiry mode (i.e. the students become producers of knowledge not just consumers). The strongest curricula form of this is in those special undergraduate programmes for selected students, but such research and inquiry may also be mainstreamed for all or many students.

Semester	RSB Courses	Credits
I	Research Led Seminar	1
II	Research Methodology	3
II	Participation in Bounded Research	2
III	Design Project/ Socio Technical Project (Scaffolded Research)	4
IV	Project Work	12

Research- Tutored: engaging in research discussions

Here the focus is on students and staff critically discussing ongoing research in the discipline.

All four ways of engaging students with research and inquiry are valid and valuable and curricula can and should contain elements of them.

Moreover, the student participation in research may be classified as,

Level 1: Prescribed Research

Level 2: Bounded Research

Level 3: Scaffolded Research

Level 4: Self actuated Research

Level 5: Open Research

Taking into consideration the above mentioned facts in respect of integrating research into the M.Sc.,(CS) curriculum, the following Research Skill Based Courses are introduced in the curriculum.

Blueprint for assessment of student's performance in Research Led Seminar Course

- **Internal Assessment: 40 Marks**
- Seminar Report (UG)/Concept Note(PG) : 5 X 4= 20 Marks
- Seminar Review Presentation : 10 Marks
- Literature Survey : 10 Marks
- **Semester Examination : 60 Marks**

(Essay type Questions set by the concerned resource persons)

Blueprint for assessment of student's performance in Socio Technical Project

- **Continuous Internal Assessment through Reviews: 40 Marks**
- Review I : 10 Marks
- Review II : 10 Marks
- Review III : 20 Marks
- **Evaluation of Socio Technical Practicum Final Report: 40 Marks**
- **Viva- Voce Examination: 20 Marks**
- **Total: 100 Marks**

Blueprint for assessment of student's performance in Research Methodology Courses

Continuous Internal Assessment: 20 Marks

- Research Tools(Lab) : 10 Marks

- Tutorial: 10 Marks

Model Paper Writing: 40 Marks

- Abstract: 5 Marks
- Introduction: 10 Marks
- Discussion: 10 Marks
- Review of Literature: 5 Marks
- Presentation: 10 Marks

Semester Examination: 40 Marks

Total: 100 Marks

PRIST DEEMED TO BE UNIVERSITY
NAAC ACCREDITED
THANJAVUR – 613 403 - TAMILNADU

1.1.2 Total number of courses having focus on employability/ entrepreneurship/ skill development offered by the University during the year

SCHOOL ARTS AND SCIENCE

DEPARTMENT OF BIOTECHNOLOGY

M.Sc. BIOTECHNOLOGY CURRICULUM

REGULATION 2022

PRIST DEEMED TO BE UNIVERSITY
NAAC ACCREDITED
THANJAVUR – 613 403 - TAMIL NADU

SCHOOL ARTS AND SCIENCE

M.Sc., BIOTECHNOLOGY– REGULATION 2022

M. Sc., Graduate Attributes

- Research, inquiry and analytical thinking abilities.
- Capability and motivation for intellectual development.
- Ethical, social and professional understanding.
- Communication in intra and inter disciplinary
- Teamwork, collaborative and management skills in scientific research
- Information literacy in respective discipline

M. Sc., Program Educational Objectives - PEO

- PEO-1To gain and apply knowledge of Biotechnology concept to solve the problems.
- PEO-2 To identify, analyse and understand the problems related to biotechnology.
- PEO-3 Ability to design and develop solution to biotechnology.
- PEO-4Ability to design, perform experiments, analyse, and interpret data for investigating complex problems.
- PEO-5 To decide and apply appropriate tools and techniques in biotechnologicals manipulations

M. Sc., Program Outcome - PO

- PO-1 Facilitates the students to acquire knowledge in biotechnology.
- PO-2 Learn about the usage of statistical tools in biological systems.
- PO-3 Analyses to leran the recent developments in the field of human genome and gene concepts.
- PO-4 Analyse the importance of classification of Biological system.
- PO-5 To understand the basic unit of the organism.

PRIST DEEMED TO BE UNIVERSITY
NAAC ACCREDITED
THANJAVUR – 613 403 - TAMILNADU

SCHOOL ARTS AND SCIENCE

M.Sc., BIOTECHNOLOGY– REGULATION 2022

EMPLOYABLITY
SKILL DEVELOPMENT
ENTREPRENEURSHIP
EMPLOYABLITY/ SKILL DEVELOPMENT

COURSE STRUCTURE

Course Code	Course Title	L	T	P	C
	SEMESTER I				
22217SEC11	General Microbiology	6	1	0	5
22217SEC12	Molecular Genetics	6	1	0	5
22217SEC13	Biochemistry	6	1	0	4
22217SEC14L	Microbiology & Molecular Genetics – Lab	0	0	4	2
22217DSC15_	Discipline specific elective I	5	0	0	4
22217RLS16	Research Led Seminar	-	-	-	1
	Total	**23**	**3**	**4**	**21**
	SEMESTER II				
22217SEC21	Cell & Molecular Biology	5	1	0	5
22217SEC22	Biophysics & Bioinformatics	5	1	0	5
22217SEC23	Industrial Biotechnology	5	0	0	4
22217SEC24L	Molecular Biology & Industrial Biotechnology – Lab	0	0	4	2
22217DSC25_	Discipline specific elective II	5	0	0	4
22217RMC2	Research Methodology	3	0	0	2

6					
22217BRC27	Participation in Bounded Research	-	-	-	2
	Total	**23**	**2**	**4**	**24**
	SEMESTER III				
22217SEC31	Genomics	6	1	0	6
22217SEC32	Proteomics	6	1	0	6
22217SEC33L	Genomics & Proteomics - Lab	0	0	5	3
22217DSC34_	Discipline specific elective III	5	0	0	4
222_OEC	Open Elective	4	0	0	3
22217SRC35	Design\socio technical research	-	-	-	2
	Total	**21**	**2**	**5**	**24**
	SEMESTER IV				
22217SEC41	Food Technology	6	1	0	6
22217SEC42	Bio instrumentation	6	1	0	6
22217SEC43L	Food technology and Bio instrumentation lab	0	0	5	3
22217DSC44	Discipline specific elective IV	5	0	0	4

22217PRW45	Project work	-	-	-	6
22217PEE	Programme Exit Examination	-	-	-	2
	Total	**17**	**2**	**5**	**27**
	Total Credits for the Programme				**96**

Discipline specific Electives

Semester	**Discipline specific Elective Courses-I**
I	a) 22227DSC15A- Immunology b) 22227DSC15B- Biosafety and biodiversity
	Discipline specific Elective Courses-II
II	a) 22227 DSC25A- Endocrinology b) 22227 DSC25B- Bioethics and IPR
	Discipline specific Elective Courses-III

III	a) 22227 DSC34A- Nanobiotechnology b) 22227 DSC34B- Environmental biotechnology
IV	**Discipline specific Elective Courses-IV**
	a) 22227 DSC44A-Gene theraphy utilization pharmocology b) 22217 DSC44B- Plant conservation & disaster management

Open Electives

Semester	**Open Elective Courses**
III	a) 222ENOEC-Writing for the media b) 222MAOEC-Applicable Mathematics Techniques c) 222PHOEC-Bio-Medical Instrumentation d) 222CHOEC-Green Chemistry e) 222CSOEC – M-Marketing f) 222CMOEC- Financial Services

CREDIT DISTRIBUTION

SEM	SEC	DSC	OEC	RSB COURSES	OTHERS	TOTAL
I	16	4	-	1	-	21
II	16	4	-	4	-	24
III	15	4	3	2	-	24
IV	15	4	-	6	2	27
Total	**62**	**16**	**3**	**13**	**2**	**96**

M.Sc., BIOTECHNOLOGY

C1- General Microbiology
C2 - Molecular Genetics
C3- Biochemistry
C4 - Microbiology & Molecular Genetics – Lab
C5 - Research Led Seminar
C6- Cell & Molecular Biology
C7 - Biophysics & Bioinformatics
C8 - Industrial Biotechnology
C9 - Molecular Biology & Industrial Biotechnology – Lab
C10 - Research Methodology
C11- Participation in Bounded Research
C12- Genomics
C13- Proteomics
C14- Genomics & Proteomics Lab

C15- Design/Socio technical research C16- Food Technology
C17- Bio instrumentation
C18- Food technology and bioinstrumentation lab
C19- Discipline Specific elective I –IV
C20- Project Work

M. Sc., CURRICULUM MAPPING

Programme Educational Objectives VS Programme Outcome

POs	1	2	3	4	5
PEO I	*		*		
PEO II	*		*	*	*
PEO III	*	*	*	*	*
PEO IV		*		*	
PEO V	*		*		*

M. Sc., Curriculum
Mapping Programme Outcome VS Course Outcome

Programme Outcome - PO Course Outcome - CO	PO 1	PO2	PO3	PO4	PO5
CO1	*	*	*	*	*
CO2	*	*		*	*
CO3	*	*	*	*	*
CO4	*	*	*		
CO5	*	*	*	*	*
CO6	*	*	*	*	*
CO7				*	*
CO8	*	*	*	*	*
CO9				*	*
CO10	*	*	*	*	*

CO11			*	*	*
CO12	*	*	*	*	*
CO13	*	*	*	*	*
CO14				*	*
CO15	*	*	*	*	*
CO16				*	*
CO17	*	*	*	*	*
CO18		*	*	*	*
CO19	*	*	*	*	*
CO20	*	*	*		

SEMESTER I

Course Code	GENERAL MICROBIOLOGY	L	T	P	C
22217AEC11		6	1	0	5

AIM:

- This paper provides the knowledge about different types of microorganisms and their identification techniques in modern biology and there by the usefulness of the techniques in research and commercial purposes.

OBJECTIVES:

- In order to make the students to understand the identification of microorganisms using advanced microbiological methods and applications of microorganisms.

OUTCOMES:

- Students can gain the idea of how to identify the microorganisms based on the modern polyphasic approach.

Unit I

Definition and historical account of microbiology. Diversified microbial world-Classification of microbes based on Whittaker's five kingdom system of classification. Structure of Algae, Bacteria, Fungi and Virus.

Unit II

Nutritional requirements and growth cycles of the above mentioned groups. Media forgrowth: Types, preparation, methods of sterilization. Isolation and enumeration ofmicroorganisms in soli,, water and air. Isolation of microorganisms from contaminated food. Techniques of pure culture, maintenance and preservation; staining: stains anddyes, types of staining; General techniques involved in Virology and Protozoology.

Unit III

Microbial physiology: Factors influencing the growth of microbes-classification based on the temperature, pH, nutrition, symbiotic associations, commonsals, saprophytes, etc., Microbiology of fermented foods-dairy products, meat and fish, alcoholic beverages-beer, wine etc., Food spoilage and preservation process. Microbes as source of food.Application of microbes in industries production of antibiotics, amino acids, organicacids, bioconversion process, microbial insecticides.

Unit IV

Biochemistry of Metabolism: Carbohydrates and energy metabolism – fermentation or glycolysis, TCA cycle and oxidative phosphorylation, ammonia metabolism. Biosynthesis of glutamate.

Purine and pyrimidine biosynthesis. Synthesis of DNA andRNA. Biosynthesis of cell wall – Peptidogylcon and Teichoic acid.

Unit V

Microbes as components of the environment –nutrient cycles – C, N, S, H, O, Mn, K,Mg, Cl and phosphorus cycles, Degradation of industrial wastes, petroleumhydrocarbons, pesticides, biofouling and corrosion. Bacterial photosynthesis, symbioticand non-symbiotic nitrogen fixation, antimicrobial agents – structure of antibiotics, antibacterial and antiviral (function &mechanism of action)

Book references:

- Fundamental Principles of Bacteriology – A.J. Salle
- Microbiology – Michael J. Pelchar, E.C.S. Chan Noel R. Krieg.
- Microbial Physiology – Albert G. Moat and John W. Foster – Willey –

  Interscience Publication
- Food Microbiology – W.C. Frazier and D.C. Westhoff, Tata Mcgra Hill Publication
- Microbial Biotechnology – Alexander N. Glazer, Hiroshni-Kaido, W.H. Freemanand Co. 1995.
- Chemical Microbiology – Antony H. Rose, Butterworths, 3rd Edition, PlenumPress, 1976.

Course Code	Molecular genetics	L	T	P	C
22217AEC12		6	1	0	5

AIM:

- This paper in genetics has been structured to give the student an in depth knowledge of the organization of the genome in prokaryotes and eukaryotes, the principles of genetic inheritance and other vital aspects such as Hardy Weinberg law, pedigree analysis and the genetic basis of disease inheritance.

OBJECTIVE:

- The major objective of the paper is to envisage thorough knowledge in genetics and genome organizations in organisms.

OUTCOME:

- After successful completion of the paper the students will get an overall view about genetic makeup of organisms and can take up a career in research.

Unit I

Gene as the unit of mutation and recombination. Identification of DNA as the geneticmaterial. Mutations: Molecular nature, mutagenesis by nitrous acid, hydroxylamine,alkylating agents, intercalators and UV, origin of spontaneous mutations and control,parasexual process in bacteria, transformation, transduction and conjugal gene transferthe phenomena, mechanisms and applications. Fine structure genetic analysis withexamples.

Unit II

Recombinations – Control, models and mechanisms. Gene as the unit of expression.Gene – cistron relationship in prokaryotes and eukaryotes. Colincarity of gene andpolypeptide. Elucidation of the genetic code. Wobble base pairing. Suppression ofnonsense, missense and frameshift mutations. Regulation of gene expression inprokaryotes and eukaryotes. The operon concept – positive and negative control,attention control. Control sequences, promoter, operator, terminator and attenuator, DNAmethylation and epigenic regulation.

Unit III

DNA damage and repair DNA damage by UV, alkylating agents, cross linkers.Mechanisms of repair – photoactivation, excision repair, recombinational repair. TheSOS and adoptive responses and their regulation, heat shock response.

Unit IV

Extrachromosoal heredity, Biology of plasmids – discovery, types and structure ofRTF, col factors and Ti. Replication and portioning. Incompatibility and copy numbercontrol. Natural and artificial plasmid transfer and their applications. Transposablegenetic elements: discovery, early experiments of McClintock in maize. Insertionsequences in prokaryotes. Omplex transposons – Tn 10, Tn 5, Tn 9 and Tn 3 as examples.Mechanisms control, consequences and applications of transposition by simple andcomplex elements. Retro elements.

Unit V

Genetics of Eukaryotes: Gene linkage and chromosome mappling, crossing over, three point cross, tetrad analysis.Complementation. Organization of chromosomes, specialized chromosomes.Chromosome abnormalities, quantitative inheritance, population genetics. Developmentalgenetics using Drosophilla as model system. Somatic cell genetics.

Reference Books:

- Microbial Genetics – S.R. Maloy, J.E. Cronan and D. Friefelde 1994. Jones andBarlett Publishers.
- Molecular Genetics of Bacteria – J.W. Dale 1994 John Willey and Sons. •

Concepts of Genetics – W.S. Klug and M.R. Cumm Prentice Hall, 1997. •

Introduction of Genetic Analysis of Griffths – Freeeman Co., 1996.

- Advanced Molecular Biology of the Gene – Watson J.D. Hopkins NH, Roberts,J.W.Steitz. J.A.

Course Code	BIOCHEMISTRY	L	T	P	C
22217SEC13		6	1	0	4

AIM:

- This paper presents the study of identification and quantitative determination of the substances, studies of their structure, determining how they are synthesized metabolized and degraded in organisms, and elucidating their role in the operation of the organism.

OBJECTIVE:

- On the successful completion of the course the students will get an overall understanding of structure of atoms, molecules and chemical bonds, enzyme kinetics, bio polymers and metabolic reactions in a living system.

OUTCOME:

- This paper in biochemistry has been designed to provide the student with a firm foundation in the biochemical aspects of cellular functions which forms a base for their future research.

Unit I

Principles of Bioenergetics. Glycolysis and carbolism of hexoses the citric acid cycle.Oxidation of fatty acids. Oxidation of amino acids. Oxidative phosphorylation.Glyoxylate cycle, TCA cycle, Kreb cycle, Pentose Phosphate pathway. Nitrogen cycle. .

Unit II

Carbohydrate – types, structure and functions of carbohydrates,biosynthesis, lipidbiosynthesis, C2, C3, C4 cycles. Biosynthesis of fatty acids and triacyl glycerol.Secondary metabolites – occurrence, classification and functions of phenolics, terpenes,flavonoids, alkaloids, saponins, glycosides.Applications of secondary metabolites in food, dairy, agricultural, cosmetics and pharmaceutical Industries.

Unit III

Biosynthesis of amino acids, nucleotides and related molecules. Classification of proteins based on functions and solubility, types of proteins structure and functions.Chemical synthesis of peptides and oligosaccharides. A general account of secondary metabolic pathway.

Unit IV

Integration and hormonal regulation of mammalian metabolism. Biological membraneand transport. Enzymes classification, mechanism, factors affecting enzyme actionVitamins and minerals.

Unit V

Lipids classification, importance, fatty acids, essential non essential fatty acids.Prostanglandins, leukotrlienes, thrombaxanes, interferons and interleukins. Antibiotics,cytoskeletal organization, ribozymes.

Book references:

- Principles of Biochemistry – A.L. Lehninger, D.L., Nelson and MM Cox 1993Wokrth Publishers, New York.

- Biochemistry – L. Styler 1994 Freeman & Co New York. .

- Biochemistry – G. Zubay 1988 macmillan Publishing Co New Yorkand Business

Course Code	MICROBIOLOGY & MOLECULAR GENETICS LAB	L	T	P	C
22217SEC14L		0	0	4	2

AIM:

- This paper in genetics has been structured to give the student an in depth knowledge of the organization of the genome in prokaryotes and eukaryotes, the principles of genetic inheritance and other vital aspects such as Hardy Weinberg law, pedigree analysis and the genetic basis of disease inheritance.

OBJECTIVE:

- The major objective of the paper is to envisage thorough knowledge in genetics and genome organizations in organisms.

OUTCOME:

- After successful completion of the paper the students will get an overall view about genetic makeup of organisms and can take up a career in research.

1. Culture media preparation liquid and solid media.

2. Selective differential media

3. Methods of sterilization and testing of sterility

4. Enumeration of bacteria, fungi and actinomycetes from soil

5. Pure culture techniques – Pour, spread and looping methods

6. Maintenance and preservation of cultures

7. Staining of Bacteria – gram, spore and AFB, Fungal wet mount – LPB

8. Motility test – hanging drop and soft agar inoculation

9. Water quality test – MPN

10. Effect of different parameters on bacterial growth kinetics (Substrate, pH, Temperature)

11. Single colony – isolation and checking for genetic markers, measurements of growth rate one step growth curve using T7 phage.

12. Induced mutagenesis and isolation of antibiotic resistant and auxotrophic mutants enrichment methods for auxotrophic and antibiotic resistant mutants.

13. Genetic mapping by p1 transduction, genetic mapping of conjugation and transformation.

14. Transposan mutagenesis of chromosomal DNA, Transposan mutangenesis of plasmid DNA

15. Expeiments with gene fusion.

Book references:

1) Sadasivam, S. and Manickam A. Biochemical Methods, 2nd Edition, New age International Private Ltd. Publishers.

2) Laboratory Techniques in Biochemistry and Molecular Biology.

3) A short Course in Bacterial Genetics – J.H. Miller 1992, Cold Spring Harbour Laboratory.

4) Methods for Genetics and Molecular Bacteriology – RGF Murray, W.A. Wood & N.B. Krig 1994 American Society for Microbiology.

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Course Code	DISCIPLINE SPECIFIC	L	T	P	C
22217DSC15A	ELECTIVE I Immunology	5	0	0	4

AIM:

- Understanding the immune system, antigen antibody reactions, applications of immunological techniques, humoral and cell mediated immunity, hypersensitivity reactions and hybridoma technology.

OBJECTIVE:

- To expose the students with various immune systems of human body.

OUTCOME:

- This course will provide the student insights into the various aspects of Immunology such as classical immunology, clinical immunology, Immunotherapy and diagnostic immunology.

Unit I

Molecular cells & organs of Immune system, Historical perspective, Innate Immunity:-Skin, Mucosal Surface, Physiological barrier, Inflammation, Adaptive Immunity,Molecules of innate & Acquired immune system:- Complement, Interferon, othermolecules Cells of Innate & Acquired Immune system. Organs of the immune system:-Primary Lymphoid organs, Secondary Lymphoid organs, Lymphatic etc.

Unit II

Antigens, Antibody & Ag-Ab Interaction - Antigens: - Immunogenicity vs Antigenicity,Factors influencing Immunogenicity, Adjuvant, Epitopes & Haptens, super antigens, autoantigens. Antibody:- Structure, classes & functions, Allotypes & Idiotypes. Basicprinciples of Antigen Antibody Interaction. Immunological techniques: Principles &Applications: Precipitation & agglutination, Radio. Immunoassay, Enzyme linkedImmunosorbent Assay etc.

Unit III

Mechanism of Immune response, Generation of Immunological diversity, Antigenrecognition, Lymphocyte development &activation, Lymphocyte interaction, cytokines &lymphoid system.

Unit IV

MHC & Transplantation Immunology - MHC:- General organization, MHC molecules &genes, Cell recognition of self & nonself, MHC restriction, Tolerance:- Central Peripheral& acquired tolerance. HLA typing methods using serological and molecular techniques.

Unit V

The Immune system in Health & Disease, AIDS & other Immunodeficiencies,Autoimmunity & autoimmune diseases. Hypersensitivity, Vaccines:- Principle & types ofvaccines, Recent advances in vaccination, Monoclonal & Recombinant antibodies.Immunological techniques: RIA, ELISA, Immunocytochemistry, Immunoblotting,Flurescence antibody techniques.

· **Book references:**

· Immunology – An Introduction, Tizard R. Jan, 1995

· Immunology – Roitt Ivan, Jonathan Brastoff, David Male, 1993. •

Immunology – Janis Kubey, 3rd Edition.

· Text Book of Microbiology – Anathanarayanana R and Jayaraman Panikar, 1996. •

Immunology – Weir D.M. and Steward, J. 1997. 8th Edition Churchill Livingston New York

Course Code	DISCIPLINE SPECIFIC ELECTIVE BIOSAFETY AND BIODIVERSITY	L	T	P	C
22217DSC15B		5	0	0	4

AIM:

- This course has been designed to provide the student insights into these invaluable areas of biotechnology, which play a crucial role in determining its future use and applications.

OBJECTIVE:

- Students get an idea about the advantages and disadvantages of biotechnological applications, ethical implications, and intellectual property rights.

OUTCOME:

- To study the diversity of plants and animal life in a particular habitat, ethical issues and potential of biotechnology for the benefit of man kind

Unit 1:

Introduction and historical background. Introduction to biological safety cabinets, primary containment for biohazards, biosafety levels, biosafety levels of specific microorganisms, recommended biosafety levels for infectious agents and infected animals. Biosafety guidelinesby Government of India. Definition of GMOs and LMOs.

Unit 2:

Environmental release of GMOs, risk assessment; risk management and communication. Overview of national regulations and relevant international agreements including gCartagena protocol.

UNIT 3 :

Biodiversity – Concept and Definition Scope and Constraints of Biodiversity Science, Composition and Scales of Biodiversity: Genetic Diversity, Species/ Organismal Diversity, Ecological/ Ecosystem Diversity, Landscape/ Pattern Diversity, Agrobiodiversity, Biocultural Diversity and Urban Biodiversity.

UNIT 4 :

Values of biodiversity Instrumental/Utilitarian value and their categories, Direct use value; Indirect/ Non-consumptive use value, Introduction to Ecological Economics; Monetizing thevalue of Biodiversity; Intrinsic Value; Ethical and aesthetic values, Anthropocentrism, Biocentrism, Ecocentrism and Religions; Intellectual Value; Deep Ecology.

UNIT 5 :

Threats to biodiversity Habitat Destruction, Fragmentation, Transformation, Degradation and

Loss: Causes, Patterns and consequences on the Biodiversity of Major Land and Aquatic Systems Invasive Species' pathways, biological impacts on terrestrial and aquatic systems. Extinction: Types of Extinctions, Processes responsible for Species Extinction, Current and Future Extinction Rates, IUCN Threatened Categories, Sixth Extinction/Biological Crisis.

REFERENCES

• Groom MJ, Meffe GR and CR Carroll, (2006). Principles of Conservation Biology. Sinauer Associates, Inc., USA

• Krishnamurthy KV, (2003). Textbook of Biodiversity. Science Publication •

Primack R, (2014). Essentials of Conservation Biology. Sinauer Associates, •

Hambler C and SM Cannly, (2013). Conservation. Cambridge University Press.

• Van Dyke F, (2008). Conservation Biology Foundations, Concepts, Applications 2nd Edition,

Course Code	CELL & MOLECULAR BIOLOGY	L	T	P	C
22217AEC21		5	1	0	5

AIM:

- This paper provides a thorough knowledge about structure and function of cells, cellular energetics, protein trafficking, bio molecules and cellular development.

OBJECTIVE:

- Understanding the structural and functional aspects of the cell provides the student with a strong foundation in the molecular mechanisms underlying cellular function.

OUTCOME:

- Students after completion of this paper will be exceptionally well prepared to pursue careers in cellular and sub cellular biological research, biomedical research, or medicine or allied health fields.

UNIT-I:

Cell architecture: Structure of cells – structure of prokaryotic and eukaryotic cells; Surface appendages – Cilia and Flagella, Capsules, Pili, Fimbriae and slime layers; Cell walls – Algae, fungi, bacteria ; Membranes of Gram positive, Gram negative bacteria and acid fast bacteria; protoplast, spheroplast and endospores; Transport across membrane – active and passive transport, transport channels and pumps, transport across nuclear membrane; Neurotransmission, neuromuscular junction.

UNIT-II:

Cellular constituents: Cytoskeleton and structural components – Microfilaments, Intermediate filaments, Microtubules; Mitochondria – structure, biogenesis; Chloroplast – structure, biogenesis; Endoplasmic reticulum and Golgi complex – structure, function, vesicular transport and import into cell organelles; Structure and function of ribosomes, mesosomes, lysosomes, peroxysomes.

UNIT-III:

Nucleus: Nucleus structure – structural organization, nucleosome, supranucleosomal structures, specialized chromosomes, polytene and lamp brush chromosomes and chromosome banding; Nucleic acid structure: DNA and RNA.

UNIT-IV:

Cell cycle: Mechanism of cell division – Mitosis, meiosis and genetic recombination; regulation of cell cycle – factors and genes regulating cell cycle (Cyclins, CDK and CDKI). Biochemistry and molecular biology of Cancer – malignant growth, tumour suppressor genes (p53, RB) and oncogenes (Ras), chemical carcinogenesis, hormonal imbalances.

UNIT-V:

Cellular development: Extracellular matrix – cell to cell and cell-matrix adhesion, cell junctions; Cellular systematic – components of systematic, receptors (cell surface – GPCR, RTK, TGF-β, Hedgehog, Wnt, Notch-Delta, NF-Kb, ion channels; intracellular – NO, Nuclear receptor), secondary messengers, effectors ; cell differentiation; gametogenesis andfertilization; development of Drosophila and Arabidopsis – spatial and temporal regulation of gene expression.

REFERENCES

• Introduction to genetics: A molecular approach, T.A. Brown, Garland Science, 2011.

• Molecular Biology of the Gene (7th Edition, J.D.Watson, Tania A. Baker, Stephen P. Bell

• Michael Levine, Richard Losick) Benjamin/Cummings Publ. Co., Inc., California, 2013 •

Genes XI (9th Edition) Benjamin Lewin, Jones & Bartlett Learning, 2008

• Molecular biology and Biotechnology. A comprehensive desk reference, R.A. Meyers (Ed) Wiley-Blackwell Publishers, 1995

Course Code	BIOPHYSICS & BIOINFORMATICS	L	T	P	C

22217AEC22		**5**	**1**	**0**	**5**

AIM:

- Biology is fast becoming an interdisciplinary science. There is accumulation of large amount of information in different areas of biology - on genome sequences of many organisms, genetic and biochemical interaction networks, cell interactions during development, and organism response to environmental stimuli, along with molecular understanding of diseases. This has led to the emerging need for a holistic description of the working of biological systems at different scales.

OBJECTIVES:

- Togain an appreciation for the field of systems biology. To understand and learn the technical details of several current experiments or technologies used in the field of systems biology. To understand some of the larger questions and issues with systems biology and large-scale data collection and analysis.

OUTCOMES:

- This paper has been designed to give the students comprehensive training in the emerging and exciting upcoming filed of Systems Biology, which will help students to get career in both Sindustry/R&D.

UNIT-1

Physics and biology: scope and methods of biophysics. Levels of molecular organization. Association of macromolecules, lipids in biological membranes. Protein in biological membranes. Molecular mechines and dynamics.

UNIT-II

Understanding structures of proteins at different levels.- primary, secondary, tertiary and quarterly: conformational analysis and forces. Understanding structures of nucleic acids at different levels- primary, secondary, tertiary and quarterly : conformational analysis of interactions- polysaccharides

UNIT-III

Introduction to Bio informatics-scope and application characteristics of hardware and software. Types of computer, Bio- chips, computer network sending and receiving e-mail. Internet browsing- searching biological articles information in internet.

UNIT-IV

Computer applications in biology- uses of databases in biology- analysis of proteins and nucleic acid sequence- molecular modeling- introduction to data processing- files- data collection preparation-editing- backup- file recovery-procedure-sorting-searching and merging.

UNIT-V

Biomolecules- carbohydrate, protein, lipids and nucleic acids, protein conformation-prediction of protein structure-fold recognition, comparative modeling (homology)-basic principles of X-ray diffraction studies, NMR, Mass spectroscopy in identifying protein information.

Reference books:

- Introduction to protein structure by C. Branden and J. Tooze(1991) Garland publishing company
- Biochemistry by L.Stryer. (1995) WH freeman and co.
- Biophysical chemistry part-I& III by cantor amd schimmel(1980) WH freeman and co. •

Biophysics and bio physical chemistry by debajyoti Das (1987) academic press. • Molecular databases for protein sequence and structure studies by sillinee. JA and sillince .M (1991) spring verlag.

- Sequence analysis primer by M. Gribskov, J.Dvvereux()1989 stockton press.

Course Code	**INDUSTRIAL BIOTECHNOLOGY**	**L**	**T**	**P**	**C**

22217AEC23		5	0	0	4

AIM:

- To understand the, environmental pollution and remediation using Biotechnology and its control.

OBJECTIVE:

- Students will get an idea about the hazards to our environment, solutions to protec it and for sustainable development.

OUTCOMES:

- This course is important in the era of industrialization leading to environmental hazards and hence will help students to take up a career in tackling industrial pollution and also to take up the research in areas like development of biological systems for remediation of contaminated environments (land, air, water), and for environment-friendly processes such as green manufacturing technologies and sustainable development.

UNIT-I

Industrial microbiology an introduction- modern fermentation process and biochemical engineering- isolation, screening and strain improvement of microorganisms.

UNIT-II

Media design and sterilization for fermentation processes- media requirements for fermentation processes- examples of simple and complex media. Design and usage of commercial media for industrial fermentations- batch and continous fermentations system- sterilization system of liquid media and air.

UNIT-III

Basic principles of bioprocess-media formulation- fermentation equipment and its use- type of fermentor (Batch and continuous fermentor) and its application. Tray, CSTR, BCF, HFMB, RBC and inner and outer loop.

UNIT-IV

Traditional industrial process – anaerobic process ethanol, lactic acid, acetone- butanol production)- aerobic process (citric acid baker's yeast penicillin production).

UNIT-V

Medical application of bioprocess engineering- commercial tissue culture process- gene therapy using viral vectors- models of viral infections- mass production of retrovirus. Advanced biological waste water treatment applications

REFERENCES:

- Industrial microbiology by J.H patel
- Industrial microbiology by G.H casida

Course Code	MOLECULAR BIOLOGY &	L	T	P	C

22217SEC24L	**INDUSTRIAL BIOTECHNOLOGY lab**	**0**	**0**	**4**	**2**

AIM:

This paper provides a thorough knowledge about structure and function of cells, cellular energetics, protein trafficking, bio molecules and cellular development.

OBJECTIVE:

Understanding the structural and functional aspects of the cell provides the student with a strong foundation in the molecular mechanisms underlying cellular function.

OUTCOME:

Students after completion of this paper will be exceptionally well prepared to pursue careers in cellular and sub cellular biological research, biomedical research, or medicine or allied health fields

- Living cells preparation by histochemical techniques
- Microtomy
- Squash preparation of onion root tip
- Production of enzyme (amylase)
- Immobilization of cells and enzymes by calcium alginate method
- Effect of different parameters on bacterial growth kinetics (ph, temperature)
- Production of organic acid
- Immunocytochemical analysis for specific cellular constituents
- Cytochemical study of cells/ cell types using specific dyes reagents
- Estimation of protein and carbohydrates
- Alcoholic fermentation of fruit juice by yeast (*Saccharomyces cerevisiae*)
- Separation of amino acid by paper chromatograph.

REFERENCE:

- Sadasivam.S and Manickam.A biochemical methods H Edition. New Age nternational PVT. Publishers.
- Boyer R. Modern experimental biochemistry, III edition, Benjamin cummings publishers.

Course Code	ENDOCRINOLOGY	L	T	P	C
22217DSC25A		5	0	0	4

AIM:

- This is a comprehensive study of the endocrine system which will allow the student to integrate and better understand the functions of the other systems of the body. The relationship of the nervous system to the endocrine system is explored in the context of signaling within a multicellular organism..

OBJECTIVE:

- To have a basic understanding of the endocrine system.

OUTCOMES:

- To know the pathophysiological significance of the system with special reference to humans.

UNIT-I

Hormones in general- definition- types of secretions- nature-classification, synthesis and their role- feedback control with specific examples hormone action proteins and steroids- cell signaling in hormone action

UNIT-II

Hypothalomo hypo physical axis – hormones of hypothalamus and their role structure of pituitary –secretions-physiological role- pathophysiology current status of pituitary as a master gland.

UNIT-III

Thyroid- parathyroid – structure- hormones- synthesis-storage-release-carrier proteins(eb. TBA&TBG)-physiological role-pathophysiology.

UNIT-IV

Adrenal and gonadal hormones- steroid biosynthesis- maintenance of cyclicity physiological role- pathophysiology- steroids in metabolism

UNIT-V

Gastro intestinal hormones-pancreas as an endocrine organ- secretions- functions-physiological role and pathophysiology other endocrine organs in vertebrates insect and crustacean hormones their role in growth and metamorphosis

REFERENCE:

- Text book of endocrinology-williams
- Physiological review of biochemistry-harper and others

Course Code	DISCIPLINE SPECIFIC ELECTIVE	L	T	P	C
22217DSC25B	II BIOETHICS AND IPR	5	0	0	4

AIM:

- To acquire To acquire specialized knowledge of law and practice relating to Insurance.

OBJECTIVE:

- The aim of this paper is to introduce the basic concepts of Intellectual property laws to the students for first time and familiarize them with the kind of rights, remedies and licensing regime associated with each kind of intellectual property so that students can have a basic understanding of Intellectual Property laws.

OUTCOME:

- To get registration in our country and foreign countries of their invention, designs and thesis or theory written by the students during their project work and for this they must have knowledge of patents, copy right, trademarks, designs and information Technology Act. Further teacher will have to demonstrate with products and ask the student to identify the different types of IPR'

Unit 1: Overview of Intellectual Property

Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design – Genetic Resources and Traditional Knowledge – Trade Secret - IPR in India : Genesis and development – IPR in abroad - Major International Instruments concerning Intellectual Property Rights: Paris Convention, 1883, the Berne Convention, 1886, the Universal Copyright Convention, 1952, the WIPO Convention, 1967,the Patent Co-operation Treaty, 1970, the TRIPS Agreement, 1994

Unit2: Patents

Patents - Elements of Patentability: Novelty , Non Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Assignment and licence , Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board

Unit 3: Copyrights

Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright - Infringement, Remedies & Penalties – Related Rights - Distinction between related rights and copyrights

Unit 4: Trademarks

Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board

Unit 5: Other forms of IP

Design: meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection

Geographical Indication (GI): Geographical indication: meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection Plant Variety Protection

Plant variety protection: meaning and benefit sharing and farmers' rights – Procedure for registration, effect of registration and term of protection Layout Design Protection

Layout Design protection: meaning – Procedure for registration, effect of registration and term of protection

.**Reference book:**

- V K Ahuja; Law relating to Intellectual Property Rights; Lexis Nexis, 2017 Reference •

Journal: 1. Journal of Intellectual Property Rights (JIPR); NISCAIR

- **Text book**: 1. Neeraj Pandey and Khusdeep Dharni; Intellectual Property Rights; PHI learning Pvt.Ltd., India 2014

Course Code	RESEARCH METHODOLOGY	L	T	P	C

22217RMC26		3	0	0	2

AIM:

- This course introduces and discusses approaches, strategies, and data collection methods relating to research in social sciences. Students will consider how to select the appropriate methodology for use in a study to be performed.

OBJECTIVE:

- This course aims to guide Master One students at the Section of English in the university of Biskra towards achieving competence and proficiency in the theory of and practice to research. This fundamental objective can be realised through helping these students to develop the subject of their research, encourage the formation of higher level of trained intellectual ability, critical analysis, rigour, and independence of thought, foster individual judgement, and skill in the application of research theory and methods, and develop skills required in writing research proposals, reports, and dissertation

OUTCOME:

- To culminate this final stage, students will learn to write a comprehensive research proposal that may be conducted in the future.

Unit I –Research

Selection of problem-stages in the execution of research: choosing a topic to publication preparation of manuscript-report writing- format of journals – proof reading – sources of information: Journals, reviews, books, monographs, etc, Bibilograpy. Journal ; standard of research journals – Impact factor.

Unit II: Statistical method

Measures of dispersion: Universe and population – delimiting population – sampling method – random sampling, stratified random sampling – types of variables: qualitative and quantitative variables – continuous and discontinuous variables – scaling method S- mean – standard deviation – standard error – coefficient of variation.

Unit III

Coparision of means, chisquard test, student test (ANOVA ''portioning of variation). F test – model sums on one way ANOVA with interpretation of data – introduction to MANIVA – Statistical and their use – significance test and fixing levels of significance – use of statisticalsoftware like COSTAT and STATISTICA. Breif introduction to pie and histograms. Use of LCD.

UNIT IV:

Chromatography – priniciple, operative technique and applications of paper, TLC, adsorption chromatography, GLC and HPLC. Ion-Exchange, molecular sieve, Electrophoretic techniques – principle and technique of gel, SDS, high voltage and discontinuous electrophoresis, Isoelectric focusing, plused field gel electrophoresis and capillary electrophoresis. Spectrometry – Centrifugation techniques.

UNIT V:

X-Rays – X-Ray diffraction, crystals and detectors, quantitative analysis and applications. Radio chemical methods – Basic concepts, counting methods and applications. Autoradiography, detection and measurement of radioactivity, applications of radioisotopes in biology.

References:-

- An introduction to practical biochemistry by David T. Plummer.
- Laboratory Manual in Biochemistry by Pattabiraman and Acharya
- Practical Biochemistry by J. Jayaraman.
- Analytical Biochemistry, D. J. Homie and Hazel Peck, Longman group, 3rd edition, 1998.
- Physical Biochemistry – Application of Biochemistry and Molecular Biology, David Friefelder, W.H Freeman and Co, 2nd Edition 1999.
- Experimental Biochemistry, Robert Switzer and Liamgarrity, W.H. Freeman and Co, 3rd 1999.
- Davis, G.B and C.A Parker, 1997. Writing the doctoral dissertation, Barrons Education series, 2nd edition, Pp 160, ISBN: 081208005
- Duneary, P. 2003. Authoring a Ph. D thesis: how to plan, draft, write and finish a doctoral dissertation. Plagrave Macmillan, Pp256. ISBN 1403905843

Course Code	**GENOMICS** 3788	**L**	**T**	**P**	**C**

22217AEC31		6	1	0	6

AIM:

- To study prokaryotic and eukaryotic genomes, general methods of genome sequencing techniques, genome analysis and annotations, genome mapping techniques and applications of genomics.

OBJECTIVE:

- Explain the aspects of genome organisation, analysis and applications.
- Provide the details of prokaryotic and eukaryotic genome.

OUTCOME:

- Acquire the aspects of Gene Contig and Shotgun method.
- Know the features of the Genome Mapping databases.

UNIT -I INTRODUCTION: Genome structure and anatomy of prokaryotic and eukaryotic genome – Nuclear genomes – Organelle genomes – Repetitive DNA sequence – Transposable elements– Pseudo genes – Genome databases – organisms-specific databases.

UNIT -II GENOME SEQUENCING DNA sequencing techniques: Maxam Gilbert method – Sanger"s method – Pyrosequencing – Whole genome sequencing – Gene Contig and Shotgun method – Human genome project.

UNIT -III GENOME ANALYSIS AND ANNOTATION: Searching and locating Genes – Programs and databases – Determining function of genes – Gene Prediction – Methods of gene prediction – Softwares and tools.

UNIT -IV GENOME MAPPING: Mapping databases – Types of mapping – Genetic mapping: DNA markers – RFLP, SSLP, RH maps, SNP – Linkage analysis – Physical mapping: Restriction mapping – FISH – STS mapping

UNIT -V APPLICATIONS OF GENOMICS DNA: microarray and its applications – Medical applications: Development of Antibiotics – Vaccines – Drug discovery – Human genetics diseases: Identification – Gene Diagnosis and Gene therapy– Genomics in Plant Biology.

MATERIALS FOR STUDY AND REFERENCE :

- Brown T.A., Genomes 3 (3rd Edn.), Garland Science Publishing, New York, 2007. • Brown T.A., Gene Cloning and DNA Analysis – An Introduction (6th Edn.), A John Wiley & Sons, Ltd., Publications, UK, 2010.
- Jeremy W. Dale and Malcolm von Schantz, From Genes to Genomes – Concepts and Applications of DNA Technology, John Wiley & Sons, Ltd., Publications, UK, 2002. • Richard J. Reece, Analysis of Genes and Genomes, John Wiley & Sons, Ltd., Publications, UK, 2004.

Course Code	PROTEOMICS	L	T	P	C

22217AEC32		**6**	**1**	**0**	**6**

AIM:

- To understand the proteins enclosed by the genes with respect to structure, function, protein – protein interactions, techniques for separation and analysis, database and applications.

OBJECTIVE:

- Give a detailed description on protein sequencing.
- Provide an overview of proteome databases.

OUTCOME:

- Gain knowledge on phylogenetic profiles
- Describe the features of Yeast two-hybrid system.

UNIT -I INTRODUCTION: Proteomics introduction – Protein sequencing – Protein Digestion Techniques – Mass Spectrometers for Protein and Peptide Analysis – Protein Identification by Peptide Mass Fingerprinting – Software Tools for Peptide Mass Fingerprinting: Finding the Matches – Peptide Sequence Analysis and Protein Identification with Tandem Mass Spectrometry

UNIT -II PROTEOME DATABASES: Proteome databases – Comparative proteomics methods – 2D gel databases – Protein interaction data bases – Metabolic pathway databases – resources for interaction prediction – network and pathway visualization tools – Protein network analysis

UNIT -III PROTEOMICS TOOLS : 2D gel electrophoresis and Mass spectra – Protein identification from 2D gel, mass spectra and sequence data – Protein property prediction – bulk, active sites, modification sites, interactive sites, location, localization, stability, shape, domains properties, secondary and tertiary structures – Protein identification programs – Muscot – Peptldent – Protein prospector – GFS

UNIT- IV FUNCTIONAL PROTEOMICS Functional proteomics – protein phenotypes – Protein-Protein Interaction Mapping: Experimental – Yeast two-hybrid system – phage display – protein fragment complementation assays – Computational approach

UNIT -IV APPLICATION OF PROTEOMICS: Applications of Proteomics – Protein Expression Profiling – Identifying Protein – Protein Interactions and Protein Complexes – Mapping Protein Modifications – Protein Arrays and Protein Chips – Application of proteomics to medicine, toxicology and pharmaceuticals
UNIT -V Current Contours: (For Continuous Internal Assessment only) Computational *Proteomics* and. Metabolomics- Sequence comparison. – Genome sequencing. – *Proteomics*. – Phylogeny. – Gene expression - Enzymology

MATERIALS FOR STUDY AND REFERENCE

- Baxevanis D and Ouellette BFF, Bioinformatics: A practical guide to the analysis of genes and proteins (3rd Edn.), John Wiley & Sons, Inc. 2005.

• . Baxevanis D and Ouellette BFF, Bioinformatics: A practical guide to the analysis of genes and proteins (2nd Edn.), John Wiley & Sons, Inc. 2002.

• Brown TA, Genomes (2nd Edn.), BIOS Scientific Publishers, Oxford, UK, 2002. •

Sensen CW, Essentials of Genomics and Bioinformatics, Wiley–VCH. 2002. •

Sensen CW, Hand book of Genome Research, Wiley–VCH Verlag GmBh & Co,

Course Code	Genomics & Proteomics - lab	L	T	P	C
22217SEC33L		0	0	5	3

AIM:

- The study of animal cells has helped us gain an insight not only in the structure and function of cells and tissues but also in different physiological, biochemical and immunological processes

OBJECTIVE:

- The major objective is to provide a world-class training experience for these students in an interdisciplinary research program connecting animal genomics with animal reproduction and biotechnology.

OUTCOME:

- This paper will help students interested in careers as laboratory, research or animal care technicians in the fields of veterinary and human health or biotechnology.

- Isolation of DNA from bacteria, fungus,animal tissues.
- Bacterial gene expression.
- Restriction mapping.
- PCR techniques.
- DNA finger printing PFLP,RAPD.
- Human Genome -Wellcome Trust Genome Browser
- FlyBase - A Database of Drosophila Genes & Genomes.
- Tandem repeats finder- A program to analyze DNA sequences
- PeptideCutter - Predicts potential cleavage sites cleaved by proteases or chemicals in a given protein sequence.
- PSORT - Program for the prediction of protein localization sites in c

• PROSITE - Protein Domain, Family & Functional Site Prediction

REFERENCE:

1. DNA cloning I & II by DM. Glover & BD. Hames(1995) IRL press. 2. PCR strategies by MA.Innis, DH.Gelfand & JJ. Sninskey (1995) academic press. 3. Concepts in biotechnology- editors D.Balasubramanian *et al*. university press,(1996). 4. Genetic engineering in animals. A.Puller(ed). VCH publishers. 5. BioEssays- K.K. Jain MD

6. Mapping of Genomes- Eric D. Green, Sue Klapholk.

Course Code	DISCIPLINE SPECIFIC ELECTIVE COURSE-III NANOBIOTECHNOLOGY	L	T	P	C
22217DSC34A		5	0	0	4

AIM:

The major applications of nanoscience is in biotechnology field.

OBJECTIVE:

nanotechnology attracts students from various disciplines, a single course which starts bysensitizing students from a varied background about the biological/biotechnological basicsand culminates into modern day applications of nanoscience in biotechnology

OUTCOME:

This course will act as a bridge between students from non-biology course at all levels

Unit- I

Basic biology principles and practice of micro fabrication techniques, Atomic force microscopy, biological production of metal nano particles, macro molecular assemblies.

Unit-II

Application in Biomedical and biological research, nano particles, viruses as nano- particles, nano chemicals and application., tumor targeting and other diagnostic application.

Unit-III

Developing drug delivery tools through nano biotechnology, nano particle based immobilization assays, quantum dots technology and its application.

Unit-IV

Synthesis and characterization of different classes of biomedical polymers their uses in pharmaceutical, cardiovascular ophthalmologic orthopedic areas.

Unit-V

Biosensors and nano biotechnology principles used in construction of microelectronic devices sensors and macro mechanical structures.and their functioning, immunonanotechnology.

Textv Book:

- N ano Biotechnology by Balaji, Subbaih

Reference Books:

- Nanobiotechnology- concepts, applications and perspectives, niemeyer, christofm. Mirkin, chad a. wiley publishers.

- Nanobiotechnology of biomimetic membranes, martin, donald (edt), springer verlag publishers.

Course Code	DISCIPLINE SPECIFIC ELECTIVE COURSE-III Environmental biotechnology	L	T	P	C
22217DSC34B		5	0	0	4

AIM:

- To understand the energy sources, environmental pollution and remediation using biotechnology and its control.

OBJECTIVE:

- Students will get an idea about the hazards to our environment, solutions to protect and for sustainable development.

OUTCOME:

- This course is important in the era of industrialization leading to environmental hazards and hence will help students to take up a career in tackling industrial pollution and also who is willing to take up the research in areas like development of biological systems for remediation of contaminated environments (land, air, water), and for environment friendly processes such as green manufacturing technologies and sustainable development

Unit I

Introduction, Importance and Scope of Environment Biotechnology. Renewable and Non-Renewable Resources of Energy. Conventional fuels and their impact on Environment – Firewood, Animal wastes, Coal, Petroleum and Animal oils.

Unit II

Modern fuels and their impact on environment – Methanogenic Bacteria, Biogas Production, Microbial Hydrogen Production, Conversion of Sugar to Alcohol, Gasohol. Effect of Green Revolution and Industrial Revolution on Environment.

Unit III

Waste Water Pollution (Sewage) Treatment Process - Septic tank, Mechanical and Biological Treatment, Trickling Filters, Activated Sludge Process, Oxidation Ponds, Anaerobic Sludge Digestion. Solid Waste Disposal- Sanitary Landfills, Composting, Vermicompost

Unit IV

Biofertilizers- Defination, Distinguished Features of Biofertilizers and Organic Manures. Role of symbiotic and asymbiotic nitrogen fixing bacteria in the enrichment of soil, Algal and fungal biofertilixers (VAM).

Unit V

Bioleaching- Ore Leaching and Role of Microbes in Mines (copper, and Uranium). Environmental significance of Genetically modified microbes, plants and animals. Bio- assessment of environmental quality.

Text Book:

- Fundamental of Environmental Studies by Bharrgava, D.S

Reference Books:

- John E Smith – Biotechnology, Cambridge University Press
- Presscott & Dunn - Industrial Mcrobiology, AVI publishing Co. USA
- Mukerji, Singh & Garg - Frontiers in applied Microbiology, Prink House India, Lucknow Peppler & Perlman – Microbial Technology, Academic Presss, New York
- Nicholas C Price – Fundamentals of Enzymology Chaplin & Bueke – Enzyme technology
- Moses and Capes – Biotechnology- the Science and Business

Course Code	Course Title	L	T	P	C
222ENOEC	Open Elective -Writing for the Media	4	0	0	2

Aim:

- To equip students to enter the realm of mass media.

Objectives:

- To help students to understand the intricacies of mass media
- To know about the barriers to mass communication
- To understand the function of mass media
- To learn the different kinds of news
- To enhance the different kinds of writing for media

Outcome:

- Understand the intricacies of mass media

UNIT-I

Mass communication- Barriers to mass communication and mass culture- Function of mass media - Media effects, Qualities of media men.

UNIT-II

News- Hard and soft news- Expected and unexpected news- Box news- Follow up news-Scoop Filters- Human interest stories- Recognizing and evaluating news.

UNIT-III

News and views- News analysis, Editorial, Columns, Article, Middle reviews, Letters-Features.

UNIT-IV

Reporting- Crime, Court, Election, Legislature, Sports, Development Investigative, Interpretative depth.

UNIT-V

Writing for Media-Inverted pyramid style-Feature style-TV/Broadcast, New style writing TV/Radio Documentaries- Writing Advertisements-Practical

References

Journalism -Susan
Professional Journalism -John Hogenberg
News Writing and Reporting -M.James Neal (Surjeet Publication)
Professional Journalism -M.V Komath
The Journalist’s Handbook -M.V Komath
Mass Communication & Journalism -D.S Mehta,

Course Code	Course Title	L	T	P	C
222MAOEC	Open Elective – Applicable Mathematical Techniques	4	0	0	2

Aim:

- To acquaint with the basic concept of Interpolation.

Objectives:

- Understand the basic concept of Interpolation.
- To enhance the knowledge about Assignment Problems, Replacement Problems, Decision Analysis and Game Theory.

Outcomes:

- Students using OR techniques in business tools for decision making
- Students develop Assignment problem and Replacement problems
- Understand the concept of decision analysis and game theory
- Students gets the knowledge about interpolation

UNIT I

Interpolation with unequal intervals: Newton's, Lagrage's, and inverse interpolation

UNIT II

Assignment Problems

UNIT III

Replacement Problems

UNIT IV

Decision Analysis

UNIT V

Game Theory

References

Unit I, "Numerical Methods in Science and Engineering" M.K.Venkatraman
Units II to V, "Operations Research", Kantiswarup, P.K. Gupta and Manmohan

Course Code	Course Title	L	T	P	C
222PHOEC	Open elective Biomedical Instrumentation	4	0	0	2

Aim:

- To understand the concepts and application of electronic Instrumentation in the Medical field.

Objective:

- Interpret technical aspects of medicine
- Solve Engineering Problems related to medical field
- Understand medical diagnosis and therapy

Outcomes:

- To familiarize students with various medical equipments and their technical aspects •

To introduce students to the measurements involved in some medical equipment. • Ability to understand diagnosis and therapy related equipments

- Understanding the problem and ability to identify the necessity of an equipment to a specific problem

UNIT – I: Bio Electric Signals And Electrodes

Fundamentals of medical instrumentation – Sources of biomedical signals – basic medical instrumentation – Intelligent medical instrumentation system – Origin of Bio electric signals – Recording Electrodes – Silver – Silver chloride electrodes – Electrodes for ECG – Electrodes for EEG – Electrodes for EMG.

UNIT – II: Recording System And Recorders

Basic recording system – General consideration for signal conditions – Preamplifiers – Biomedical signal analysis technique – main amplifier and driver stage – Writing systems – direct writing recorders – the ink jet recorders – Electrocardiograph, Electroencephalograph – Electromyography and other Biomedical recorders.

UNIT – III: Measurement And Analysis Techniques

Electro cardiography – measurements of Blood pressure - measurements of Blood flow and cardiac output, Respiratory therapy Equipment – Origin of EEG – Action Potentials of the brain – evoked potentials – Placement of electrodes – Recording set up – Analysis of EEG.

UNIT – IV: Magnetic Resonance And Ultrasonic Imaging Systems

Principles of NMR Imaging system – Image reconstruction Techniques – Basic NMR components – Biological efforts of NMR Imaging – Advantages of NMR Imaging System – Diagnostic ultra Sound – Physics of ultrasonic waves – metical ultra sound – basic pulse – echo apparatus, A – Scan – echocardiograph(M mode).

UNIT – V: Advanced Bio Medical Systems

Pacemakers – Need for Cardiac pacemaker – External Pace makes – Implantable Pace makers – recent development in Implantable Pacemakers – Pacing system Analyzer –

Defibrillator – Pacer – Cardioverter – Physiotherapy and electro therapy equipment – High frequency heat therapy – short wave diathermy – microwave and ultrasonic therapy – pain relief through electrical simulation.

Books for Study

1. R.S Khandpur, Handbook of Biomedical instrumentation, Tata McGraw Hill publishing company Limited. New Delhi,(2003). (Unit I,II,IV & V)
2. Lestlie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, Bio medical instrumentation and measurements, PHI, New Delhi.(Unit-III)

Book for Reference

1. M.Arumugam, Biomedical Instrumentation, Anuradha Agencies, Kumbakonam (2000).

Course Code	Course Title	L	T	P	C
222CHOEC	Open Elective-Green Chemistry	4	0	0	2

Aim:

- To reduce the soil and water pollution in environment.

Objectives:

- To learn about the environmental status, public awareness in evolution, principles involved in green chemistry, bio-catalytic reactions, global warming and its control measures, availability of green analytical methods.

Outcomes:

- To understand the environmental status and evolution.
  - To know about the Pollution and its prevention measures.
    - To familiarize the green chemistry.
    - To learn about the bio-catalytic reactions.
    - To understand about the vitamins and antiobiotics.

Unit I - Introduction

Introduction-Current status of chemistry and the Environment-Evolution of the Environmental movement: Public awareness - Dilution is the solution to pollution-Pollution prevention.

Unit II - Principles

Green Chemistry – Definition – Principles of Green Chemistry - Why is this new area of Chemistry getting to much attention - Why should chemist pursue the Goals of Green Chemistry - The roots of innovation – Limitations.

Unit III - Bio Catalytic Reactions

Green Chemistry Using Bio Catalytic Reactions – Introduction - Fermentation and Bio transformations - Production of Bulk and fine chemicals by microbial fermentation Antibiotics – Vitamins - Bio catalyses synthesis of industrial chemicals by bacterial constructs - Future Tends.

Unit IV - Green House Effect

Green house effect and Global Warming – Introduction - How the green house effect is produced - Major sources of green house gases - Emissions of CO2 - Impact of green house effect on global climate - Control and remedial measures of green house effect - Global warming a serious threat - Important points.

Unit V - Green Analytical Methods

Future trends in Green Chemistry - Green analytical methods, Redox reagents, Green catalysts; Green nano-synthesis, Green polymer chemistry, Exploring nature, Biomimetic, Proliferation of solvent-less reactions; Non-covalent derivatization, Biomass conversion, emission control

References:

1. Introduction to Green Chemistry – M.Rayan and M.Tinnes
2. New Trends in Green Chemistry – V.K.Ahluwalia and M.Kidwai

Course Code	Course Title	L	T	P	C
222CSOEC	Open Elective-M- Marketing	4	0	0	2

Aim :

• To provide the conceptual and technological developments in the field of internet and web designing with the emphasis on comprehensive knowledge of internet. **Objectives:**

• To understand the web designing and web development with the knowledge of internet. •

To learn the overview of the design of HTML & Scripting Languages. • To learn the use of website and internet design and development.

Outcomes:

• Acquire knowledge about functionalities of Internet

• Acquire knowledge about functionalities of world wide web

• Explore markup languages features and create interactive web pages using them •
Learn and design Client side validation using scripting languages

• Acquire knowledge about Open source JavaScript libraries

• Able to design front end web page and connect to the back end databases.

UNIT I

Internet, Growth of Internet, Owners of the Internet, Anatomy of Internet, ARPANET and Internet history of the World Wide Web, basic Internet Terminology, Net etiquette. Internet Applications – Commerce on the Internet, Governance on the Internet, Impact of Internet on Society – Crime on/through the Internet. Connectivity types: level one, level two and level three connectivity, Setting up a connection: hardware requirement, selection of a modem, software requirement, modem configuration, Internet accounts by ISP: Telephone line options, Protocol options, Service options, Telephone line options – Dialup connections through the telephone system, dedicated connections through the telephone system, ISDN, Protocol options – Shell, SLIP, PPP, Service options – E-mail, WWW, News Firewall

UNIT II

Network definition, Common terminologies: LAN, WAN, Node, Host, Workstation, bandwidth, Interoperability, Network administrator, network security, Network Components: Severs, Clients, Communication Media, Types of network: Peer to Peer, Clients Server, Addressing in Internet: DNS, Domain Name and their organization, understanding the Internet Protocol Address. Network topologies: Bust, star and ring, Ethernet, FDDI, ATM and Intranet.

UNIT III

Email Networks and Servers, Email protocols –SMTP, POP3, IMAp4, MIME6, Structure of an Email – Email Address, Email Header, Body and Attachments, Email Clients: Netscape mail Clients, Outlook Express, Web based E-mail. Email encryption- Address Book, Signature File.

UNIT IV

HTML page structure, HTML Text, HTML links, HTML document tables, HTML Frames, HTML Images, multimedia - ASP, VB Script, JAVA Script, JAVA and Front Page, Flash

UNIT V

Overview, SGML, Web hosting, HTML. CGL, Documents Interchange Standards, Components of Web Publishing, Document management, Web Page Design Consideration and Principles, Search and Meta Search Engines, WWW, Browser, HTTP, Publishing Tools Overview of Internet Security, Firewalls, Internet Security, Management Concepts and Information Privacy and Copyright Issues, basics of asymmetric cryptograms.

Text Book

World Wide Web design with HTML – C. Xavier – Tata McGraw – Hill – 2000.

References

1. Greenlaw R and Hepp E "Fundamentals of Internet and www" 2nd EL, Tata McGrawHill,2007.
2. Ivan Bayross, "HTML, DHTML, JavaScript, Perl CGI", 3rd Edition, BPB Publications.
3. D. Comer, "The Internet Book", Pearson Education, 2009.
4. M. L. Young,"The Complete reference to Internet", Tata McGraw Hill, 2007.
5. Godbole AS & Kahate A, "Web Technologies", Tata McGrawHill,2008. 6. Jackson, "Web Technologies", Pearson Education, 2008.
7. B. Patel & Lal B. Barik, " Internet & Web Technology ", Acme LearningPublishers.
8. Leon and Leon, "Internet for Everyone", Vikas Publishing House.

Course Code	Course Title	L	T	P	C

22CM1OEC	Open Elective-Financial Services	4	0	0	2

AIM

To analyze the various financial institutions and their services.

OBJECTIVES

I. To gain knowledge on financial services.

II. To understand importance of various services including banking, insurance, mutual funds.

UNIT – I

Financial system-An Overview: Indian Financial System-Global Financial System-Financial Services Environment- Credit Rating –Factoring and Forfeiting –Leasing

UNIT – II

Financial Markets –An Overview: Definition-Role-Functions-Constituents-Financial Instruments-Capital Market instruments-Indian money and Capital Market-Global Financial Markets.

UNIT – III

Money Market –An Overview: Definition-Characterstistics-Objectives-Imporatance-Functions Segment-Financial Institutions-Indian Money Market-Global Money Market

Unit – IV

Capital Market: Money Market-Characteristics-Functions-New financial Instruments-measures of Investor Protection-Indian Capital Market-Major Issues

Unit-V

Stock Exchange: History of Stock Exchange-Functions-Indian Stock Exchanges-Organization structure-Regulations of Stock Exchange –Recent Developments

OUTCOME

To introduces meaning and functions of Financial Intermediaries
To understand the role of merchant bank and its services
To provide information regarding management of mutual funds and Regulations
To understand the role and functions of financial services Marketing To know the structure and types of debt Instruments
To realize Foreign Exchange Market

REFERENCE BOOKS

1. Gordon , Natarajan – Financial Market and Services.
2. Dr. S. Gurusamy – Financial services and Market.
3. Kucchol S.C. – Financial Management
4. Pandey I.M. – Financial Management.

Course Code	FOOD TECHNOLOGY	L	T	P	C
22217AEC41		6	1	0	6

Aim:

- This course aims to help the students to understand the various properties of food and the factors that make it vulnerable for spoilage

Objectives:

- This course is designed to understand the chemical nature and associated microbes of food and to understand the principles of food processing, preservation and manufacture.

Outcomes:

- To understand the basic food safety issues in the food market
- To develop and evaluate quality of new food products using objective and subjective methodologies.
- To understand the basic concepts in food chemistry and food analysis

Unit I

Basics of Food Technology Food chemistry: constituents of food - contribution to texture, flavour and organoleptic properties of food. Food additives - intentional and nonintentional and their functions. Enzymes in food processing.

Unit II

Microbiology of Food Sources and activity of microorganisms associated with food. Food fermentation & food chemicals. Food borne diseases - infections and intoxications. Food spoilage - causes.

Unit III

Food Processing Raw material characteristics; cleaning, sorting and grading of foods; physical conversion operations - mixing, emulsification, extraction, filtration, centrifugation, membrane separation, crystallization, heat processing.

Unit IV

Food Preservation Use of high temperatures - sterilization, pasteurization, blanching, canning - concept, procedure & application; Low temperature storage - freezing curve characteristics. Factors affecting quality of frozen foods. Irradiation preservation of foods.

Unit V

Manufacture of Food Products Bread and baked foods. Dairy products - milk processing, cheese, butter, ice-cream. Vegetable and fruit products. Edible oils and fats. Meat, poultry and fish products. Confectionery, beverages.

Reference Books

1. Crosby, N.T. 1981. Food packaging Materials Applied Science Publishers, London.
2. David, S. Robinson. 1997. Food Chemistry and nutritive value. Longman group, UK.
3. Frazier, W.C. and Westhoff, D.C. 1988. Food Microbiology,

Course Code	Course Title	L	T	P	C
22217AEC42	BIOINSTRUMENTATION	6	1	0	6

Aim:

- The students searching for Biomedical Instrumentation Courses and Training Programs found the following related articles

Objectives:

- This course will give an understanding about the working principles, construction and applications of the instruments often used in the studies related to various disciplines of Biological Sciences.

Outcomes:

- Check for analytical functions and find the analytical function and study . •

Learn the measurement systems, errors of measurement,

- Demonstrate basic knowledge of Biotechniques

Unit I

Basic Instrumentation (Theory & Demo) Principles, operation protocol & applications of the following instruments: Weighing balance, pH meter, Polarography, Radioactivity, ECG, FTIR.

Unit II

Microscopy (Hands on) Observation of different microbes. Light – Bright & Dark field; Phase contrast, Inverted Phase contrast; Fluorescent, Electron – TEM & SEM; Confocal

Unit III

Spectroscopy (Theory & Demo) Colorimeter, Spectrometer, UV visible spectrometer, X – ray spectrometer, ELISA reader, Atomic absorption spectrometer, Flame photometer, Flourimeter & Spectro flourimeter.

Unit IV

Separation Techniques (Theory & Demo) Centrifugation - Principle, operation, types & applications. Chromatography - Principle, operation & applications - Paper – ascending, descending & Circular, TLC, HPTLC, GC, HPLC, Column Chromatography, Ion Exchange & Affinity Chromatography, LC – MS.

Unit V

Electrophoresis (Theory & Demo) Native & denatured - zone, iso-electrofocusing & isotachophoresis, 1D & 2D. PCR, MoldiTof

Reference Books:

• S.SadasivamA. Manickam. 2004. Biochemical Methods.

• 2nd Edition. New Age International (p) Ltd, Publishers. 2. Dr. G.Rajagopal, Dr. B.D.Toora.

2005. Practical Biochemistry. 2nd Edition. Ahuja Book Company Pvt.Ltd. • J.Jayaraman.
2000. Laboratory Manual in Biochemistry. New Age International Publishers.

Course Code	Course Title	L	T	P	C

22217SEC43L	FOOD TECHNOLOGY AND BIO INSTRUMENTATION LAB	0	0	5	3

Aim :

- To understand the principle and application of Bioinstrumentation and food technology

Objectives :

- By doing this course the students will get hand on exposure & understand the chemical nature and associated microbes of food and the principles of food processing, preservation and manufacture. And the techniques used in understanding the biological process

Outcomes:

- Ability to apply principles of food engineering in industry.
- Understand, identify and analyze a problem related to food industry and ability to find an appropriate solution for the same.

1. Test for sensitivity of microorganisms.
2. Down stream processes of enzymes – dialysis.
3. Ion exchange chromatography – drying – cellulose column chromatography.
4. Immobilization of yeast cell by alginate beads
5. Bioassay techniques for antibiotics.
6. Large scale production of organic acids, large scale production of solvents using fermentor (Demo)
7. Visit to Distillery unit; alcohol production and pharmacological industries. Pasteur Institute (Field visit).
8. Isolation & identification microbes from spoiled food.
9. Production of yogurt, butter.
10. Antibiotic production by different strains of microbes (Theory).
11. Calculate BMI
12. Handling of Colorimeter and Spectrophotometer
13. Estimation of RNA by orcinol method.
14. Estimation of DNA by Diphenylamine metho,Demonstratio
15. Paper chromatography for separations and detections of simple sugars and amino acids. 16. Separation of plant pigments by column chromatography.
17. Thin layer chromatography of amino acids.

Refrence book:

- Laboratory Mannual in Biochemistry by J. Jayaraman. New Age International Publishers. 2nd Edn. 1981.
- Stanbury, P.F., A. Whitaker ans S.J. Hall. 1995. Principles of fermentation Technology, Pergamon, UK

Course Code	Course Title	L	T	P	C
22217 DSC44A	GENE THERAPHY UTILIZATION PHARMACOLOGY	5	0	0	4

Aim:

- After successful completion of the paper the students will get an overall view about genetic makeup of organisms and can take up a career in research.

Objective:

- This paper in genetics has been structured to give the student an in depth knowledge of the organization of the genome in prokaryotes and eukaryotes, the principles of genetic inheritance and other vital aspects such as Hardy Weinberg law, pedigree analysis and the genetic basis of disease inheritance.

Outcomes:

- understand some of the types of disease that might be treatable by gene therapy • understand the basic principals of genetic manipulation
- understand how genetics may be used in the design of drugs..

UNIT I: History of genetics

Gene as the unit of mutation and recombination. Identification of DNA as the geneticmaterial. Mutations: Molecular nature, mutagenesis by nitrous acid, hydroxylamine,alkylating agents, intercalators and UV, origin of spontaneous mutations and control,parasexual process in bacteria, transformation, transduction and conjugal gene transferthe phenomena, mechanisms and applications. Fine structure genetic analysis withexamples.

UNIT II: **Genetic mapping**

Haplotype, Physical and Cytogenetic mapping, SNP, RFLP, TRE, PCR-OLA, SSCP, RAPD

UNIT III: Identifying human disease genes

General gene therapy strategies, Targeted killing of specific cells, Targeted mutation correction, Targeted inhibition of gene expression. Gene replacement therapy by viral vectors: Oncovirus, Lentivirus, Adenovirus, Adenoassociated virus, Herpes Simplex virus, Naked DNA or direct injection or particle bombardment-gene gun, Liposome mediated DNA transfer, Receptor mediated endocytosis, Repair of mutations in situ through the cellular DNA repair machinery, Antisense induced exon splicing, In-utero fetal gene therapy

UNIT IV: Gene blocking therapies

Gene Knockouts, Gene disruption-p53, prion diseases, immunological, short RNA, Gene therapy for non-inheritable diseases, stem cell therapy, somatic cell gene therapy and germ line gene therapy

UNIT V: Gene therapy: problem, solutions and future prospects

Controversial issues in medical genetics

In vitro fertilization, Prenatal sex determination, Surrogate therapy, Genetic counseling, Germline gene therapy, ELSI, NBAC, IPR, Patenting, Human transgene

Refrence Books:

• Human Molecular Genetics- Tom Strachan

• Concepts of Genetics- William s. Klug

• Emery’s Elements of Medical Genetics- Robert F. Mueller & Ian D. Young •

Concepts of Genetics – W.S. Klug and M.R. Cumm Prentice Hall, 1997. •

Introduction of Genetic Analysis of Griffths – Freeeman Co., 1996.

Course Code	**Course Title**	**L**	**T**	**P**	**C**
22217 DSC44B	PLANT CONSERVATION & DISASTER	5	0	0	4

	MANAGEMENT				

Aim:

• Understanding foundations of hazards, disasters and associated natural/social phenomena.

Objective:

• To maintain essential ecological processes and life supporting systems. • To preserve the diversity of species or the range of genetic material found in the worlds organisms.

• The course focuses on the reasons responsible for disaster, its impact on the environment and society. To impart the knowledge on the measures and steps to minimise or overcome the burden on the ecosystem.

Outcomes:

• To make sustainable utilization of species and ecosystems.

• Familiarity with disaster management theory (cycle, phases)Knowledge about existing global frameworks and existing agreements (e.g. Sendai)

UNIT I: Plant Diversity

Biodiversity – Concept and Definition Scope and Constraints of Biodiversity Science, Composition and Scales of Biodiversity: Genetic Diversity, Species/ Organismal Diversity, Ecological/ Ecosystem Diversity, Landscape/ Pattern Diversity, Agrobiodiversity, Biocultural Diversity and Urban Biodiversity

UNIT II: Conservation challenges in the twenty first century

Urbanisation; Creating knowledge society, Conflict management and decision making, Management of introduced species. 18 Evaluation of priorities for conservation of habitats and species Selection criteria for protection of species – species quality, IUCN Guidelines for Red List categories and criteria (version 7.0), Red List of Indian Flora and Fauna, Selection criteria for protection of habitats – hotspots, Conservation

UNIT III : Introduction to Disasters

Natural Disasters –Educative – Trends in Climatology, Meteorology and Hydrology. Seismic Activities. Changes in Coastal Zone, Coastal Erosion, Beach Protection. Coastal Erosion due to Natural and Manmade Structures.

UNIT IV : Types of Disasters – Natural

Disasters – Nature and characteristics of Cyclones – Tornadoes – Avalanches – Flood –Drought – Volcanic – Earthquakes – Fire – Landslides – Causes and effects - Impact on Environment Forecasting and Warning System – Disaster Profile of India. Manmade disasters: Nuclear, chemical, fire explosion, accidents, bioweapons. Deforestation, monoculture, Building construction.

UNIT V : Disaster Management

Disaster Management Cycle- Predisaster Planning -Training of Disaster – Prone Areas – Prioritization – Regulations – Protection Measures during Disaster and Post Disaster. Relief Camp Organization — Disaster Training – Role of Information and Communication Technology, GPS, Remote Sensing and Geographic Information System in Disaster Management.

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• Hambler C and SM Cannly, (2013). Conservation. Cambridge University Press • Van Dyke F, (2008). Conservation Biology Foundations, Concepts, Applications 2nd Edition, Springer

• Natural Hazards, Bryant Edwards (2005), Cambridge University Press, U.K. • Space Technology for Disaster management: A Remote Sensing & GIS Perspective, Roy, P.S. (2000), Indian Institute of Remote Sensing (NRSA), Dehradun.

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