

# **REGULATION**

## **2019**



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

## INDEX

REGULATION – 2019

S.NO	DEPARTMENT	PAGE NO.
1	Electronics and communication engineering	1
2	Computer Science and Engineering	421
3	Civil engineering	794
4	Mechanical engineering	837
5	Electrical and electronics engineering	1026
6	Microbiology	1344



School: ENGINEERING AND TECHNOLOGY  
Dept: ECE- 19 REGULATION - Mapping of cross cutting issues

Program me Name & Code	Course Code	Title of the Course	Cross cutting Issues			
			Professional ethics	Gender Sensitization	Environment and Sustainability	
BTech(FT) ECE 19UGECEFT	191VEA19	Value Education	-	-	-	-
BTech(FT) ECE 19UGECEFT	191ICA29	Fundamentals of Indian Constitution and Economy	-	-	-	-
BTech(FT) ECE 19UGECEFT	19149S46	Environmental Science and Engineering	-	-	-	✓
BTech(FT) ECE 19UGECEFT	19153FE54B	Energy Conservation and Management	-	-	-	-
BTech(FT) ECE 19UGECEFT	19154FE54A	Renewable Energy Sources	-	-	-	-
BTech(FT) ECE 19UGECEFT	19155FE54A	Air Pollution and Control Engineering	-	-	-	-
BTech(FT) ECE 19UGECEFT	19155FE54B	Geographic Information System	-	-	-	-
BTech(FT) ECE 19UGECEFT	19152CSR	Design/Socio Technical Project	-	-	-	-
BTech(FT) ECE 19UGECEFT	19153FE74B	Introduction to Renewable Energy Systems	-	-	-	-
BTech(FT) ECE 19UGECEFT	19155FE74A	Green Building Design	-	-	-	-
BTech(FT) ECE 19UGECEFT	19155FE74B	Waste Water Treatment	-	-	-	-
BTech(FT) ECE 19UGECEFT	19152E81F	Professional Ethics in Engineering	✓	-	-	-
BTech(FT) ECE 19UGECEFT	19152E82G	Environmental and Social Impact Assessment	-	-	-	✓



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BTech(FT)	ECE	19UGECEFT	19152E82H	TelehealthTechnology	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19147S11	CommunicativeEnglish	✓	-	-	-
BTech(FT)	ECE	19UGECEFT	19148S12	EngineeringMathematics I	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19149S13	EngineeringPhysics	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19149S14	EngineeringChemistry	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19154S15	EngineeringGraphics	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19150S16	ProblemSolvingand PythonProgramming	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19150L19	Problem Solving and Python Programming Lab	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19149L18	PhysicsandChemistry Lab	-	-	-	-
BTech(FT)	ECE	19UGECEFT	191VEA19	ValueEducation	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19147S21	TechnicalEnglish	✓	-	-	-
BTech(FT)	ECE	19UGECEFT	19148S22	EngineeringMathematics II	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19149S23B	Physicsfor Electronics Engineering	-	-	-	-
BTech(FT)	ECE	19UGECEFT	191523S24B	CircuitAnalysis	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19153S25B	BasicElectrical And Instrumentation Engineering	-	-	-	-





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BTech(FT)	ECE	19UGECEFT	19152S26B	Electronic Devices	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19148S31B	Linear Algebra and Partial Differential Equations	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152C32	Control Systems Engineering	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152C33	Fundamentals of Data Structures In C	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152C34	Digital Electronics	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152C35	Signals and Systems	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152C36	Electronic Circuits-I	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152L37	Fundamentals of Data Structures in C Lab	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152L38	Analog and Digital Circuits Lab	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152L39	Interpersonal Skills/ Listening & Speaking	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19148S41B	Probability and Random Processes	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152C42	Electronic Circuits II	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152C43	Communication Theory	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152C44	Electromagnetic Fields	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152C45	Linear Integrated Circuits	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19149S46	Environmental Science and	-	-	-	-



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				Engineering				
BTech(FT)	ECE	19UGECEFT	19152L47	Circuits Design and Simulation Lab	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152L48	Linear Integrated Circuits Lab	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152CRS	Research Led Seminar	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152C51	Digital Communication	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152C52	Discrete-Time Signal Processing	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152C53	Computer Architecture and Organization	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152C55	Communication Networks	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152L57	Discrete-Time Signal Processing Lab	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152L58	Communication Systems Lab	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152L59	Communication Networks Lab	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152CRM	Research Methodology	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152C61	Microprocessors and Microcontrollers	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152C62	VLSI Design	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152C63	Wireless Communication	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152C64	Principles of Management	-	-	-	-



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BTech(FT)	ECE	19UGECEFT	19152C65	Transmission Lines and RF Systems				
BTech(FT)	ECE	19UGECEFT	19152L67	Microprocessors and Microcontrollers Lab	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152L68	VLSI Design Lab	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152L69	Professional Communication	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152LTS	Technical Seminar	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152C71	Antennas and Microwave Engineering	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152C72	Optical Communication	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152C73	Embedded and Real Time Systems	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152C75	Adhoc and Wireless Sensor Networks	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152L77	Embedded Lab	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152L78	Advanced Communication Lab	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152CSR	Design/Socio-Technical Project	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152P83	Project Work	-	-	-	-
BTech(FT)	ECE	19UGECEFT	19152PEE	Programme Exit Examination	-	-	-	-
BTech(PT)ECE19UGECEFT			19148S11BP	Transforms and Partial Differential Equations	-	-	-	-



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BTech(PT)ECE19UGECEPT	19152H12P	Electromagnetic Theory	-	-	-	-
BTech(PT)ECE19UGECEPT	19152H13P	Digital Electronics	-	-	-	-
BTech(PT)ECE19UGECEPT	19152H14P	Electronic Circuits-I	-	-	-	-
BTech(PT)ECE19UGECEPT	19152H15P	Signals and Systems	-	-	-	-
BTech(PT)ECE19UGECEPT	19148S21P	Numerical Methods	-	-	-	-
BTech(PT)ECE19UGECEPT	19153S22P	Electrical Engineering and Control Systems	-	-	-	-
BTech(PT)ECE19UGECEPT	19152H23P	Linear Integrated Circuits	-	-	-	-
BTech(PT)ECE19UGECEPT	19152H24P	Electronic Circuits-II	-	-	-	-
BTech(PT)ECE19UGECEPT	19152H25P	Transmission Lines and Waveguides	-	-	-	-
BTech(PT)ECE19UGECEPT	19148S31BP	Probability and Random Processes	-	-	-	-
BTech(PT)ECE19UGECEPT	19152H32P	Microprocessor Interfacing and Applications	-	-	-	-
BTech(PT)ECE19UGECEPT	19152H33P	Digital Signal Processing	-	-	-	-
BTech(PT)ECE19UGECEPT	19152H34P	Communication Theory	-	-	-	-
BTech(PT)ECE19UGECEPT	19152L35P	Digital Signal Processing and Microprocessor Lab	-	-	-	-
BTech(PT)ECE19UGECEPT	19152H41P	Digital Communication	-	-	-	-



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BTech(PT)ECE19UGECEPT	19152H42P	Antenna and Wave Propagation	-	-	-	-
BTech(PT)ECE19UGECEPT	19152H43P	Computer Networks	-	-	-	-
BTech(PT)ECE19UGECEPT	19152L45P	Networks and Communication Lab	-	-	-	-
BTech(PT)ECE19UGECEPT	19152H51P	Optical Communication and Networks	-	-	-	-
BTech(PT)ECE19UGECEPT	19152H52P	Microwave Engineering	-	-	-	-
BTech(PT)ECE19UGECEPT	19152H53P	VLSI Design	-	-	-	-
BTech(PT)ECE19UGECEPT	19152L55P	Optical Communication and Microwave Lab	-	-	-	-
BTech(PT)ECE19UGECEPT	19152H61P	Mobile and Wireless Communication	-	-	-	-
BTech(PT)ECE19UGECEPT	19152H62P	Medical Electronics	-	-	-	-
BTech(PT)ECE19UGECEPT	19152H63P	Microcontroller and Embedded Systems	-	-	-	-
BTech(PT)ECE19UGECEPT	19152L65P	VLSI and Embedded Systems Lab	-	-	-	-
BTech(PT)ECE19UGECEPT	19160S71P	Total Quality Management	✓	-	-	-
BTech(PT)ECE19UGECEPT	19152H72P	Wireless Networks	-	-	-	-
BTech(PT)ECE19UGECEPT	19152H73P	Telecommunication Switching and Networks	-	-	-	-



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BTech(PT)ECE19UGECEPT	19152P75P	Project Work & Viva Voce	-	-	-	-
MTech(FT) ECE 19PGECEFT	19248S11B	for Electronics Engineering	-	-	-	-
MTech(FT) ECE 19PGECEFT	19271C12	Statistical Signal Processing	-	-	-	-
MTech(FT) ECE 19PGECEFT	19271C13	Modern Digital Communication Systems	-	-	-	-
MTech(FT) ECE 19PGECEFT	19271C14	Communication Protocol Engineering	-	-	-	-
MTech(FT) ECE 19PGECEFT	19271C15	Advanced Radiation Systems	-	-	-	-
MTech(FT) ECE 19PGECEFT	19271L17	Communication Systems Lab - I	-	-	-	-
MTech(FT) ECE 19PGECEFT	19271CRS	Research Led Seminar	-	-	-	-
MTech(FT) ECE 19PGECEFT	19271C21	Mobile Communication Networks	-	-	-	-
MTech(FT) ECE 19PGECEFT	19271C22	Advanced Microwave Systems	-	-	-	-
MTech(FT) ECE 19PGECEFT	19271C23	Fiber Optic Networking	-	-	-	-
MTech(FT) ECE 19PGECEFT	19271L26	Communication Systems Lab - II	-	-	-	-
MTech(FT) ECE 19PGECEFT	192TECWR	Technical Writing / Seminars	-	-	-	-
MTech(FT) ECE 19PGECEFT	19271CRM	Research Methodology	-	-	-	-
MTech(FT) ECE 19PGECEFT	19271CBR	Participation in Bounded Research	-	-	-	-
MTech(FT) ECE 19PGECEFT	19271C31	Wireless Sensor Networks	-	-	-	-



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MTech(FT)	ECE	19PGECEFT	19271P35	ProjectPhase-I	-	-	-	-
MTech(FT)	ECE	19PGECEFT	19271CSR	Design / Socio TechnicalProject	-	-	-	-
MTech(FT)	ECE	19PGECEFT	19271P41	ProjectPhase-II	-	-	-	-
MTech(FT)	ECE	19PGECEFT	19271E16A	Internetworkingand Multimedia	-	-	-	-
MTech(FT)	ECE	19PGECEFT	19271E16B	DigitalImage Processing	-	-	-	-
MTech(FT)	ECE	19PGECEFT	19271E16C	LASERCommunic ation	-	-	-	-
MTech(FT)	ECE	19PGECEFT	19271E24A	HighSpeedSwitchi ng Architecture	-	-	-	-
MTech(FT)	ECE	19PGECEFT	19271E24B	DSP Processor Architectureand Programming	-	-	-	-
MTech(FT)	ECE	19PGECEFT	19271E24C	DigitalSpeech Processing	-	-	-	-
MTech(FT)	ECE	19PGECEFT	19271E25A	DigitalCommunica tion Receivers	-	-	-	-
MTech(FT)	ECE	19PGECEFT	19271E25B	SoftComputing	-	-	-	-
MTech(FT)	ECE	19PGECEFT	19271E25C	Communication NetworkSecurity	-	-	-	-
MTech(FT)	ECE	19PGECEFT	19271E32A	SoftwareDefined Radio	-	-	-	-
MTech(FT)	ECE	19PGECEFT	19271E32B	Satellite Communication	-	-	-	-
MTech(FT)	ECE	19PGECEFT	19271E32C	CDMASystems	-	-	-	-



School: ENGINEERING AND TECHNOLOGY  
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MTech(FT)	ECE	19PGECEPT	19271E33A	Wavelets and Multi Resolution Processing	-	-	-	-
MTech(FT)	ECE	19PGECEPT	19271E33B	High Performance Communication Networks	-	-	-	-
MTech(FT)	ECE	19PGECEPT	19271E33C	Advanced Microprocessors and Microcontrollers	-	-	-	-
MTech(FT)	ECE	19PGECEPT	19271E34A	Simulation of Communication Networks	-	-	-	-
MTech(FT)	ECE	19PGECEPT	19271E34B	Medical Imaging	-	-	-	-
MTech(FT)	ECE	19PGECEPT	19271E34C	Mobile ADHOC Networks	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19248S11BP	Applied Mathematics for Electronics Engineering	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271C12P	Statistical Signal Processing	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271C13P	Modern Digital Communication Systems	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271L14P	Communication Systems Lab -I	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271CRSP	Research Led Seminar	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271C21P	Mobile Communication Networks	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271C22P	Advanced Microwave Systems	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271L24P	Communication Systems Lab-II	-	-	-	-
MTech(PT)	ECE	19PGECEPT	192TECW RP	Technical Writing / Seminars	-	-	-	-





School: ENGINEERING AND TECHNOLOGY  
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MTech(PT)	ECE	19PGECEPT	19271CRMP	Research Methodology	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271CBRP	Participation in Bounded Research	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271C31P	Communication Protocol Engineering	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271C32P	Advanced Radiation Systems	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271CSR	Design/Socio-Technical Project	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271C41P	Wireless Sensor Networks	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271C42P	Fiber Optic Networking	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271P44P	Project Work Phase - I	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271P61P	Project Work Phase - II	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271E23AP	High Speed Switching Architecture	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271E23BP	DSP Processor Architecture and Programming	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271E23CP	Digital Speech Processing	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271E33AP	Internet working and Multimedia	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271E33BP	Digital Image Processing	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271E33CP	LASER Communication	-	-	-	-
				Digital Communication Receivers				



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MTech(PT)	ECE	19PGECEPT	19271E43AP		-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271E43BP	SoftComputing	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271E43CP	Communication NetworkSecurity	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271E51AP	SoftwareDefined Radio	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271E51BP	Satellite Communication	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271E51CP	CDMASystems	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271E52AP	WaveletsandMulti Resolution Processing	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271E52BP	HighPerformance Communication Networks	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271E52CP	Advanced Microprocessorsand Microcontrollers	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271E53AP	Simulationof Communicatio n Networks	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271E53BP	Medical Imaging	-	-	-	-
MTech(PT)	ECE	19PGECEPT	19271E53CP	MobileADHOC networks	-	-	-	-

### **1.3.1SUPPORTINGDOCUMENTS**

Courses (offered in 2019-20) which address the Gender Sensitization, Human Values, Professional Ethics, Environment and sustainability.

## **SCHOOLOFENGINEERINGANDTECHNOLOGY**

### **DEPARTMENTOFELECTRONICSANDCOMMUNICATION**

### **ENGINEERING**

Gender Sensitization and Human Values	
Professional Ethics	
Human Values	
Environment and sustainability	
Professional Ethics & Human Values	



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**Vallam, Thanjavur**

**SCHOOL OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF  
ELECTRONICS & COMMUNICATION ENGINEERING**

**PROGRAM HANDBOOK**

**B.TECH – FULL TIME**

[REGULATION 2019]

### **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:

**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**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.

**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.

**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.

**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.

**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.

**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.

**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**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.

**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.

**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 programme objective and the outcomes is given in the following table

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMME OUTCOMES												
	A	B	C	D	E	F	G	H	I	J	K	L	M
<b>1</b>	3	3	2	3	2	1	1	2	1	1	3	1	3
<b>2</b>	3	3	3	3	3	1	1	1	1	1	1	2	2
<b>3</b>	3	3	3	3	3	2	2	3	1	2	2	2	2

**Contribution      1: Reasonable                      2: Significant                      3: Strong**

## B.TECH (FULL TIME) – ECE – R-2019

### I - VIII SEMESTERS CURRICULUM

#### SEMESTER I

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
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
<b>PRACTICALS</b>						
7.	19150L17	Problem Solving and Python Programming Lab	0	0	4	2
8.	19149L18	Physics and Chemistry Laboratory	0	0	4	2
9.	191VEA19	Value Education				-
<b>TOTAL</b>			<b>19</b>	<b>0</b>	<b>12</b>	<b>25</b>

#### SEMESTER II

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	19147S21	Technical English	4	0	0	4
2.	19148S22	Engineering Mathematics II	4	0	0	4
3.	19149S23B	Physics for Electronics Engineering	3	0	0	3
4.	19153S24B	Circuit Analysis	4	0	0	4
5.	19153S25B	Basic Electrical And Instrumentation Engineering	3	0	0	3
6.	19152S26B	Electronic Devices	3	0	0	3
<b>PRACTICALS</b>						
7.	19154L27	Engineering Practices Laboratory	0	0	4	2
8.	19152L28B	Circuits and Devices Laboratory	0	0	4	2
9.	191ICA29	Fundamentals of Indian Constitution and Economy				-
<b>TOTAL</b>			<b>21</b>	<b>0</b>	<b>8</b>	<b>25</b>

#### SEMESTER III

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	19148S31B	Linear Algebra and Partial Differential Equations	4	0	0	4
2.	19152S32	Control Systems Engineering	3	0	0	3
3.	19152S33	Fundamentals of Data Structures in C	3	0	0	3
4.	19152C34	Digital Electronics	3	0	0	3
5.	19152C35	Signals and Systems	4	0	0	4
6.	19152C36	Electronic Circuits- I	3	0	0	3
<b>PRACTICALS</b>						
7.	19152L37	Fundamentals of Data Structures in C	0	0	4	2

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
		Laboratory				
8.	19152L38	Analog and Digital Circuits Laboratory	0	0	4	2
9.	19152L39	Interpersonal Skills / Listening & Speaking	0	0	2	1
<b>TOTAL</b>			20	0	10	25

#### SEMESTER IV

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	19148S41B	Probability and Random Processes	4	0	0	4
2.	19152C42	Electronic Circuits II	3	0	0	3
3.	19152C43	Communication Theory	3	0	0	3
4.	19152C44	Electromagnetic Fields	4	0	0	4
5.	19152C45	Linear Integrated Circuits	3	0	0	3
6.	19149S46	Environmental Science and Engineering	3	0	0	3
<b>PRACTICALS</b>						
7.	19152L47	Circuits Design and Simulation Laboratory	0	0	4	2
8.	19152L48	Linear Integrated Circuits Laboratory	0	0	4	2
<b>Research Skill Development (RSD) Course</b>						
9.	19152CRS	Research Led Seminar				1
<b>TOTAL</b>			20	0	8	25

#### SEMESTER V

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	19152C51	Digital Communication	3	0	0	3
2.	19152C52	Discrete-Time Signal Processing	4	0	0	4
3.	19152S53	Computer Architecture and Organization	3	0	0	3
4.	<b>191_OE54</b>	<b>Open Elective – I</b>	3	0	0	3
5.	19152C55	Communication Networks	3	0	0	3
6.	<b>19152E56</b>	<b>Elective – I</b>	3	0	0	3
<b>PRACTICALS</b>						
7.	19152L57	Digital Signal Processing Laboratory	0	0	4	2
8.	19152L58	Communication Systems Laboratory	0	0	4	2
9.	19152L59	Communication Networks Laboratory	0	0	4	2
<b>Research Skill Development (RSD) Course</b>						
10.	19152CRM	Research Methodology	3	0	0	3
<b>TOTAL</b>			19	0	12	28



**SEMESTER VI**

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	19152C61	Microprocessors and Microcontrollers	3	0	0	3
2.	19152C62	VLSI Design	3	0	0	3
3.	19152C63	Wireless Communication	3	0	0	3
4.	19152S64	Principles of Management	3	0	0	3
5.	19152C65	Transmission Lines and RF Systems	3	0	0	3
6.	19152E66_	Elective – II	3	0	0	3
<b>PRACTICALS</b>						
7.	19152L61	Microprocessors and Microcontrollers Laboratory	0	0	4	2
8.	19152L62	VLSI Design Laboratory	0	0	4	2
9.	19152L63	Professional Communication	0	0	2	1
10.	19152L64	Technical Seminar	0	0	2	1
<b>Research Skill Development (RSD) Course</b>						
11.	19152CBR	Participation in Bounded Research				1
<b>TOTAL</b>			18	0	12	25

**SEMESTER VII**

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	19152C71	Antennas and Microwave Engineering	3	0	0	3
2.	19152C72	Optical Communication	3	0	0	3
3.	19152C73	Embedded and Real Time Systems	3	0	0	3
4.	191_OE74_	Open Elective – II	3	0	0	3
5.	19152C75	Adhoc and Wireless Sensor Networks	3	0	0	3
6.	19152E76_	Elective – III	3	0	0	3
<b>PRACTICALS</b>						
7.	19152L77	Embedded Laboratory	0	0	4	2
8.	19152L78	Advanced Communication Laboratory	0	0	4	2
<b>Research Skill Development (RSD) Course</b>						
9.	19152CSR	Design/Socio Technical Project				3
<b>TOTAL</b>			18	0	8	25

**SEMESTER VIII**

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	19152E81_	Elective – IV	3	0	0	3
2.	19152E82_	Elective – V	3	0	0	3
<b>PRACTICALS</b>						
3.	19152P83	Project Work	0	0	20	10
4.	19152PEE	Programme Exit Examination	0	0	0	2
<b>TOTAL</b>			6	0	20	18
<b>TOTAL NO. OF CREDITS:</b>						<b>196</b>

## LIST OF ELECTIVES

### ELECTIVE - I (SEMESTER V)

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	19152E56A	Object Oriented Programming	3	0	0	3
2.	19152E56B	Medical Electronics	3	0	0	3
3.	19152E56C	Operating Systems	3	0	0	3
4.	19152E56D	Robotics and Automation	3	0	0	3
5.	19152E56E	Nano Technology and Applications	3	0	0	3
6.	19152E56F	Human Rights	3	0	0	3
7.	19152E56G	Total Quality Management	3	0	0	3

### ELECTIVE – II (SEMESTER VI)

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	19152E66A	Cryptography and Network Security	3	0	0	3
2.	19152E66B	Advanced Digital Signal Processing	3	0	0	3
3.	19152E66C	MEMS and NEMS	3	0	0	3
4.	19152E66D	Multimedia Compression and Communication	3	0	0	3
5.	19152E66E	CMOS Analog IC Design	3	0	0	3
6.	19152E66F	Wireless Networks	3	0	0	3
7.	19152E66G	Intellectual Property Rights	3	0	0	3

### ELECTIVE – III (SEMESTER VII)

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	19152E76A	Advanced Wireless Communication	3	0	0	3
2.	19152E76B	Cognitive Radio	3	0	0	3
3.	19152E76C	Foundation Skills in Integrated Product Development	3	0	0	3
4.	19152E76D	Machine Learning Techniques	3	0	0	3
5.	19152E76E	Electronics Packaging and Testing	3	0	0	3
6.	19152E76F	Mixed Signal IC Design	3	0	0	3
7.	19152E76G	Disaster Management	3	0	0	3

**ELECTIVE – IV (SEMESTER VIII)**

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	19152E81A	Electro Magnetic Interference and Compatibility	3	0	0	3
2.	19152E81B	Low Power SoC Design	3	0	0	3
3.	19152E81C	Photonic Networks	3	0	0	3
4.	19152E81D	Compressive Sensing	3	0	0	3
5.	19152E81E	Digital Image Processing	3	0	0	3
6.	19152E81F	Professional Ethics in Engineering	3	0	0	3

**ELECTIVE - V (SEMESTER VIII)**

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	19152E82A	Video Analytics	3	0	0	3
2.	19152E82B	DSP Architecture and Programming	3	0	0	3
3.	19152E82C	Satellite Communication	3	0	0	3
4.	19152E82D	Soft Computing	3	0	0	3
5.	19152E82E	Principles of Speech Processing	3	0	0	3
6.	19152E82F	Fundamentals of Nano Science	3	0	0	3

## LIST OF OPEN ELECTIVES

### OPEN ELECTIVE – I (SEMESTER V)

Sl. No	DEPT	COURSE CODE	COURSE TITLE	L	T	P	C
1.	CSE	19150OE54A	Database Management Systems	3	0	0	3
2.		19150OE54B	Cloud Computing	3	0	0	3
3.	EEE	19153OE54A	Industrial Nano Technology	3	0	0	3
4.		19153OE54B	Energy Conservation and Management	3	0	0	3
5.	MECH	19154OE54A	Renewable Energy Sources	3	0	0	3
6.		19154OE54B	Automotive Systems	3	0	0	3
7.	CIVIL	19155OE54A	Air Pollution and Control Engineering	3	0	0	3
8.		19155OE54B	Geographic Information System	3	0	0	3

### OPEN ELECTIVE – II (SEMESTER VII)

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.	EEE	19153OE74A	Basic Circuit Theory	3	0	0	3
4.		19153OE74B	Introduction to Renewable Energy Systems	3	0	0	3
5.	MECH	19154OE74A	Industrial Safety	3	0	0	3
6.		19154OE74B	Testing of Materials	3	0	0	3
7.	CIVIL	19155OE74A	Green Building Design	3	0	0	3
8.		19155OE74B	Waste Water Treatment	3	0	0	3

## B.TECH (FULL TIME) – ECE – R-2019

### 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		Open Elective		Nos.	Credits		Nos.	Credits	
	Nos.	Credits	Nos.	Credits	Nos.	Credits	Nos.	Credits	Nos.	Credits						
I	02	07	02	04	-	-	-	-	-	-	04	14	25	01	-	25
II	03	10	02	04	-	-	-	-	-	-	03	11	25	01	-	25
III	05	16	03	05	-	-	-	-	-	-	01	04	25	-	-	25
IV	05	16	02	04	01	01	-	-	-	-	01	04	25	-	-	25
V	04	13	03	06	01	03	01	03	01	03	-	-	28	-	-	28
VI	05	15	02	04	01	01	01	03	-	-	-	-	23	02	02	25
VII	04	12	02	04	01	03	01	03	01	03	-	-	25	-	-	25
VIII	-	-	01	10	-	-	02	06	-	-	-	-	16	01	02	18
<b>TOTAL CREDITS</b>													<b>192</b>		<b>04</b>	<b>195</b>

\*RSD-Research Skill Development

**HOD**

**DEAN**

**DEAN -  
ACADEMIC AFFAIRS**

**SEMESTER I**

19147S11

**COMMUNICATIVE ENGLISH**

L	T	P	C
4	0	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.

**TOTAL: 60 PERIODS****OUTCOMES:****At the end of the course, learners will be able to:**

- Read articles of a general kind in magazines and newspapers.
- Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.

- Comprehend conversations and short talks delivered in English
- Write short essays of a general kind and personal letters and emails in English.

**TEXT BOOKS:**

1. Board of Editors. **Using English** A Coursebook for Undergraduate Engineers and Technologists. Orient BlackSwan Limited, Hyderabad: 2015
2. Richards, C. Jack. **Interchange Students' Book-2** New Delhi: CUP, 2015.

**REFERENCES:**

1. Bailey, Stephen. **Academic Writing: A practical guide for students**. New York: Rutledge, 2011.
2. Means, L. Thomas and Elaine Langlois. **English & Communication For Colleges**. Cengage Learning, USA: 2007
3. Redston, Chris & Gillies Cunningham **Face2Face** (Pre-intermediate Student's Book & Workbook) Cambridge University Press, New Delhi: 2005
4. Comfort, Jeremy, et al. **Speaking Effectively: Developing Speaking Skills for Business English**. Cambridge University Press, Cambridge: Reprint 2011
5. Dutt P. Kiranmai and Rajeevan Geeta. **Basic Communication Skills**, Foundation Books: 2013.

**SEMESTER I**

19148S12

**ENGINEERING MATHEMATICS I**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**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, 43<sup>rd</sup> Edition, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7<sup>th</sup> 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, 10<sup>th</sup> Edition, 2016.
2. Jain R.K. and Iyengar S.R.K., —Advanced Engineering Mathematics, Narosa Publications, New Delhi, 3<sup>rd</sup> 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", 12<sup>th</sup> Edition, Pearson India, 2016.

**SEMESTER I****19149S13****ENGINEERING PHYSICS**

L	T	P	C
3	0	0	3

**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 conduction 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.

**SEMESTER I****19149S14****ENGINEERING CHEMISTRY****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, 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<sub>2</sub>-O<sub>2</sub> 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.

**SEMESTER I****19154S15****ENGINEERING GRAPHICS**

L	T	P	C
2	0	4	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 BOOKS:**

1. Natrajan K.V., —A text book of Engineering Graphics, Dhanalakshmi Publishers, Chennai, 2009.

2. Venugopal K. and Prabhu Raja V., —Engineering Graphicsl, New Age International (P) Limited, 2008.

**REFERENCES:**

1. Bhatt N.D. and Panchal V.M., —Engineering Drawingl, Charotar Publishing House, 50<sup>th</sup> Edition, 2010.
2. Basant Agarwal and Agarwal C.M., —Engineering Drawingl, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Gopalakrishna K.R., —Engineering Drawingl (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 Graphicsl, Oxford University, Press, New Delhi, 2015.
6. Shah M.B., and Rana B.C., —Engineering Drawingl, Pearson, 2<sup>nd</sup> Edition, 2009.

**Publication of Bureau of Indian Standards:**

- IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
- IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
- IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
- IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
- IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

19150S16

**PROBLEM SOLVING AND PYTHON PROGRAMMING**

L	T	P	C
3	0	0	3

**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.

**TOTAL: 45 PERIODS****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.



**TEXT BOOKS:**

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist``, 2<sup>nd</sup> 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. John V Guttag, —Introduction to Computation and Programming Using Python``, Revised and 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. Timothy A. Budd, —Exploring Python, Mc-Graw Hill Education (India) Private Ltd., 2015.
4. Kenneth A. Lambert, —Fundamentals of Python: First Programs, CENGAGE Learning, 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 to Computer Science using Python 3, Second edition, Pragmatic Programmers, LLC, 2013.

## SEMESTER I

19150L17

### PROBLEM SOLVING AND PYTHON PROGRAMMING LAB

L	T	P	C
0	0	4	2

#### 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

#### 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**

**SEMESTER I****19149L18****PHYSICS AND CHEMISTRY LABORATORY****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.

**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
  - a) Determination of wavelength, and particle size using Laser
  - b) Determination of acceptance angle in an optical fiber.
3. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
4. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
5. Determination of wavelength of mercury spectrum – spectrometer grating
6. Determination of band gap of a semiconductor
7. Determination of thickness of a thin wire – Air wedge method

**TOTAL: 30 PERIODS****OUTCOMES:**

Upon completion of the course, the students will be able to 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 viscometry.
1. Estimation of HCl using  $\text{Na}_2\text{CO}_3$  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<sup>TH</sup> edition, 2014)



**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. Raman, Meenakshi and Sharma, Sangeetha- **Technical Communication Principles and Practice.**Oxford University Press: New Delhi,2014.
2. Kumar, Suresh. E. **Engineering English.** Orient Blackswan: Hyderabad,2015
3. Booth-L. Diana, **Project Work,** Oxford University Press, Oxford: 2014.
4. Grussendorf, Marion, **English for Presentations,** Oxford University Press, Oxford: 2007
5. Means, L. Thomas and Elaine Langlois, **English & Communication For Colleges.** Cengage Learning, USA: 2007

**Additional Reading:**

**Students can be asked to read Tagore, Chetan Bhagat and for supplementary reading.**

19148S22

ENGINEERING MATHEMATICS II

L	T	P	C
4	0	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  $w = z + c, cz, z^{-1}, z^2$  - 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.

**TOTAL: 60 PERIODS****OUTCOMES:**

**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, 43<sup>rd</sup> Edition, 2014.
2. Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10<sup>th</sup> 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, 7<sup>th</sup> Edition, 2009.
2. Jain R.K. and Iyengar S.R.K., — Advanced Engineering Mathematics I, Narosa Publications, New Delhi , 3<sup>rd</sup> 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, 4<sup>th</sup> 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.



**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 theorem – 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 NANO-ELECTRONIC 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 structures,
- 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

19153S24B

CIRCUIT ANALYSIS

L T P C  
4 0 0 4**OBJECTIVES:**

- To introduce the basic concepts of DC and AC circuits behavior
- To study the transient and steady state response of the circuits subjected to step and sinusoidal excitations.
- To introduce different methods of circuit analysis using Network theorems, duality and topology.

**UNIT I BASIC CIRCUITS ANALYSIS AND NETWORK TOPOLOGY 12**

Ohm's Law – Kirchoff'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.

**UNIT II NETWORK THEOREMS FOR DC AND AC CIRCUITS 12**

Network theorems – Superposition theorem, Thevenin's theorem, Norton's theorem, Reciprocity theorem, Millman's theorem, and Maximum power transfer theorem, application of Network theorems- Network reduction: voltage and current division, source transformation – star delta conversion.

**UNIT III RESONANCE AND COUPLED CIRCUITS 12**

Resonance - Series resonance - Parallel resonance - Variation of impedance with frequency - Variation in 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 and double tuned coupled circuits.

**UNIT IV TRANSIENT ANALYSIS 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, RL and RLC Circuits to sinusoidal excitation.

**UNIT V TWO PORT NETWORKS 12**

Two port networks, Z parameters, Y parameters, Transmission (ABCD) parameters, Hybrid(H) Parameters, Interconnection of two port networks, Symmetrical properties of T and  $\pi$  networks.

**TOTAL : 60 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Develop the capacity to analyze electrical circuits, apply the circuit theorems in real time
- Design and understand and evaluate the AC and DC circuits.

**TEXT BOOKS:**

1. William H. Hayt, Jr. Jack E. Kemmerly and Steven M. Durbin, —Engineering Circuit Analysis, McGraw Hill Science Engineering, Eighth Edition, 11<sup>th</sup> Reprint 2016.
2. Joseph Edminister and Mahmood Nahvi, —Electric Circuits, Schaum's Outline Series, Tata McGraw Hill Publishing Company, New Delhi, Fifth Edition Reprint 2016.

**REFERENCES:**

1. Charles K. Alexander, Mathew N.O. Sadiku, —Fundamentals of Electric Circuits, Fifth Edition, McGraw Hill, 9<sup>th</sup> Reprint 2015.

2. A.Bruce Carlson, —Cicuits: Engineering Concepts and Analysis of Linear Electric Circuitsl, Cengage Learning, India Edition 2<sup>nd</sup> Indian Reprint 2009.
3. Allan H.Robbins, Wilhelm C.Miller, —Circuit Analysis Theory and Practicel, Cengage Learning, Fifth Edition, 1<sup>st</sup> Indian Reprint 2013.

19153S25B

## BASIC ELECTRICAL AND INSTRUMENTATION ENGINEERING

L	T	P	C
3	0	0	3

**OBJECTIVES:**

To impart knowledge on

- Operation of Three phase electrical circuits and power measurement
- Working principles of Electrical Machines
- Working principle of Various measuring instruments

**UNIT I AC CIRCUITS AND POWER SYSTEMS 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

**UNIT III DC MACHINES 9**

Introduction – Constructional Features– Motoring and generation principle - Emf And Torque equation – Circuit Model – Methods of Excitation and magnetisation characteristics – Starting and Speed Control – Universal Motor

**UNIT IV AC MACHINES 9**

Principle of operation of three-phase induction motors – 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 MEASUREMENT AND INSTRUMENTATION 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: 45 PERIODS****OUTCOMES:****At the end of the course the students will be able to**

- Understand the concept of three phase power circuits and measurement.
- Comprehend the concepts in electrical generators, motors and transformers
- Choose appropriate measuring instruments for given application

**TEXT BOOKS:**

1. D P Kothari and I.J Nagarath, —Basic Electrical and Electronics Engineering, McGraw Hill Education (India) Private Limited, Third Reprint ,2016
2. Giorgio Rizzoni, —Principles and Applications of Electrical Engineering, McGraw Hill Education (India) Private Limited, 2010
3. S.K.Bhattacharya —Basic Electrical and Electronics Engineering, Pearson India, 2011

**REFERENCES:**

1. Del Toro ,|Electrical Engineering Fundamentals|, Pearson Education, New Delhi, 2015.

2. Leonard S Bobrow, — Foundations of Electrical Engineering, Oxford University Press, 2013
3. Rajendra Prasad ,Fundamentals of Electrical engineering, Prentice Hall of India, 2006.
4. Mittle N., —Basic Electrical Engineering, Tata McGraw Hill Edition, 24<sup>th</sup> reprint 2016
5. A.E.Fitzgerald, David E Higginbotham and Arvin Grabel, —Basic Electrical Engineering, McGraw Hill Education (India) Private Limited, 2009.

**OBJECTIVES:**

To acquaint the students with the construction, theory and operation of the basic electronic devices such as PN junction diode, Bipolar and Field effect Transistors, Power control devices, LED, LCD and other Opto-electronic devices

**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 - $\pi$  model - h-parameter model, Ebers Moll Model- Gummel Poon-model, 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, D-MOSFET, E-MOSFET- Characteristics – Comparison of MOSFET with JFET.

**UNIT IV SPECIAL SEMICONDUCTOR 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 POWER DEVICES AND DISPLAY DEVICES 9**

UJT, SCR, Diac, Triac, Power BJT- Power MOSFET- DMOS-VMOS. LED, LCD, Photo transistor, Opto Coupler, Solar cell, CCD.

**TOTAL : 45 PERIODS****OUTCOMES:**

**At the end of the course the students will be able to:**

- Explain the V-I characteristic of diode, UJT and SCR
- Describe the equivalence circuits of transistors
- Operate the basic electronic devices such as PN junction diode, Bipolar and Field effect Transistors, Power control devices, LED, LCD and other Opto-electronic devices

**TEXT BOOKS:**

1. Donald A Neaman, —Semiconductor Physics and Devices, Fourth Edition, Tata Mc GrawHill Inc. 2012.
2. Salivahanan. S, Suresh Kumar. N, Vallavaraj.A, —Electronic Devices and circuits, Third Edition, Tata McGraw- Hill, 2008.

**REFERENCES:**

1. Robert Boylestad and Louis Nashelsky, —Electron Devices and Circuit Theory, Pearson Prentice Hall, 10th edition, July 2008.
2. R.S.Sedha, — A Text Book of Applied Electronics, S.Chand Publications, 2006.
3. Yang, —Fundamentals of Semiconductor devices, McGraw Hill International Edition, 1978.

**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:**

Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

**Plumbing Works:**

1. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
2. Study of pipe connections requirements for pumps and turbines.
3. Preparation of plumbing line sketches for water supply and sewage works.
4. Hands-on-exercise:  
Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
5. Demonstration of plumbing requirements of high-rise buildings.

**Carpentry using Power Tools only:**

1. Study of the joints in roofs, doors, windows and furniture.
2. 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:**

Simple Turning and Taper turning  
Drilling Practice

**Sheet Metal Work:**

Forming & Bending:  
Model making – Trays and funnels.  
Different type of joints.

**Machine assembly practice:**

Study of centrifugal pump  
Study of air conditioner

**Demonstration on:**

Smithy operations, upsetting, swaging, setting down and bending. Example –  
Exercise – Production of hexagonal headed bolt.  
Foundry operations like mould preparation for gear and step cone pulley.  
Fitting – Exercises – Preparation of square fitting and V – fitting models.



## **GROUP B (ELECTRICAL & ELECTRONICS)**

### **III ELECTRICAL ENGINEERING PRACTICE**

**13**

Residential house wiring using switches, fuse, indicator, lamp and energy meter.

Fluorescent lamp wiring.

Stair case wiring

Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.

Measurement of energy using single phase energy meter.

Measurement of resistance to earth of an electrical equipment.

### **IV ELECTRONICS ENGINEERING PRACTICE**

**16**

Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.

Study of logic gates AND, OR, EX-OR and NOT.

Generation of Clock Signal.

Soldering practice – Components Devices and Circuits – Using general purpose PCB.

Measurement of ripple factor of HWR and FWR.

**TOTAL: 60  
PERIODS**

### **OUTCOMES:**

**On successful completion of this course, the student will be able to**

- 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, foundry and fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, soldering practices.

**OBJECTIVES:**

- To learn the characteristics of basic electronic devices such as Diode, BJT, FET, SCR
  - To understand the working of RL, RC and RLC circuits
  - To gain hand on experience in Thevinin & Norton theorem, KVL & KCL, and Super Position Theorems
1. Characteristics of PN Junction Diode
  2. Zener diode Characteristics & Regulator using Zener diode
  3. Common Emitter input-output Characteristics
  4. Common Base input-output Characteristics
  5. FET Characteristics
  6. SCR Characteristics
  7. Clipper and Clamper & FWR
  8. Verifications Of Thevinin & Norton theorem
  9. Verifications Of KVL & KCL
  10. Verifications Of Super Position Theorem
  11. verifications of maximum power transfer & reciprocity theorem
  12. Determination Of Resonance Frequency of Series & Parallel RLC Circuits
  13. Transient analysis of RL and RC circuits

**TOTAL : 60 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Analyze the characteristics of basic electronic devices
- Design RL and RC circuits
- Verify Thevinin & Norton theorem KVL & KCL, and Super Position Theorems

**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.

**19148S31B LINEAR ALGEBRA AND PARTIAL DIFFERENTIAL EQUATIONS**

L	T	P	C
4	0	0	4

**OBJECTIVES:**

- To introduce the basic notions of groups, rings, fields which will then be used to solve related problems.
- To understand the concepts of vector space, linear transformations and diagonalization.
- To apply the concept of inner product spaces in orthogonalization.
- To understand the procedure to solve partial differential equations.
- 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 VECTOR SPACES****12**

Vector spaces – Subspaces – Linear combinations and linear system of equations – Linear independence and linear dependence – Bases and dimensions.

**UNIT II LINEAR TRANSFORMATION AND DIAGONALIZATION****12**

Linear transformation - Null spaces and ranges - Dimension theorem - Matrix representation of a linear transformations - Eigenvalues and eigenvectors - Diagonalizability.

**UNIT III INNER PRODUCT SPACES****12**

Inner product, norms - Gram Schmidt orthogonalization process - Adjoint of linear operations - Least square approximation.

**UNIT IV PARTIAL DIFFERENTIAL EQUATIONS****12**

Formation – Solutions of first order equations – Standard types and equations reducible to standard types – Singular solutions – Lagrange’s linear equation – Integral surface passing through a given curve – Classification of partial differential equations - Solution of linear equations of higher order with constant coefficients – Linear non-homogeneous partial differential equations.

**UNIT V FOURIER SERIES SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS****12**

Dirichlet’s conditions – General Fourier series – Half range sine and cosine series - Method of separation of variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in Cartesian coordinates.

**TOTAL: 60 PERIODS****OUTCOMES:**

**Upon successful completion of the course, students should be able to:**

- Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
- Demonstrate accurate and efficient use of advanced algebraic techniques.
- Demonstrate their mastery by solving non - trivial problems related to the concepts and by 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, 43<sup>rd</sup> Edition, 2014.

2. Friedberg, A.H., Insel, A.J. and Spence, L., —Linear Algebra, Prentice Hall of India, New Delhi, 2004.

**REFERENCES:**

1. Burden, R.L. and Faires, J.D, "Numerical Analysis", 9<sup>th</sup> Edition, Cengage Learning, 2016.
2. James, G. —Advanced Modern Engineering Mathematics, Pearson Education, 2007.
3. Kolman, B. Hill, D.R., —Introductory Linear Algebra, Pearson Education, New Delhi, First Reprint, 2009.
4. Kumaresan, S., —Linear Algebra – A Geometric Approach, Prentice – Hall of India, New Delhi, Reprint, 2010.
5. Lay, D.C., —Linear Algebra and its Applications, 5<sup>th</sup> Edition, Pearson Education, 2015.
6. O'Neil, P.V., —Advanced Engineering Mathematics, Cengage Learning, 2007.
7. Strang, G., —Linear Algebra and its applications, Thomson (Brooks/Cole), New Delhi, 2005.
8. Sundarapandian, V. —Numerical Linear Algebra, Prentice Hall of India, New Delhi, 2008.

**OBJECTIVES:**

- To introduce the components and their representation of control systems
- To learn various methods for analyzing the time response, frequency response and stability of the systems.
- To learn the various approach for the state variable analysis.

**UNIT I        SYSTEMS COMPONENTS AND THEIR REPRESENTATION        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        TIME RESPONSE ANALYSIS        9**

Transient response-steady state response-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        FREQUENCY RESPONSE AND SYSTEM ANALYSIS        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        CONCEPTS OF STABILITY ANALYSIS        9**

Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Relative stability-Root locus concept-Guidelines for sketching root locus-Nyquist stability criterion.

**UNIT V        CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS        9**

State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-Equivalence between transfer function and state variable representations-State variable analysis of digital control system-Digital control design using state feedback.

**TOTAL: 45 PERIODS****OUTCOMES:**

**Upon completion of the course, the student should be able to:**

- Identify the various control system components and their representations.
- Analyze the various time domain parameters.
- Analysis the various frequency response plots and its system.
- Apply the concepts of various system stability criterions.
- Design various transfer functions of digital control system using state variable models.

**TEXT BOOK:**

1. M.Gopal, —Control System – Principles and Designl, Tata McGraw Hill, 4th Edition, 2012.

**REFERENCES:**

1. J.Nagrath and M.Gopal, —Control System Engineeringl, New Age International Publishers, 5<sup>th</sup> Edition, 2007.
2. K. Ogata, ‘Modern Control Engineering’, 5<sup>th</sup> edition, PHI, 2012.

3. S.K.Bhattacharya, Control System Engineering, 3rd Edition, Pearson, 2013.
4. Benjamin.C.Kuo, —Automatic control systemsll, Prentice Hall of India, 7th Edition,1995.

19152S33

## FUNDAMENTALS OF DATA STRUCTURES IN C

L T P C  
3 0 0 3**OBJECTIVES:**

- To learn the features of C
- To learn the linear and non-linear data structures
- To explore the applications of linear and non-linear data structures
- To learn to represent data using graph data structure
- To learn the basic sorting and searching algorithms

**UNIT I C PROGRAMMING BASICS 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 and Branching – 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, STRUCTURES AND UNIONS 9**

Functions – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic. Structures and unions - definition – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

**UNIT III LINEAR DATA STRUCTURES 9**

Arrays and its representations – Stacks and Queues – Linked lists – Linked list-based implementation of Stacks and Queues – Evaluation of Expressions – Linked list based polynomial addition.

**UNIT IV NON-LINEAR DATA STRUCTURES 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 SEARCHING AND SORTING ALGORITHMS 9**

Linear Search – Binary Search. Bubble Sort, Insertion sort – Merge sort – Quick sort - Hash tables – Overflow handling.

**TOTAL: 45 PERIODS****OUTCOMES:**

**Upon completion of the course, students will be able to:**

- Implement linear and non-linear data structure operations using C
- Suggest appropriate linear / non-linear data structure for any given data set.
- Apply hashing concepts for a given problem
- Modify or suggest new data structure for an application
- Appropriately choose the sorting algorithm for an application

**TEXTBOOKS:**

1. Pradip Dey and Manas Ghosh, —Programming in C, Second Edition, Oxford University Press, 2011.
2. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, —Fundamentals of Data Structures in C, Second Edition, University Press, 2008.

**REFERENCES:**

1. Mark Allen Weiss, —Data Structures and Algorithm Analysis in C, Second Edition, Pearson Education, 1996
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, —Data Structures and Algorithms, Pearson Education, 1983.



3. Robert Kruse, C.L.Tondo, Bruce Leung, Shashi Mogalla , — Data Structures and Program Design in C, Second Edition, Pearson Education, 2007
4. Jean-Paul Tremblay and Paul G. Sorenson, —An Introduction to Data Structures with Applications, Second Edition, Tata McGraw-Hill, 1991.

19152C34

**DIGITAL ELECTRONICS**

L	T	P	C
3	0	0	3

**OBJECTIVES:**

- To present the Digital fundamentals, Boolean algebra and its applications in digital systems
- To familiarize with the design of various combinational digital circuits using logic gates
- To introduce the analysis and design procedures for synchronous and asynchronous sequential circuits
- To explain the various semiconductor memories and related technology
- To introduce the electronic circuits involved in the making of logic gates

**UNIT I DIGITAL FUNDAMENTALS****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 of products and product of sums, Minterms and Maxterms, Karnaugh map Minimization and Quine-McCluskey method of minimization.

**UNIT II COMBINATIONAL CIRCUIT DESIGN****9**

Design of Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder – Carry look ahead Adder, BCD Adder, Multiplexer, Demultiplexer, Magnitude Comparator, Decoder, Encoder, Priority Encoder.

**UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS****9**

Flip flops – SR, JK, T, D, Master/Slave FF – operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design - Moore/Mealy models, state minimization, state assignment, circuit implementation – Design of Counters- Ripple Counters, Ring Counters, Shift registers, Universal Shift Register.

**UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS****9**

Stable and Unstable states, output specifications, cycles and races, state reduction, race free assignments, Hazards, Essential Hazards, Pulse mode sequential circuits, Design of Hazard free circuits.

**UNIT V MEMORY DEVICES AND DIGITAL INTEGRATED CIRCUITS****9**

Basic memory structure – ROM -PROM – EPROM – EEPROM –EAPROM, RAM – Static and dynamic RAM - Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using PLA, PAL.

Digital integrated circuits: Logic levels, propagation delay, power dissipation, fan-out and fan-in, noise margin, logic families and their characteristics-RTL, TTL, ECL, CMOS

**TOTAL: 45 PERIODS****OUTCOMES:****At the end of the course:**

- Use digital electronics in the present contemporary world
- Design various combinational digital circuits using logic gates
- Do the analysis and design procedures for synchronous and asynchronous sequential circuits
- Use the semiconductor memories and related technology
- Use electronic circuits involved in the design of logic gates

**TEXT BOOK:**

1. M. Morris Mano and Michael D. Ciletti, —Digital Designl, 5th Edition, Pearson, 2014.

**REFERENCES:**

1. Charles H.Roth. —Fundamentals of Logic Design, 6th Edition, Thomson Learning, 2013.
2. Thomas L. Floyd, —Digital Fundamentals, 10th Edition, Pearson Education Inc, 2011
3. S.Salivahanan and S.Arivazhagan—Digital Electronics, Ist Edition, Vikas Publishing House pvt Ltd, 2012.
4. Anil K.Maini —Digital Electronics, Wiley, 2014.
5. A.Anand Kumar —Fundamentals of Digital Circuits, 4th Edition, PHI Learning Private Limited, 2016.
6. Soumitra Kumar Mandal — Digital Electronics, McGraw Hill Education Private Limited, 2016.

19152C35

SIGNALS AND SYSTEMS

L	T	P	C
4	0	0	4

**OBJECTIVES:**

- To understand the basic properties of signal & systems
- To know the methods of characterization of LTI systems in time domain
- To analyze continuous time signals and system in the Fourier and Laplace domain
- To analyze discrete time signals and system in the Fourier and Z transform domain

**UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS 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 & Aperiodic signals, Deterministic & Random signals, Energy & Power signals - Classification of systems- CT systems and DT systems- – Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable.

**UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS 12**

Fourier series for periodic signals - Fourier Transform – properties- Laplace Transforms and properties

**UNIT III LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS 12**

Impulse response - convolution integrals- Differential Equation- Fourier and Laplace transforms in Analysis of CT systems - Systems connected in series / parallel.

**UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS 12**

Baseband signal Sampling – Fourier Transform of discrete time signals (DTFT) – Properties of DTFT - Z Transform & Properties

**UNIT V LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS 12**

Impulse response – Difference equations-Convolution sum- Discrete Fourier Transform and Z Transform Analysis of Recursive & Non-Recursive systems-DT systems connected in series and parallel.

**TOTAL: 60 PERIODS****OUTCOMES:**

**At the end of the course, the student should be able to:**

- To be able to determine if a given system is linear/causal/stable
- Capable of determining the frequency components present in a deterministic signal
- Capable of characterizing LTI systems in the time domain and frequency domain
- To be able to compute the output of an LTI system in the time and frequency domains

**TEXT BOOK:**

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, —Signals and Systems, Pearson, 2015. (Unit 1-V)

**REFERENCES**

1. B. P. Lathi, —Principles of Linear Systems and Signals, Second Edition, Oxford, 2009.
2. R.E.Zeimer, W.H.Tranter and R.D.Fannin, —Signals & Systems - Continuous and Discrete, Pearson, 2007.
3. John Alan Stuller, —An Introduction to Signals and Systems, Thomson, 2007.



**TEXT BOOKS:**

1. Donald. A. Neamen, Electronic Circuits Analysis and Design, 3<sup>rd</sup> Edition, Mc Graw Hill Education (India) Private Ltd., 2010. (Unit I-IV)
2. Robert L. Boylestad and Louis Nasheresky, —Electronic Devices and Circuit Theoryl, 11<sup>th</sup> Edition, Pearson Education, 2013. (Unit V)

**REFERENCES**

1. Millman J, Halkias.C.and Sathyabrada Jit, Electronic Devices and Circuits, 4<sup>th</sup> Edition, Mc Graw Hill Education (India) Private Ltd., 2015.
2. Salivahanan and N. Suresh Kumar, Electronic Devices and Circuits, 4<sup>th</sup> Edition, , Mc Graw Hill Education (India) Private Ltd., 2017.
3. Floyd, Electronic Devices, Ninth Edition, Pearson Education, 2012.
4. David A. Bell, Electronic Devices & Circuits, 5<sup>th</sup> Edition, Oxford University Press, 2008.
5. Anwar A. Khan and Kanchan K. Dey, A First Course on Electronics, PHI, 2006.
6. Rashid M, Microelectronics Circuits, Thomson Learning, 2007.

19152L37 FUNDAMENTALS OF DATA STRUCTURES IN C LABORATORY

L T P C  
0 0 4 2

**OBJECTIVES:**

- To understand and implement basic data structures using C
- To apply linear and non-linear data structures in problem solving.
- To learn to implement functions and recursive functions by means of data structures
- To implement searching and sorting algorithms

**LIST OF EXERCISES**

1. Basic C Programs – looping, data manipulations, arrays
2. Programs using strings – string function implementation
3. Programs using structures and pointers
4. Programs involving dynamic memory allocations
5. Array implementation of stacks and queues
6. Linked list implementation of stacks and queues
7. Application of Stacks and Queues
8. Implementation of Trees, Tree Traversals
9. Implementation of Binary Search trees
10. Implementation of Linear search and binary search
11. Implementation Insertion sort, Bubble sort, Quick sort and Merge Sort
12. Implementation Hash functions, collision resolution technique

**TOTAL:60 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- Write basic and advanced programs in C
- Implement functions and recursive functions in C
- Implement data structures using C
- Choose appropriate sorting algorithm for an application and implement it in a modularized way

**OBJECTIVES:****The student should be made to:**

- Study the Frequency response of CE, CB and CC Amplifier
- Learn the frequency response of CS Amplifiers
- Study the Transfer characteristics of differential amplifier
- Perform experiment to obtain the bandwidth of single stage and multistage amplifiers
- Perform SPICE simulation of Electronic Circuits
- Design and implement the Combinational and sequential logic circuits

**LIST OF ANALOG EXPERIMENTS:**

1. Design of Regulated Power supplies
2. Frequency Response of CE, CB, CC and CS amplifiers
3. Darlington Amplifier
4. Differential Amplifiers - Transfer characteristics, CMRR Measurement
5. Cascode and Cascade amplifiers
6. Determination of bandwidth of single stage and multistage amplifiers
7. Analysis of BJT with Fixed bias and Voltage divider bias using Spice
8. Analysis of FET, MOSFET with fixed bias, self-bias and voltage divider bias using simulation software like Spice
9. Analysis of Cascode and Cascade amplifiers using Spice
10. Analysis of Frequency Response of BJT and FET using Spice

**LIST OF DIGITAL EXPERIMENTS**

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 using IC 7483
3. Design and implementation of Multiplexer and De-multiplexer using logic gates
4. Design and implementation of encoder and decoder using logic gates
5. Construction and verification of 4 bit ripple counter and Mod-10 / Mod-12 Ripple counters
6. Design and implementation of 3-bit synchronous up/down counter

**TOTAL : 60 PERIODS****OUTCOMES:****On completion of this laboratory course, the student should be able to:**

- Design and Test rectifiers, filters and regulated power supplies.
- Design and Test BJT/JFET amplifiers.
- Differentiate cascode and cascade amplifiers.
- Analyze the limitation in bandwidth of single stage and multi stage amplifier
- Measure CMRR in differential amplifier
- Simulate and analyze amplifier circuits using PSpice.
- Design and Test the digital logic circuits.



19152L39

## INTERPERSONAL SKILLS / LISTENING &amp; SPEAKING

L	T	P	C
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 : 30PERIODS****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. Vargo, Mari. Speak Now Level 4. Oxford University Press: Oxford, 2013.
4. Richards C. Jack. Person to Person (Starter). Oxford University Press: Oxford, 2006.
5. Ladousse, Gillian Porter. Role Play. Oxford University Press: Oxford, 2014

**19148S41B      PROBABILITY AND RANDOM PROCESSES**

L	T	P	C
4	0	0	4

**OBJECTIVES :**

- To provide necessary basic concepts in probability and random processes for applications such as 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.
- To understand the basic concepts of random processes which are widely used in IT fields.
- To understand the concept of correlation and spectral densities.
- To understand the significance of linear systems with random inputs.

**UNIT I      PROBABILITY AND RANDOM VARIABLES      12**

Probability – 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      RANDOM PROCESSES      12**

Classification – Stationary process – Markov process - Markov chain - Poisson process – Random telegraph process.

**UNIT IV      CORRELATION AND SPECTRAL DENSITIES      12**

Auto correlation functions – Cross correlation functions – Properties – Power spectral density – Cross spectral density – Properties.

**UNIT V      LINEAR SYSTEMS WITH RANDOM INPUTS      12**

Linear time invariant system – System transfer function – Linear systems with random inputs – Auto correlation and cross correlation functions of input and output.

**TOTAL : 60 PERIODS****OUTCOMES:****Upon successful completion of the course, students should 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 random processes in engineering disciplines.
- Understand and apply the concept of correlation and spectral densities.
- 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.

**TEXT BOOKS:**

1. Ibe, O.C., " Fundamentals of Applied Probability and Random Processes ", 1<sup>st</sup> Indian Reprint, Elsevier, 2007.
2. Peebles, P.Z., "Probability, Random Variables and Random Signal Principles ", Tata McGraw Hill, 4<sup>th</sup> Edition, New Delhi, 2002.

**REFERENCES:**

1. Cooper. G.R., McGillem. C.D., "Probabilistic Methods of Signal and System Analysis", Oxford University Press, New Delhi, 3<sup>rd</sup> 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. and Childers. D.G., — Probability and Random Processes with Applications to Signal Processing and Communications ", Academic Press, 2004.
4. Stark. H. and Woods. J.W., — Probability and Random Processes with Applications to Signal Processing ", Pearson Education, Asia, 3<sup>rd</sup> Edition, 2002.
5. Yates. R.D. and Goodman. D.J., —Probability and Stochastic Processes", Wiley India Pvt. Ltd., Bangalore, 2<sup>nd</sup> Edition, 2012.



**REFERENCES:**

1. Robert L. Boylestad and Louis Nasheresky, —Electronic Devices and Circuit Theoryl, 10th Edition, Pearson Education / PHI, 2008
2. David A. Bell, —Electronic Devices and Circuitsl, Fifth Edition, Oxford University Press, 2008.
3. Millman J. and Taub H., —Pulse Digital and Switching Waveformsl, TMH, 2000.
4. Millman and Halkias. C., Integrated Electronics, TMH, 2007.

19152C43

COMMUNICATION THEORY

L T P C  
3 0 0 3**OBJECTIVES:**

- To introduce the concepts of various analog modulations and their spectral characteristics
- To understand the properties of random process
- To know the effect of noise on communication systems
- To study the limits set by Information Theory

**UNIT I AMPLITUDE MODULATION****9**

Amplitude Modulation- DSBSC, DSBFC, SSB, VSB - Modulation index, Spectra, Power relations and Bandwidth – AM Generation – Square law and Switching modulator, DSBSC Generation – Balanced and Ring Modulator, SSB Generation – Filter, Phase Shift and Third Methods, VSB Generation – Filter Method, Hilbert Transform, Pre-envelope & complex envelope –comparison of different AM techniques, Superheterodyne Receiver

**UNIT II ANGLE MODULATION****9**

Phase and frequency modulation, Narrow Band and Wide band FM – Modulation index, Spectra, Power relations and Transmission Bandwidth - FM modulation –Direct and Indirect methods, FM Demodulation – FM to AM conversion, FM Discriminator - PLL as FM Demodulator.

**UNIT III RANDOM PROCESS****9**

Random variables, Random Process, Stationary Processes, Mean, Correlation & Covariance functions, Power Spectral Density, Ergodic Processes, Gaussian Process, Transmission of a Random Process Through a LTI filter.

**UNIT IV NOISE CHARACTERIZATION****9**

Noise sources – Noise figure, noise temperature and noise bandwidth – Noise in cascaded systems. Representation of Narrow band noise –In-phase and quadrature, Envelope and Phase – Noise performance analysis in AM & FM systems – Threshold effect, Pre-emphasis and de-emphasis for FM.

**UNIT V SAMPLING & QUANTIZATION****9**

Low pass sampling – Aliasing- Signal Reconstruction-Quantization - Uniform & non-uniform quantization - quantization noise - Logarithmic Companding –PAM, PPM, PWM, PCM – TDM, FDM.

**TOTAL: 45  
PERIODS**

**OUTCOMES:****At the end of the course, the student should be able to:**

- Design AM communication systems
- Design Angle modulated communication systems
- Apply the concepts of Random Process to the design of Communication systems
- Analyze the noise performance of AM and FM systems
- Gain knowledge in sampling and quantization

**TEXT BOOKS:**

1. J.G.Proakis, M.Salehi, —Fundamentals of Communication Systems, Pearson Education 2014. (UNIT I-IV)
2. Simon Haykin, —Communication Systems, 4th Edition, Wiley, 2014.(UNIT I-V)

**REFERENCES:**

1. B.P.Lathi, —Modern Digital and Analog Communication Systems, 3rd Edition, Oxford University Press, 2007.

2. D.Roody, J.Coolen, —Electronic Communications, 4th edition PHI 2006
3. A.Papoulis, —Probability, Random variables and Stochastic Processes, McGraw Hill, 3<sup>rd</sup> edition, 1991.
4. B.Sklar, —Digital Communications Fundamentals and Applications, 2nd Edition Pearson Education 2007
5. H P Hsu, Schaum Outline Series - —Analog and Digital Communications, TMH 2006
6. Couch.L., "Modern Communication Systems", Pearson, 2001.



19152C44

**ELECTROMAGNETIC FIELDS****L T P C**  
**4 0 0 4****OBJECTIVES:**

- To gain conceptual and basic mathematical understanding of electric and magnetic fields in free space and in materials
- To understand the coupling between electric and magnetic fields through Faraday's law, displacement current and Maxwell's equations
- To understand wave propagation in lossless and in lossy media
- To be able to solve problems based on the above concepts

**UNIT I INTRODUCTION****12**

Electromagnetic model, Units and constants, Review of vector algebra, Rectangular, cylindrical and spherical coordinate systems, Line, surface and volume integrals, Gradient of a scalar field, Divergence of a vector field, Divergence theorem, Curl of a vector field, Stoke's theorem, Null identities, Helmholtz's theorem

**UNIT II ELECTROSTATICS****12**

Electric field, Coulomb's law, Gauss's law and applications, Electric potential, Conductors in static electric field, Dielectrics in static electric field, Electric flux density and dielectric constant, Boundary conditions, Capacitance, Parallel, cylindrical and spherical capacitors, Electrostatic energy, Poisson's and Laplace's equations, Uniqueness of electrostatic solutions, Current density and Ohm's law, Electromotive force and Kirchhoff's voltage law, Equation of continuity and Kirchhoff's current law

**UNIT III MAGNETOSTATICS****12**

Lorentz force equation, Law of no magnetic monopoles, Ampere's law, Vector magnetic potential, Biot-Savart law and applications, Magnetic field intensity and idea of relative permeability, Magnetic circuits, Behaviour of magnetic materials, Boundary conditions, Inductance and inductors, Magnetic energy, Magnetic forces and torques

**UNIT IV TIME-VARYING FIELDS AND MAXWELL'S EQUATIONS****12**

Faraday's law, Displacement current and Maxwell-Ampere law, Maxwell's equations, Potential functions, Electromagnetic boundary conditions, Wave equations and solutions, Time-harmonic fields

**UNIT V PLANE ELECTROMAGNETIC WAVES****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 plane conducting boundary, Normal incidence at a plane dielectric boundary

**TOTAL: 60 PERIODS****OUTCOMES:****By the end of this course, the student should be able to:**

- Display an understanding of fundamental electromagnetic laws and concepts
- Write Maxwell's equations in integral, differential and phasor forms and explain their physical meaning
- Explain electromagnetic wave propagation in lossy and in lossless media
- Solve simple problems requiring estimation of electric and magnetic field quantities based on these concepts and laws

**TEXT BOOKS:**

1. D.K. Cheng, Field and wave electromagnetics, 2nd ed., Pearson (India), 1989 (UNIT I, II,III IV,V)

2. W.H. Hayt and J.A. Buck, Engineering electromagnetics, 7th ed., McGraw-Hill (India), 2006 (UNIT I-V)

#### **REFERENCES**

1. D.J. Griffiths, Introduction to electrodynamics, 4th ed., Pearson (India), 2013
2. B.M. Notaros, Electromagnetics, Pearson: New Jersey, 2011
3. M.N.O. Sadiku and S.V. Kulkarni, Principles of electromagnetics, 6th ed., Oxford (Asian Edition), 2015

**19152C45                      LINEAR INTEGRATED CIRCUITS****L T P C  
3 0 0 3****OBJECTIVES:**

- To introduce the basic building blocks of linear integrated circuits
- To learn the linear and non-linear applications of operational amplifiers
- To introduce the theory and applications of analog multipliers and PLL
- To learn the theory of ADC and DAC
- To introduce the concepts of waveform generation and introduce some special function ICs

**UNIT I                      BASICS OF OPERATIONAL AMPLIFIERS                      9**

Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References, BJT Differential amplifier with active loads, Basic information about op-amps – Ideal Operational Amplifier - General operational amplifier stages -and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, Open and closed loop configurations – JFET Operational Amplifiers – LF155 and TL082.

**UNIT II                      APPLICATIONS OF OPERATIONAL AMPLIFIERS                      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 and clamper, Low-pass, high-pass and band-pass Butterworth filters.

**UNIT III                      ANALOG MULTIPLIER AND PLL                      9**

Analog Multiplier using Emitter Coupled Transistor Pair - Gilbert Multiplier cell – Variable transconductance 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 AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing and clock synchronisation.

**UNIT IV                      ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS                      9**

Analog and Digital Data Conversions, D/A converter – specifications - weighted resistor type, R-2R Ladder type, Voltage Mode and Current-Mode R - 2R Ladder types - switches for D/A converters, high speed sample-and-hold circuits, A/D Converters – specifications - Flash type - Successive Approximation type - Single Slope type – Dual Slope type - A/D Converter using Voltage-to-Time Conversion - Over-sampling A/D Converters, Sigma – Delta converters.

**UNIT V                      WAVEFORM GENERATORS AND SPECIAL FUNCTION ICs                      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 adjustable voltage regulators - IC 723 general purpose regulator - Monolithic switching regulator, Low Drop – Out(LDO) Regulators - Switched capacitor filter IC MF10, Frequency to Voltage and Voltage to Frequency converters, Audio Power amplifier, Video Amplifier, Isolation Amplifier, Opto-couplers and fibre optic IC.

**TOTAL: 45 PERIODS****OUTCOMES:**

**Upon completion of the course, the student should be able to:**

- Design linear and non linear applications of OP – AMPS
- Design applications using analog multiplier and PLL
- Design ADC and DAC using OP – AMPS
- Generate waveforms using OP – AMP Circuits
- Analyze special function ICs

**TEXT BOOKS:**

1. D.Roy Choudhry, Shail Jain, —Linear Integrated Circuits, New Age International Pvt. Ltd., 2018, Fifth Edition. (Unit I – V)
2. Sergio Franco, —Design with Operational Amplifiers and Analog Integrated Circuits, 4th Edition, Tata Mc Graw-Hill, 2016 (Unit I – V)

**REFERENCES:**

1. Ramakant A. Gayakwad, —OP-AMP and Linear ICs, 4th Edition, Prentice Hall / Pearson Education, 2015.
2. Robert F.Coughlin, Frederick F.Driscoll, —Operational Amplifiers and Linear Integrated Circuits, Sixth Edition, PHI, 2001.
3. B.S.Sonde, —System design using Integrated Circuits, 2nd Edition, New Age Pub, 2001.
4. Gray and Meyer, —Analysis and Design of Analog Integrated Circuits, Wiley International, 5<sup>th</sup> Edition, 2009.
5. William D.Stanley, —Operational Amplifiers with Linear Integrated Circuits, Pearson Education, 4<sup>th</sup> Edition, 2001.
6. S.Salivahanan & V.S. Kanchana Bhaskaran, —Linear Integrated Circuits, TMH, 2<sup>nd</sup> Edition, 4<sup>th</sup> Reprint, 2016.

**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’, 2<sup>nd</sup> 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. Rajagopalan, R, ‘\_Environmental Studies-From Crisis to Cure’, Oxford University Press, 2005.
4. G. Tyler Miller and Scott E. Spoolman, ‘—Environmental Sciencell’, Cengage Learning India PVT, LTD, Delhi, 2014.

19152L47

CIRCUITS DESIGN AND SIMULATION LABORATORY

L T P C  
0 0 4 2

**OBJECTIVES:**

- To gain hands on experience in designing electronic circuits
- To learn simulation software used in circuit design
- To learn the fundamental principles of amplifier circuits
- To differentiate feedback amplifiers and oscillators.
- To differentiate the operation of various multivibrators

**DESIGN AND ANALYSIS OF THE FOLLOWING CIRCUITS**

1. Series and Shunt feedback amplifiers-Frequency response, Input and output impedance
2. RC Phase shift oscillator and Wien Bridge Oscillator
3. Hartley Oscillator and Colpitts Oscillator
4. Single Tuned Amplifier
5. RC Integrator and Differentiator circuits
6. Astable and Monostable multivibrators
7. Clippers and Clampers

**SIMULATION USING SPICE (Using Transistor):**

1. Tuned Collector Oscillator
2. Twin -T Oscillator / Wein Bridge Oscillator
3. Double and Stagger tuned Amplifiers
4. Bistable Multivibrator
5. Schmitt Trigger circuit with Predictable hysteresis
6. Analysis of power amplifier

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**On completion of this laboratory course, the student should be able to:**

- Analyze various types of feedback amplifiers
- Design oscillators, tuned amplifiers, wave-shaping circuits and multivibrators
- Design and simulate feedback amplifiers, oscillators, tuned amplifiers, wave-shaping circuits and multivibrators using SPICE Tool.

19152L48

**LINEAR INTEGRATED CIRCUITS LABORATORY**

L	T	P	C
0	0	4	2

**OBJECTIVES:**

- To understand the basics of linear integrated circuits and available ICs
- To understand the characteristics of the operational amplifier.
- To apply operational amplifiers in linear and nonlinear applications.
- To acquire the basic knowledge of special function IC.
- To use SPICE software for circuit design

**DESIGN AND TESTING OF THE FOLLOWING CIRCUITS**

1. Inverting, Non inverting and differential amplifiers.
2. Integrator and Differentiator.
3. Instrumentation amplifier
4. Active low-pass, High-pass and band-pass filters.
5. Astable & Monostable multivibrators using Op-amp
6. Schmitt Trigger using op-amp.
7. Phase shift and Wien bridge oscillators using Op-amp.
8. Astable and Monostable multivibrators using NE555 Timer.
9. PLL characteristics and its use as Frequency Multiplier, Clock synchronization
10. R-2R Ladder Type D- A Converter using Op-amp.
11. DC power supply using LM317 and LM723.
12. Study of SMPS

**SIMULATION USING SPICE:**

1. Active low-pass, High-pass and band-pass filters using Op-amp
2. Astable and Monostable multivibrators using NE555 Timer.
3. A/ D converter
4. Analog multiplier

**TOTAL: 60 PERIODS****OUTCOMES:****On completion of this laboratory course, the student should be able to:**

- Design amplifiers, oscillators, D-A converters using operational amplifiers.
- Design filters using op-amp and performs an experiment on frequency response.
- Analyze the working of PLL and describe its application as a frequency multiplier.
- Design DC power supply using ICs.
- Analyze the performance of filters, multivibrators, A/D converter and analog multiplier using SPICE.





19152C52

## DISCRETE-TIME SIGNAL PROCESSING

L T P C  
4 0 0 4**OBJECTIVES:**

- To learn discrete fourier transform, properties of DFT and its application to linear filtering
- To understand the characteristics of digital filters, design digital IIR and FIR filters and apply these filters to filter undesirable signals in various frequency bands
- To understand the effects of finite precision representation on digital filters
- To understand the fundamental concepts of multi rate signal processing and its applications
- To introduce the concepts of adaptive filters and its application to communication engineering

**UNIT I DISCRETE FOURIER TRANSFORM 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 computation of DFT - Radix-2 Decimation-in-time (DIT) Fast Fourier transform (FFT), Decimation-in-frequency (DIF) Fast Fourier transform (FFT). Linear filtering using FFT.

**UNIT II INFINITE IMPULSE RESPONSE FILTERS 12**

Characteristics of practical frequency selective filters. characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters (LPF, HPF, BPF, BRF) - Approximation of derivatives, Impulse invariance method, Bilinear transformation. Frequency transformation in the analog domain. Structure of IIR filter - direct form I, direct form II, Cascade, parallel realizations.

**UNIT III FINITE IMPULSE RESPONSE FILTERS 12**

Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filters using Fourier series method - FIR filter design using windows (Rectangular, Hamming and Hanning window), Frequency sampling method. FIR filter structures - linear phase structure, direct form realizations

**UNIT IV FINITE WORD LENGTH EFFECTS 12**

Fixed point and floating point number representation - ADC - quantization - truncation and rounding - quantization noise - input / output quantization - coefficient quantization error - product quantization error - overflow error - limit cycle oscillations due to product quantization and summation - scaling to prevent overflow.

**UNIT V INTRODUCTION TO DIGITAL SIGNAL PROCESSORS 12**

DSP functionalities - circular buffering - DSP architecture - Fixed and Floating point architecture principles - Programming - Application examples.

**TOTAL: 60 PERIODS****OUTCOMES:****At the end of the course, the student should be able to**

- Apply DFT for the analysis of digital signals and systems
- Design IIR and FIR filters
- Characterize the effects of finite precision representation on digital filters
- Design multirate filters
- Apply adaptive filters appropriately in communication systems

**TEXT BOOK:**

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. Emmanuel C. Ifeachor & Barrie W. Jervis, —Digital Signal Processing, Second Edition, Pearson Education / Prentice Hall, 2002.
2. A. V. Oppenheim, R.W. Schaffer and J.R. Buck, —Discrete-Time Signal Processing, 8<sup>th</sup> Indian Reprint, Pearson, 2004.
3. Sanjit K. Mitra, —Digital Signal Processing – A Computer Based Approach, Tata Mc Graw Hill, 2007.
4. Andreas Antoniou, —Digital Signal Processing, Tata Mc Graw Hill, 2006.



2. William Stallings —Computer Organization and Architecture, Seventh Edition, Pearson Education, 2006.
3. Govindarajalu, —Computer Architecture and Organization, Design Principles and Applications", Second edition, McGraw-Hill Education India Pvt Ltd, 2014.

# LIST OF OPEN ELECTIVES

## OPEN ELECTIVE – I (SEMESTER V)

*OPEN ELECTIVE – I*  
**SEMESTER V**

**19150OE54A**

**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 7**

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 DATABASE DESIGN 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 ADVANCED TOPICS 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:**

#### **Upon completion of the course, the students will 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

**TEXT BOOKS:**

1. 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:**

1. C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.
2. Raghu Ramakrishnan, —Database Management SystemsI, Fourth Edition, McGraw-Hill College Publications, 2015.

**19150OE54B**

**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 - IaaS – 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:**

**On Completion of the course, the students 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.

**TEXT BOOKS:**

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.



**REFERENCES:**

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing", Tata Mcgraw Hill, 2013.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach", Tata Mcgraw Hill, 2009.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)", O'Reilly, 2009.

**19153OE54A**

**INDUSTRIAL NANO TECHNOLOGY**

**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 NANOTECHNOLOGY IN CHEMICAL INDUSTRY 9**

Nanocatalysts – 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 NANOTECHNOLOGY IN AGRICULTURE AND FOOD TECHNOLOGY 9**

Nanotechnology in Agriculture -Precision farming, Smart delivery system – Insecticides using nanotechnology – Potential of nano-fertilizers - Nanotechnology in Food industry.

**UNIT V NANOTECHNOLOGY IN TEXTILES AND COSMETICS 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:**

1. Neelina H. Malsch (Ed.), Biomedical Nanotechnology, CRC Press (2005)
2. Udo H. Brinker, Jean-Luc Miesusset (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)

**19153OE54B**

**ENERGY CONSERVATION AND MANAGEMENT**

**L T P C  
3 0 0 3**

**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 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:**

**Upon completion of this course, the students can able to analyse the energy data of industries.**

- Can carry out energy accounting and balancing
- Can suggest methodologies for energy savings

**TEXT BOOKS:**

1. Energy Manager Training Manual (4 Volumes) available at [www.energymanagertraining.com](http://www.energymanagertraining.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.

**191540E54A**

**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 tilted 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:**

- 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.

**TEXT BOOKS:**

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.

**191540E54B**

**AUTOMOTIVE SYSTEMS**

**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.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**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.

**TEXT BOOKS:**

1. 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:**

1. 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.

**19155OE54A**

**AIR POLLUTION AND CONTROL ENGINEERING**

**L T P C  
3 0 0 3**

**OBJECTIVE:**

- To impart knowledge on the principle and design of control of Indoor/ particulate/ gaseous air pollutant and its emerging trends.

**UNIT I INTRODUCTION**

**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:**

The students completing the course will have

- An understanding of the nature and characteristics of air pollutants, noise pollution and 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:**

1. 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.



**19155OE54B**

**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 Elevation 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:**

**This course equips the student 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

**TEXT BOOKS:**

1. 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.

**REFERENCE:**

1. Lo.C.P., Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems, Prentice-Hall India Publishers, 2006



3. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, —Computer Networks: An Open Source Approach, Mc Graw Hill Publisher, 2011.
4. Larry L. Peterson, Bruce S. Davie, —Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers, 2011.

# LIST OF ELECTIVES

## ELECTIVE – I (SEMESTER V)

***ELECTIVE – I***  
**SEMESTER V**

**19152E56A                      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 exception, 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**

### 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 referencel, 8<sup>th</sup> Edition, McGraw Hill Education, 2011.
2. Cay S. Horstmann, Gary cornell, —Core Java Volume –I Fundamentalsl, 9<sup>th</sup> Edition, Prentice Hall, 2013.

**REFERENCES:**

1. Paul Deitel, Harvey Deitel, —Java SE 8 for programmersl, 3<sup>rd</sup> Edition, Pearson, 2015.
2. Steven Holzner, —Java 2 Black bookl, Dreamtech press, 2011.
3. Timothy Budd, —Understanding Object-oriented programming with Javal, Updated Edition, Pearson Education, 2000.



**19152E56C**

**OPERATING SYSTEMS**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To understand the basic concepts and functions of operating systems.
- To understand Processes and Threads
- To analyze Scheduling algorithms.
- To understand the concept of Deadlocks.
- To analyze various memory management schemes.
- To understand I/O management and File systems.
- To be familiar with the basics of Linux system and Mobile OS like iOS and Android.

**UNIT I OPERATING SYSTEM OVERVIEW 7**

Computer System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview-objectives and functions, Evolution of Operating System.- Computer System Organization Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.

**UNIT II PROCESS MANAGEMENT 11**

Processes - Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication; CPU Scheduling - Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real time scheduling; Threads- Overview, Multithreading models, Threading issues; Process Synchronization - The critical-section problem, Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization, Critical regions, Monitors; Deadlock – System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

**UNIT III STORAGE MANAGEMENT 9**

Main Memory – Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, 32 and 64 bit architecture Examples; Virtual Memory – Background, Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, OS Examples.

**UNIT IV FILE SYSTEMS AND I/O SYSTEMS 9**

Mass Storage system – Overview of Mass Storage Structure, Disk Structure, Disk Scheduling and Management, swap space 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, Efficiency and Performance, Recovery; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem, Streams, Performance.

**UNIT V CASE STUDY 9**

Linux System - Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, Input-Output Management, File System, Interprocess Communication; Mobile OS - iOS and Android - Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the students should be able to:**

- Analyze various scheduling algorithms.
- Understand deadlock, prevention and avoidance algorithms.

- Compare and contrast various memory management schemes.
- Understand the functionality of file systems.
- Perform administrative tasks on Linux Servers and compare iOS and Android Operating Systems.

**TEXT BOOK :**

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, —Operating System Concepts, 9th Edition, John Wiley and Sons Inc., 2012.

**REFERENCES :**

1. Ramaz Elmasri, A. Gil Carrick, David Levine, —Operating Systems – A Spiral Approach, Tata McGraw Hill Edition, 2010.
2. Achyut S.Godbole, Atul Kahate, — Operating Systems, McGraw Hill Education, 2016.
3. Andrew S. Tanenbaum, —Modern Operating Systems, Second Edition, Pearson Education, 2004.
4. Gary Nutt, —Operating Systems, Third Edition, Pearson Education, 2004.
5. Harvey M. Deital, —Operating Systems, Third Edition, Pearson Education, 2004.
6. Daniel P Bovet and Marco Cesati, —Understanding the Linux kernel, 3rd edition, O'Reilly, 2005.
7. Neil Smyth, —iPhone iOS 4 Development Essentials – Xcode, Fourth Edition, Payload media, 2011.



**19152E56D**

**ROBOTICS AND AUTOMATION**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

**The student should be made:**

- To understand the basic concepts associated with the design, functioning, applications and social aspects of robots
- To study about the electrical drive systems and sensors used in robotics for various applications
- To learn about analyzing robot kinematics, dynamics through different methodologies and study various design aspects of robot arm manipulator and end-effector
- To learn about various motion planning techniques and the associated control architecture
- To understand the implications of AI and other trending concepts of robotics

**UNIT I FOUNDATION FOR BEGINNERS**

**9**

Introduction -- brief history, definition, anatomy, types, classification, specification and need based applications; role and need of robots for the immediate problems of the society, future of mankind and automation-ethical issues; industrial scenario local and global, case studies on mobile robot research platform and industrial serial arm manipulator

**UNIT II BUILDING BLOCKS OF A ROBOT**

**9**

Types of electric motors - DC, Servo, Stepper; specification, drives for motors - speed & direction control and circuitry, Selection criterion for actuators, direct drives, non-traditional actuators; Sensors for localization, navigation, obstacle avoidance and path planning in known and unknown environments – optical, inertial, thermal, chemical, biosensor, other common sensors; Case study on choice of sensors and actuators for maze solving robot and self driving cars

**UNIT III KINEMATICS, DYNAMICS AND DESIGN OF ROBOTS & END-EFFECTORS**

**9**

Robot kinematics - Geometric approach for 2R, 3R manipulators, homogenous transformation using D-H representation, kinematics of WMR, Lagrangian formulation for 2R robot dynamics; Mechanical design aspects of a 2R manipulator, WMR; End-effector - common types and design case study.

**UNIT IV NAVIGATION, PATH PLANNING AND CONTROL 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, application of Neural network, fuzzy logic, optimization algorithms for navigation problems, programming methodologies of a robot

**UNIT V AI AND OTHER RESEARCH TRENDS IN ROBOTICS**

**9**

Application of Machine learning - AI, Expert systems; Tele-robotics and Virtual Reality, Micro & Nanorobots, Unmanned vehicles, Cognitive robotics, Evolutionary robotics, Humanoids

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**The student should be able to:**

- Explain the concepts of industrial robots in terms of classification, specifications and coordinate systems, along with the need and application of robots & automation
- Examine different sensors and actuators for applications like maze solving and self driving cars.
- Design a 2R robot & an end-effector and solve the kinematics and dynamics of motion for robots.
- Explain navigation and path planning techniques along with the control architectures adopted for robot motion planning.
- Describe the impact and progress in AI and other research trends in the field of robotics.

**TEXT BOOKS:**

1. Saeed. B. Niku, Introduction to Robotics, Analysis, system, Applications, Pearson Educations, 2002
2. Roland Siegwart, Illah Reza Nourbakhsh, Introduction to Autonomous Mobile Robots, MIT Press, 2011

**REFERENCES:**

1. Richard David Klafner, Thomas A. Chmielewski, Michael Negin, Robotic engineering: an integrated approach, Prentice Hall, 1989
2. Craig, J. J., Introduction to Robotics: Mechanics and Control, 2nd Edition, 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. Robin Murphy, Introduction to AI Robotics, MIT Press, 2000
6. Ronald C. Arkin, Behavior-based Robotics, MIT Press, 1998
7. N. P. Padhy, Artificial Intelligence and Intelligent Systems, Oxford University Press, 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.

**19152E56E**

**NANO TECHNOLOGY AND APPLICATIONS**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To provide a broad view of the nascent field of nanoscience and nanotechnology to undergraduates
- To explore the basics of nanomaterial synthesis and characterization.
- To introduce the applications of nanotechnology

**UNIT I INTRODUCTION TO NANOTECHNOLOGY 9**

Basic Structure of Nanoparticles- Kinetics in Nanostructured Materials- Zero dimensional, size and shape of nanoparticles; one-dimensional and two dimensional nanostructures- clusters of metals and semiconductors, bio nano-particles.

**UNIT II FABRICATION AND CHARACTERIZATION OF NANOMATERIALS 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.

**UNIT III PROPERTIES AND MEASUREMENT OF NANOMATERIALS 9**

Optical Properties: Absorption, Fluorescence, and Resonance; Methods for the measurement of nanomaterials; Microscopy measurements: SEM, TEM, AFM and STM. Confocal and TIRF imaging.

**UNIT IV NANO STRUCTURES 9**

Carbon Nanotubes, Fullerenes, Nanowires, Quantum Dots. Applications of nanostructures. Reinforcement in Ceramics, Drug delivery, Giant magnetoresistance, etc. Cells response to Nanostructures.

**UNIT V APPLICATIONS OF NANOTECHNOLOGY 9**

Nano electronics, Nano sensors, Nanotechnology in Diagnostics applications, Environmental and Agricultural Applications of nanotechnology, Nano technology for energy systems

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Describe the basic science behind the properties of materials.
- Interpret the creation, characterization, and manipulation of nanoscale materials.
- Comprehend the exciting applications of nanotechnology at the leading edge of scientific research
- Apply their knowledge of nanotechnology to identify how they can be exploited for new applications.

**TEXT BOOKS:**

1. Springer Handbook of Nanotechnology by Bharat Bhushan 2004. (Unit I – V)
2. Encyclopedia of Nanotechnology - Hari Singh Nalwa 2004. (Unit I – V)

**REFERENCES:**

1. Nanomaterials, Nanotechnologies and Design: an Introduction to Engineers and Architects, D. Michael Ashby, Paulo Ferreira, Daniel L. Schodek, Butterworth-Heinemann, 2009.

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 of Nanoceramics and their Based Nanodevices (Vol. 2) Edited by Tseung-Yuen Tseng and Hari Singh Nalwa, American Scientific Publishers.

**19152E56F**

**HUMAN RIGHTS**

**L T P C  
3 0 0 3**

**OBJECTIVE:**

- 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 Magna 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 Lawsl, Central Law Agency, Allahabad, 2014.
- 2.Chandra U., —Human Rightsl, Allahabad Law Agency, Allahabad, 2014.
- 3.Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

**19152E56G**

**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.Besterfield, 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<sup>th</sup> 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

**19152L57 DIGITAL SIGNAL PROCESSING LABORATORY**

L	T	P	C
0	0	4	2

**OBJECTIVES:****The student should be made:**

- To perform basic signal processing operations such as Linear Convolution, Circular Convolution, Auto Correlation, Cross Correlation and Frequency analysis in MATLAB
- To implement FIR and IIR filters in MATLAB and DSP Processor
- To study the architecture of DSP processor
- To design a DSP system to demonstrate the Multi-rate and Adaptive signal processing concepts.

**LIST OF EXPERIMENTS:****MATLAB / EQUIVALENT SOFTWARE PACKAGE**

1. Generation of elementary Discrete-Time sequences
2. Linear and Circular convolutions
3. Auto correlation and Cross Correlation
4. Frequency Analysis using DFT
5. Design of FIR filters (LPF/HPF/BPF/BSF) and demonstrates the filtering operation
6. Design of Butterworth and Chebyshev IIR filters (LPF/HPF/BPF/BSF) and demonstrate the filtering operations

**DSP PROCESSOR BASED IMPLEMENTATION**

1. Study of architecture of Digital Signal Processor
2. Perform MAC operation using various addressing modes
3. Generation of various signals and random noise
4. Design and demonstration of FIR Filter for Low pass, High pass, Band pass and Band stop filtering
5. Design and demonstration of Butter worth and Chebyshev IIR Filters for Low pass, High pass, Band pass and Band stop filtering
6. Implement an Up-sampling and Down-sampling operation in DSP Processor

**TOTAL: 60 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Carryout basic signal processing operations
- Demonstrate their abilities towards MATLAB based implementation of various DSP systems
- Analyze the architecture of a DSP Processor
- Design and Implement the FIR and IIR Filters in DSP Processor for performing filtering operation over real-time signals
- Design a DSP system for various applications of DSP

**SEMESTER V**

**19152L58          COMMUNICATION SYSTEMS LABORATORY**

**L   T   P   C**  
**0   0   4   2**

**OBJECTIVES:**

**The student should be made:**

- To visualize the effects of sampling and TDM
- To Implement AM & FM modulation and demodulation
- To implement PCM & DM
- To simulate Digital Modulation schemes
- To simulate Error control coding schemes

**LIST OF EXPERIMENTS:**

1. Signal Sampling and reconstruction
2. Time Division Multiplexing
3. AM Modulator and Demodulator
4. FM Modulator and Demodulator
5. Pulse Code Modulation and Demodulation
6. Delta Modulation and Demodulation
7. Line coding schemes
8. Simulation of ASK, FSK, and BPSK generation schemes
9. Simulation of DPSK, QPSK and QAM generation schemes
10. Simulation of signal constellations of BPSK, QPSK and QAM
11. Simulation of ASK, FSK and BPSK detection schemes
12. Simulation of Linear Block and Cyclic error control coding schemes
13. Simulation of Convolutional coding scheme
14. Communication link simulation

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Simulate & validate the various functional modules of a communication system
- Demonstrate their knowledge in base band signaling schemes through implementation of digital modulation schemes
- Apply various channel coding schemes & demonstrate their capabilities towards the improvement of the noise performance of communication system
- Simulate end-to-end communication Link



**19152L59 COMMUNICATION NETWORKS LABORATORY**

L	T	P	C
0	0	4	2

**OBJECTIVES:****The student should be made to:**

- Learn to communicate between two desktop computers
- Learn to implement the different protocols
- Be familiar with IP Configuration
- Be familiar with the various routing algorithms
- Be familiar with simulation tools

**LIST OF EXPERIMENTS:**

1. Implementation of Error Detection / Error Correction Techniques
2. Implementation of Stop and Wait Protocol and sliding window
3. Implementation and study of Goback-N and selective repeat protocols
4. Implementation of High Level Data Link Control
5. Implementation of IP Commands such as ping, Traceroute, nslookup.
6. Implementation of IP address configuration.
7. To create scenario and study the performance of network with CSMA / CA protocol and compare with CSMA/CD protocols.
8. Network Topology - Star, Bus, Ring
9. Implementation of distance vector routing algorithm
10. Implementation of Link state routing algorithm
11. Study of Network simulator (NS) and simulation of Congestion Control Algorithms using NS
12. Implementation of Encryption and Decryption Algorithms using any programming language

**TOTAL: 60 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Communicate between two desktop computers
- Implement the different protocols
- Program using sockets.
- Implement and compare the various routing algorithms
- Use the simulation tool.

**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 standard laboratory precautions and best practices for experimental work
- To provide orientation for basic mathematical computation useful in basic research

**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:**

Basic mathematical and experimental skills and exposure to window-based computer operation system.

**UNIT I**

Introduction to Research – Definition, Objectives, Motivation and purpose – types of research – Pure and applied, survey, case study experimental, exploratory – Research Design – Steps in selection and formulation of research problem - Steps in research – Criteria of Good Research, Problems Encountered by Researchers in India.

**UNIT II**

Research Problem: Definition of research problem, selecting the problem - Necessity of defining the problem - Techniques involved in defining the problem - Research design - Needs and features of good design - Different research design - Basic principles of experimental designs. Development of a research plan, Formulation of Hypothesis – Sampling techniques – Sampling error and sample size. 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. 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.

**UNIT IV**

Processing and analysis of data – editing – coding – transcription – tabulation – outline of statistical analysis- Uncertainty, accuracy and precision- Mean value; standard deviation; error on the mean-Using a spreadsheet for data analysis- Graphs and graph plotting-Least squares methods – 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. 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, Technical Presentation.

**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.

**19152C61      MICROPROCESSORS AND MICROCONTROLLERS****L T P C**  
**3 0 0 3****OBJECTIVES:**

- To understand the Architecture of 8086 microprocessor.
- To learn the design aspects of I/O and Memory Interfacing circuits.
- To interface microprocessors with supporting chips.
- To study the Architecture of 8051 microcontroller.
- To design a microcontroller based system

**UNIT I      THE 8086 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 – Interrupts and interrupt service routines – Byte and String Manipulation.

**UNIT II      8086 SYSTEM BUS STRUCTURE      9**

8086 signals – Basic configurations – System bus timing –System design using 8086 – I/O programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors.

**UNIT III      I/O INTERFACING      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 – Programming and applications Case studies: Traffic Light control, LED display, LCD display, Keyboard display interface and Alarm Controller.

**UNIT IV      MICROCONTROLLER      9**

Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits – Instruction set - Addressing modes - Assembly language programming.

**UNIT V      INTERFACING MICROCONTROLLER      9**

Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARM processors

**TOTAL: 45 PERIODS****OUTCOMES:****At the end of the course, the students should be able to:**

- Understand and execute programs based on 8086 microprocessor.
- Design Memory Interfacing circuits.
- Design and interface I/O circuits.
- Design and implement 8051 microcontroller based systems.

**TEXT BOOKS:**

1. Yu-Cheng Liu, Glenn A.Gibson, —Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Designl, Second Edition, Prentice Hall of India, 2007. (UNIT I-III)
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, —The 8051 Microcontroller and Embedded Systems: Using Assembly and Cl, Second Edition, Pearson education, 2011. (UNIT IV-V)

**REFERENCES:**

1. Douglas V.Hall, —Microprocessors and Interfacing, Programming and Hardware, TMH, 2012
2. A.K.Ray, K.M.Bhurchandi, "Advanced Microprocessors and Peripherals" 3<sup>rd</sup> edition, Tata McGrawHill, 2012

19152C62

VLSI DESIGN

L T P C  
3 0 0 3**OBJECTIVES:**

- Study the fundamentals of CMOS circuits and its characteristics.
- Learn the design and realization of combinational & sequential digital circuits.
- Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed
- Learn the different FPGA architectures and testability of VLSI circuits.

**UNIT I INTRODUCTION TO MOS TRANSISTOR 9**

MOS Transistor, CMOS logic, Inverter, Pass Transistor, Transmission gate, Layout Design Rules, Gate Layouts, Stick Diagrams, Long-Channel I-V Characteristics, C-V Characteristics, Non ideal I-V Effects, DC Transfer characteristics, RC Delay Model, Elmore Delay, Linear Delay Model, Logical effort, Parasitic Delay, Delay in Logic Gate, Scaling.

**UNIT II COMBINATIONAL MOS LOGIC CIRCUITS 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, Circuit Pitfalls.

**Power:** Dynamic Power, Static Power, Low Power Architecture.

**UNIT III SEQUENTIAL CIRCUIT DESIGN 9**

Static latches and Registers, Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits.

**Timing Issues :** Timing Classification Of Digital System, Synchronous Design.

**UNIT IV DESIGN OF ARITHMETIC BUILDING BLOCKS AND SUBSYSTEM 9**

**Arithmetic Building Blocks:** Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff.

**Designing Memory and Array structures:** Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry.

**UNIT V IMPLEMENTATION STRATEGIES AND TESTING 9**

FPGA Building Block Architectures, FPGA Interconnect Routing Procedures. Design for Testability: *Ad Hoc* Testing, Scan Design, BIST, IDDQ Testing, Design for Manufacturability, Boundary Scan.

**TOTAL: 45 PERIODS****OUTCOMES:****UPON COMPLETION OF THE COURSE, STUDENTS SHOULD be ABLE TO**

- Realize the concepts of digital building blocks using MOS transistor.
- Design combinational MOS circuits and power strategies.
- Design and construct Sequential Circuits and Timing systems.
- Design arithmetic building blocks and memory subsystems.
- Apply and implement FPGA design flow and testing.

**TEXT BOOKS:**

1. Neil H.E. Weste, David Money Harris —CMOS VLSI Design: A Circuits and Systems Perspective, 4<sup>th</sup> Edition, Pearson , 2017 (UNIT I,II,V)
2. Jan M. Rabaey ,Anantha Chandrakasan, Borivoje. Nikolic, IDigital Integrated Circuits:A Design perspective, Second Edition , Pearson , 2016.(UNIT III,IV)

## REFERENCES

1. M.J. Smith, —Application Specific Integrated Circuitsl, Addisson Wesley, 1997
2. Sung-Mo kang, Yusuf leblebici, Chulwoo Kim —CMOS Digital Integrated Circuits:Analysis & Designl,4<sup>th</sup> edition McGraw Hill Education,2013
3. Wayne Wolf, —Modern VLSI Design: System On Chipl, Pearson Education, 2007
4. R.Jacob Baker, Harry W.LI., David E.Boyee, —CMOS Circuit Design, Layout and Simulationl, Prentice Hall of India 2005.

19152C63

## WIRELESS COMMUNICATION

L	T	P	C
3	0	0	3

**OBJECTIVES:**

- To study the characteristic of wireless channel
- To understand the design of a cellular system
- To study the various digital signaling techniques and multipath mitigation techniques
- To understand the concepts of multiple antenna techniques

**UNIT I WIRELESS CHANNELS 9**

Large scale path loss – Path loss models: Free Space and Two-Ray models -Link Budget design – Small scale fading- Parameters of mobile multipath channels – Time dispersion parameters-Coherence bandwidth – Doppler spread & Coherence time, fading due to Multipath time delay spread – flat fading – frequency selective fading – Fading due to Doppler spread – fast fading – slow fading.

**UNIT II CELLULAR ARCHITECTURE 9**

Multiple Access techniques - FDMA, TDMA, CDMA – Capacity calculations–Cellular concept-Frequency reuse - channel assignment- hand off- interference & system capacity-trunking & grade of service – Coverage and capacity improvement.

**UNIT III DIGITAL SIGNALING FOR FADING CHANNELS 9**

Structure of a wireless communication link, Principles of Offset-QPSK, p/4-DQPSK, Minimum Shift Keying, Gaussian Minimum Shift Keying, Error performance in fading channels, OFDM principle – Cyclic prefix, Windowing, PAPR.

**UNIT IV MULTIPATH MITIGATION TECHNIQUES 9**

Equalisation – Adaptive equalization, Linear and Non-Linear equalization, Zero forcing and LMS Algorithms. Diversity – Micro and Macro diversity, Diversity combining techniques, Error probability in fading channels with diversity reception, Rake receiver.

**UNIT V MULTIPLE ANTENNA TECHNIQUES 9**

MIMO systems – spatial multiplexing -System model -Pre-coding - Beam forming - transmitter diversity, receiver diversity- Channel state information-capacity in fading and non-fading channels.

**TOTAL: 45 PERIODS****OUTCOMES:****The student should be able to:**

- Characterize a wireless channel and evolve the system design specifications
- Design a cellular system based on resource availability and traffic demands
- Identify suitable signaling and multipath mitigation techniques for the wireless channel and system under consideration.

**TEXT BOOKS:**

1. Rappaport, T.S., —Wireless communications, Pearson Education, Second Edition, 2010. (UNIT I, II, IV)
2. Andreas.F. Molisch, —Wireless Communications, John Wiley – India, 2006. (UNIT III, V)

**REFERENCES:**

1. Wireless Communication –Andrea Goldsmith, Cambridge University Press, 2011
2. Van Nee, R. and Ramji Prasad, —OFDM for wireless multimedia communications, Artech House, 2000
3. David Tse and Pramod Viswanath, — Fundamentals of Wireless Communication, Cambridge University Press, 2005.
4. Upena Dalal, —Wireless Communication, Oxford University Press, 2009.



**SEMESTER VI****19152S64      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
- 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., 10<sup>th</sup> Edition, 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert —Management, Pearson Education, 6<sup>th</sup> Edition, 2004.

**REFERENCES:**

1. Stephen A. Robbins & David A. Decenzo & Mary Coulter, —Fundamentals of Management”, Pearson Education, 7th Edition, 2011.
2. Robert Kreitner & Mamata Mohapatra, — Management, Biztantra, 2008.
3. Harold Koontz & Heinz Weihrich —Essentials of management, Tata McGraw Hill, 1998.
4. Tripathy PC & Reddy PN, —Principles of Management, Tata McGraw Hill, 1999.

**19152C65 TRANSMISSION LINES AND RF SYSTEMS**

L	T	P	C
3	0	0	3

**OBJECTIVES:**

- To introduce the various types of transmission lines and its characteristics
- To give thorough understanding about high frequency line, power and impedance measurements
- To impart technical knowledge in impedance matching using smith chart
- To introduce passive filters and basic knowledge of active RF components
- To get acquaintance with RF system transceiver design

**UNIT I TRANSMISSION LINE THEORY 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 and different methods of loading - Line not terminated in  $Z_0$  - Reflection coefficient - calculation of current, voltage, power delivered and efficiency of transmission - Input and transfer impedance - Open and short circuited lines - reflection factor and reflection loss.

**UNIT II HIGH FREQUENCY TRANSMISSION LINES 9**

Transmission line equations at radio frequencies - Line of Zero dissipation - Voltage and current on the dissipation-less line, Standing Waves, Nodes, Standing Wave Ratio - Input impedance of the dissipation-less line - Open and short circuited lines - Power and impedance measurement on lines - Reflection losses - Measurement of VSWR and wavelength.

**UNIT III IMPEDANCE MATCHING IN HIGH FREQUENCY LINES 9**

Impedance matching: Quarter wave transformer - Impedance matching by stubs - Single stub and double stub matching - Smith chart - Solutions of problems using Smith chart - Single and double stub matching using 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, Bessel Functions, TM and TE waves in Circular waveguides.

**UNIT V RF SYSTEM DESIGN CONCEPTS 9**

Active RF components: Semiconductor basics in RF, bipolar junction transistors, RF field effect transistors, High electron mobility transistors Basic concepts of RF design, Mixers, Low noise amplifiers, voltage control oscillators, Power amplifiers, transducer power gain and stability considerations.

**TOTAL: 45 PERIODS****OUTCOMES:****Upon completion of the course, the student should be able to:**

- Explain the characteristics of transmission lines and its losses
- Write about the standing wave ratio and input impedance in high frequency transmission lines
- Analyze impedance matching by stubs using smith charts
- Analyze the characteristics of TE and TM waves
- Design a RF transceiver system for wireless communication

**TEXT BOOKS:**

1. John D Ryder, —Networks, lines and fields, 2nd Edition, Prentice Hall India, 2015. (UNIT I-IV)
2. Mathew M. Radmanesh, —Radio Frequency & Microwave Electronics, Pearson Education Asia, Second Edition, 2002. (UNIT V)

**REFERENCES:**

1. Reinhold Ludwig and Powel Bretchko, RF Circuit Design – Theory and Applications, Pearson Education Asia, First Edition, 2001.
2. D. K. Misra, —Radio Frequency and Microwave Communication Circuits- Analysis and Design, John Wiley & Sons, 2004.
3. E.C.Jordan and K.G. Balmain, —Electromagnetic Waves and Radiating Systems Prentice Hall of India, 2006.
4. G.S.N Raju, "Electromagnetic Field Theory and Transmission Lines Pearson Education, First edition 2005.

# LIST OF ELECTIVES

## ELECTIVE – II (SEMESTER VI)

*ELECTIVE – II*  
**SEMESTER VI**

**19152E66A CRYPTOGRAPHY AND NETWORK SECURITY**

**L T P C**  
**3 0 0 3**

### OBJECTIVES:

- To understand Cryptography Theories, Algorithms and Systems.
- To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.

### UNIT I INTRODUCTION

**9**

Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography).- Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis.

### UNIT II SYMMETRIC CRYPTOGRAPHY

**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 PUBLIC KEY CRYPTOGRAPHY

**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.

### UNIT IV MESSAGE AUTHENTICATION AND INTEGRITY

**9**

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications - Kerberos, X.509

### UNIT V SECURITY PRACTICE AND SYSTEM SECURITY

**9**

Electronic Mail security – PGP, S/MIME – IP security – Web Security - SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.

**TOTAL: 45 PERIODS**

### OUTCOMES:

**At the end of the course, the student should be able to:**

- Understand the fundamentals of networks security, security architecture, threats and vulnerabilities
- Apply the different cryptographic operations of symmetric cryptographic algorithms
- Apply the different cryptographic operations of public key cryptography
- Apply the various Authentication schemes to simulate different applications.
- Understand various Security practices and System security standards

**TEXT BOOK:**

1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 3rd Edition, 2006.

**REFERENCES:**

1. C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd
2. Behrouz A. Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.
3. Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN 0-13-046019-2

**19152E66B**

**ADVANCED DIGITAL SIGNAL PROCESSING**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To learn and understand the concepts of stationary and non-stationary random signals and analysis & characterization of discrete-time random processes
- To enunciate the significance of estimation of power spectral density of random processes
- To introduce the principles of optimum filters such as Wiener and Kalman filters
- To introduce the principles of adaptive filters and their applications to communication engineering
- To introduce the concepts of multi-resolution analysis

**UNIT I DISCRETE-TIME RANDOM PROCESSES 9**

Random variables - ensemble averages a review, random processes - ensemble averages, autocorrelation and autocovariance matrices, ergodic random process, white noise, filtering random processes, spectral factorization, special types of random processes - AR, MA, ARMA

**UNIT II SPECTRUM ESTIMATION 10**

Bias and consistency, Non-parametric methods - Periodogram, modified-Periodogram - performance analysis. Bartlett's method, Welch's method, Blackman-Tukey method. Performance comparison. Parametric methods - autoregressive (AR) spectrum estimation - autocorrelation method, Prony's method, solution using Levinson Durbin recursion.

**UNIT III OPTIMUM FILTERS 9**

Wiener filters - FIR Wiener filter - discrete Wiener Hopf equation, Applications - filtering, linear prediction. IIR Wiener filter - causal and non-causal filters. Recursive estimators - discrete Kalman filter.

**UNIT IV ADAPTIVE FILTERS 9**

Principles and properties of adaptive filters - FIR adaptive filters. Adaptive algorithms - steepest descent algorithm, the LMS algorithm - convergence. Applications of adaptive filtering - noise cancellation, channel equalization.

**UNIT V MULTIREOLUTION ANALYSIS 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 wavelet transform - noise reduction, image compression.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Articulate and apply the concepts of special random processes in practical applications
- Choose appropriate spectrum estimation techniques for a given random process
- Apply optimum filters appropriately for a given communication application
- Apply appropriate adaptive algorithm for processing non-stationary signals
- Apply and analyse wavelet transforms for signal and image processing based applications

**TEXT BOOKS**

1. Monson H. Hayes, "Statistical digital signal processing and modeling", John Wiley and Sons Inc. New York, Indian reprint 2008. (UNIT I-IV)
2. P. P. Vaidyanathan, "Multirate systems and filter banks", Prentice Hall Inc. 1993 (UNIT V)

**REFERENCES:**

1. John G. Proakis & Dimitris G. Manolakis, —Digital Signal Processing – Principles, Algorithms & Applications, Fourth Edition, Pearson Education / Prentice Hall, 2007.
2. Sophocles J. Orfanidis, "Optimum signal processing", McGraw Hill, 2000

**19152E66C**

**MEMS AND NEMS**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To introduce the concepts of micro and nano electromechanical devices
- To know the fabrication process of Microsystems
- To know the design concepts of micro sensors and micro actuators
- To introduce the concepts of quantum mechanics and nano systems

**UNIT I INTRODUCTION TO MEMS AND 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 MEMS FABRICATION TECHNOLOGIES 9**

Photolithography, Ion Implantation, Diffusion, Oxidation, CVD, Sputtering Etching techniques, Micromachining: Bulk Micromachining, Surface Micromachining, LIGA.

**UNIT III MICRO SENSORS 9**

MEMS Sensors: Design of Acoustic wave sensors, Vibratory gyroscope, Capacitive Pressure sensors, Case study: Piezoelectric energy harvester

**UNIT IV MICRO ACTUATORS 9**

Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces, Case Study:RF Switch.

**UNIT V NANO DEVICES 9**

Atomic Structures and Quantum Mechanics, Shrodinger Equation, ZnO nanorods based NEMS device: Gas sensor.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On successful completion of this course, the student should be able to:**

- Interpret the basics of micro/nano electromechanical systems including their applications and advantages
- Recognize the use of materials in micro fabrication and describe the fabrication processes including surface micromachining, bulk micromachining and LIGA.
- Analyze the key performance aspects of electromechanical transducers including sensors and actuators
- Comprehend the theoretical foundations of quantum mechanics and Nano systems

**REFERENCES:**

1. Marc Madou, —Fundamentals of Microfabrication, CRC press 1997.
2. Stephen D. Senturia, Micro system Design, Kluwer Academic Publishers, 2001
3. Tai Ran Hsu, MEMS and Microsystems Design and Manufacture, Tata Mcraw Hill, 2002.
4. Chang Liu, —Foundations of MEMS, Pearson education India limited, 2006,
5. Sergey Edward Lyshevski, —MEMS and NEMS: Systems, Devices, and Structures, CRC Press, 2002



**19152E66D**

**MULTIMEDIA COMPRESSION AND COMMUNICATION**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

**The student should be made:**

- To understand the compression schemes for text, voice, image and video
- To understand the QoS issues in multimedia network
- To know the communication protocols for multimedia networking

**UNIT I AUDIO COMPRESSION 9**

Sampling and Quantization of Speech (PCM) - Adaptive differential PCM - Delta Modulation - Vector Quantization- Linear predictive coding (LPC) - Code excited Linear predictive Coding (CELP)

**UNIT II IMAGE AND VIDEO COMPRESSION 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 III TEXT COMPRESSION 7**

Static and Dynamic Huffman coding – Arithmetic coding –Lempel-Ziv coding – LZW coding

**UNIT IV GUARANTEED SERVICE MODEL 10**

Best Effort service model – Scheduling and Dropping policies – Network Performance Parameters – Quality of Service and metrics – WFQ and its variants – Random Early Detection – QoS aware Routing – Admission Control – Resource Reservation – RSVP - Traffic Shaping Algorithms – Caching – Laissez Faire Approach - Possible Architectures – An Overview of QoS Architectures

**UNIT V MULTIMEDIA COMMUNICATION 10**

Stream characteristics for Continuous media – Temporal Relationship – Object Stream Interactions, Media Levity, Media Synchronization – Models for Temporal Specifications – Streaming of Audio and Video – Jitter – Fixed playout and Adaptive playout – Recovering from packet loss – RTSP — Multimedia Communication Standards – RTP/RTCP – SIP and H.263

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Design audio compression techniques
- Configure Text, image and video compression techniques
- Select suitable service model for specific application
- Configure multimedia communication network

**TEXT BOOK:**

1. Fred Halsall, —Multimedia communication- Applications, Networks, Protocols and Standards, Pearson education, 2007.

**REFERENCES**

1. Tay Vaughan, —Multimedia Making it work , McGraw-Hill Osborne Media, 2006.
2. Kurose and W. Ross, —Computer Networking —A Top Down Approach, Pearson education, 3rd ed, 2005.
3. KR. Rao,Z S Bojkovic, D A Milovanovic, —Multimedia Communication Systems: Techniques, Standards, and Networks, Pearson Education 2007

4. R. Steimnetz, K. Nahrstedt, —Multimedia Computing, Communications and Applications, Pearson Education, First ed, 1995.
5. Nalin K Sharda, \_Multimedia Information Networking', Prentice Hall of India, 1999
6. Aura Ganz, Zvi Ganz and Kitti Wongthawaravat, \_Multimedia Wireless Networks: Technologies, Standards and QoS', Prentice Hall, 2003.
7. Ellen Kayata Wesel, \_Wireless Multimedia Communications: Networking Video, Voice and Data', Addison Wesley, 1998

**19152E66E**

**CMOS ANALOG IC DESIGN**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To study the fundamentals of analog circuits and MOS device models
- To gain knowledge on various configurations of MOS transistors and feedback concepts
- To study the characteristics of noise and frequency response of the amplifier
- To learn the concepts of Op-Amp frequency compensation, capacitor switches and PLLs

**UNIT I INTRODUCTION TO ANALOG IC DESIGN AND CURRENT MIRRORS 9**

Concepts of Analog Design - General consideration of MOS devices – MOS I/V Characteristics – Second order effects – MOS device models. Basic current mirrors- Cascode current mirrors- Active current mirrors- Large and Small signal analysis- Common mode properties.

**UNIT II AMPLIFIERS AND FEEDBACK 9**

Basic Concepts – Common source stage- Source follower- Common gate stage- Cascode stage. Single ended and differential operation- Basic Differential pair- Common mode response-Differential pair with MOS loads- Gilbert Cell. Feedback- General Consideration of feedback circuits- Feedback topologies- Effect of loading- Effect of feedback on Noise.

**UNIT III FREQUENCY RESPONSE OF AMPLIFIERS AND NOISE 9**

General considerations- Miller Effect and Association of Poles with Nodes, Common source stage- Source followers- Common gate stage- Cascode stage- Differential pair. Noise- Statistical characteristics of noise- Types of noise- Representation of noise in circuits- Noise in single stage amplifiers- Noise in differential pairs- Noise Bandwidth.

**UNIT IV OPERATIONAL AMPLIFIER STABILITY AND FREQUENCY COMPENSATION 9**

General Considerations- One and Two Stage Op Amps- Gain Boosting- Comparison- Common mode feedback- Input range limitations- Slew rate- Power Supply Rejection- Noise in Op Amps-General consideration of stability and frequency compensation- Multipole system- Phase margin-Frequency compensation- Compensation of two stage op Amps- Other compensation techniques.

**UNIT V SWITCHED CAPACITOR CIRCUITS AND PLLS 9**

General Considerations- Sampling switches- Switched Capacitor Amplifiers- Switched Capacitor Integrator- Switched Capacitor Common mode feedback. Phase Locked Loops-Simple PLL-Charge pump PLLs - Non ideal Effects in PLLs- Delay locked loops- its Applications.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, student should be able to:**

- Realize the concepts of Analog MOS devices and current mirror circuits.
- Design different configuration of Amplifiers and feedback circuits.
- Analyze the characteristics of frequency response of the amplifier and its noise.
- Analyze the performance of the stability and frequency compensation techniques of Op-Amp Circuits.
- Construct switched capacitor circuits and PLLs

**TEXT BOOK:**

1. Behzad Razavi, —Design of Analog CMOS Integrated Circuits, Tata McGraw Hill, 2001, 33<sup>rd</sup> re-print, 2016.

**REFERENCES:**

1. Phillip Allen and Douglas Holmberg —CMOS Analog Circuit Design|| Second Edition, Oxford University Press, 2004.
2. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer, Analysis and Design of Analog Integrated Circuits, 5th Edition, Wiley, 2009
3. Grebene, —Bipolar and MOS Analog Integrated circuit design||, John Wiley & sons, Inc., 2003

**19152E66F**

**WIRELESS NETWORKS**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

**The student should be made:**

- To understand the concept about Wireless networks, protocol stack and standards
- To understand and analyse the network layer solutions for Wireless networks
- To study about fundamentals of 3G Services, its protocols and applications
- To have in depth knowledge on internetworking of WLAN and WWAN
- To learn about evolution of 4G Networks, its architecture and applications

**UNIT I WIRELESS LAN**

**9**

Introduction-WLAN technologies: - IEEE802.11: System architecture, protocol architecture, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, WPAN – IEEE 802.15.4, Wireless USB, Zigbee, 6LoWPAN, WirelessHART

**UNIT II MOBILE NETWORK LAYER**

**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 3G OVERVIEW**

**9**

Overview of UTMS Terrestrial Radio access network-UMTS Core network Architecture: 3GPP Architecture, User equipment, CDMA2000 overview- Radio and Network components, Network structure, Radio Network, TD-CDMA, TD – SCDMA.

**UNIT IV INTERNETWORKING BETWEEN WLANS AND WWANS**

**9**

Internetworking objectives and requirements, Schemes to connect WLANS and 3G Networks, Session Mobility, Internetworking Architecture for WLAN and GPRS, System Description, Local Multipoint Distribution 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 Broadband Wireless Access and Services, MVNO.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the student would be able to:**

- Conversant with the latest 3G/4G networks and its architecture
- Design and implement wireless network environment for any application using latest wireless protocols and standards
- Ability to select the suitable network depending on the availability and requirement
- Implement different type of applications for smart phones and mobile devices with latest network strategies

**TEXT BOOKS:**

1. Jochen Schiller, |Mobile Communications|, Second Edition, Pearson Education 2012.(Unit I,II,III)
2. Vijay Garg, —Wireless Communications and networking|, First Edition, Elsevier 2007. (Unit IV,V)

## REFERENCES:

1. Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, "3G Evolution HSPA and LTE for Mobile Broadband", Second Edition, Academic Press, 2008.
2. Anurag Kumar, D.Manjunath, Joy kuri, —Wireless Networking, First Edition, Elsevier 2011.
3. Simon Haykin , Michael Moher, David Koilpillai, —Modern Wireless Communications, First Edition, Pearson Education 2013

**19152E66G**

**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.

**19152L61 MICROPROCESSORS AND MICROCONTROLLERS LABORATORY**

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**OBJECTIVES:**

- To Introduce ALP concepts, features and Coding methods
- Write ALP for arithmetic and logical operations in 8086 and 8051
- Differentiate Serial and Parallel Interface
- Interface different I/Os with Microprocessors
- Be familiar with MASM

**LIST OF EXPERIMENTS:**

**8086 Programs using kits and MASM**

1. Basic arithmetic and Logical operations
2. Move a data block without overlap
3. Code conversion, decimal arithmetic and Matrix operations.
4. Floating point operations, string manipulations, sorting and searching
5. Password checking, Print RAM size and system date
6. Counters and Time Delay

**Peripherals and Interfacing Experiments**

1. Traffic light controller
2. Stepper motor control
3. Digital clock
4. Key board and Display
5. Printer status
6. Serial interface and Parallel interface
7. A/D and D/A interface and Waveform Generation

**8051 Experiments using kits and MASM**

1. Basic arithmetic and Logical operations
2. Square and Cube program, Find 2's complement of a number
3. Unpacked BCD to ASCII

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Write ALP Programmes for fixed and Floating Point and Arithmetic operations
- Interface different I/Os with processor
- Generate waveforms using Microprocessors
- Execute Programs in 8051
- Explain the difference between simulator and Emulator



**OBJECTIVES:**

**The student should be made:**

- To learn Hardware Descriptive Language(Verilog/VHDL)
- To learn the fundamental principles of VLSI circuit design in digital and analog domain
- To familiarize fusing of logical modules on FPGAs
- To provide hands on design experience with professional design (EDA) platforms

**LIST OF EXPERIMENTS:****Part I: Digital System Design using HDL & FPGA****(24 Periods)**

1. Design an Adder (Min 8 Bit) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
2. Design a Multiplier (4 Bit Min) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
3. Design an ALU using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
4. Design a Universal Shift Register using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
5. Design Finite State Machine (Moore/Mealy) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
6. Design Memories using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA

Compare pre synthesis and post synthesis simulation for experiments 1 to 6.

**Part-II Digital Circuit Design****(24 Periods)**

7. Design and simulate a CMOS inverter using digital flow
8. Design and simulate a CMOS Basic Gates & Flip-Flops
9. Design and simulate a 4-bit synchronous counter using a Flip-Flops

Manual/Automatic Layout Generation and Post Layout Extraction for experiments 7 to 9  
Analyze the power, area and timing for experiments 7 to 9 by performing Pre Layout and Post Layout Simulations.

**Part-III Analog Circuit Design****(12 Periods)**

10. Design and Simulate a CMOS Inverting Amplifier.
11. Design and Simulate basic Common Source, Common Gate and Common Drain Amplifiers.

Analyze the input impedance, output impedance, gain and bandwidth for experiments 10 and 11 by performing Schematic Simulations.

Design and simulate simple 5 transistor differential amplifier. Analyze Gain, Bandwidth and CMRR by performing Schematic Simulations.

**TOTAL :60 PERIODS****OUTCOMES:**

**At the end of the course, the student should be able to:**

- Write HDL code for basic as well as advanced digital integrated circuit
- Import the logic modules into FPGA Boards
- Synthesize Place and Route the digital IPs
- Design, Simulate and Extract the layouts of Digital & Analog IC Blocks using EDA tools

19152L63

## PROFESSIONAL COMMUNICATION

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**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.

**19152C71****ANTENNAS AND MICROWAVE ENGINEERING****L T P C****3 0 0 3****OBJECTIVES:**

- To enable the student to understand the basic principles in antenna and microwave system design
- To enhance the student knowledge in the area of various antenna designs.
- To enhance the student knowledge in the area of microwave components and antenna for practical applications.

**UNIT I INTRODUCTION TO MICROWAVE SYSTEMS AND ANTENNAS 9**

Microwave frequency bands, Physical concept of radiation, Near- and far-field regions, Fields and Power Radiated by an Antenna, Antenna Pattern Characteristics, Antenna Gain and Efficiency, Aperture Efficiency and Effective Area, Antenna Noise Temperature and G/T, Impedance matching, Friis transmission equation, Link budget and link margin, Noise Characterization of a microwave receiver.

**UNIT II RADIATION MECHANISMS AND DESIGN ASPECTS 9**

Radiation Mechanisms of Linear Wire and Loop antennas, Aperture antennas, Reflector antennas, Microstrip antennas and Frequency independent antennas, Design considerations and applications.

**UNIT III ANTENNA ARRAYS AND APPLICATIONS 9**

Two-element array, Array factor, Pattern multiplication, Uniformly spaced arrays with uniform and non-uniform excitation amplitudes, Smart antennas.

**UNIT IV PASSIVE AND ACTIVE MICROWAVE DEVICES 9**

Microwave Passive components: Directional Coupler, Power Divider, Magic Tee, attenuator, resonator, Principles of Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes, Microwave tubes: Klystron, TWT, Magnetron.

**UNIT V MICROWAVE DESIGN PRINCIPLES 9**

Impedance transformation, Impedance Matching, Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Power amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design

**TOTAL: 45 PERIODS****OUTCOMES:****The student should be able to:**

- Apply the basic principles and evaluate antenna parameters and link power budgets
- Design and assess the performance of various antennas
- Design a microwave system given the application specifications

**TEXTBOOKS:**

1. John D Krauss, Ronald J Marhefka and Ahmad S. Khan, "Antennas and Wave Propagation: Fourth Edition, Tata McGraw-Hill, 2006. (UNIT I, II, III)
2. David M. Pozar, "Microwave Engineering", Fourth Edition, Wiley India, 2012.(UNIT I,IV,V)

**REFERENCES:**

1. Constantine A.Balanis, —Antenna Theory Analysis and Design, Third edition, John Wiley India Pvt Ltd., 2005.
2. R.E.Collin, "Foundations for Microwave Engineering", Second Edition, IEEE Press, 2001.

19152C72

## OPTICAL COMMUNICATION

L	T	P	C
3	0	0	3

**OBJECTIVES:**

- To study about the various optical fiber modes, configuration and transmission characteristics of optical fibers
- To learn about the various optical sources, detectors and transmission techniques
- To explore various idea about optical fiber measurements and various coupling techniques
- To enrich the knowledge about optical communication systems and networks

**UNIT I INTRODUCTION TO OPTICAL FIBERS 9**

Introduction-general optical fiber communication system- basic optical laws and definitions-optical modes and configurations -mode analysis for optical propagation through fibers-modes in planar wave guide-modes in cylindrical optical fiber-transverse electric and transverse magnetic modes- fiber materials-fiber fabrication techniques-fiber optic cables-classification of optical fiber-single mode fiber-graded index fiber.

**UNIT II TRANSMISSION CHARACTERISTIC OF OPTICAL FIBER 9**

Attenuation-absorption --scattering losses-bending losses-core and cladding losses-signal dispersion – inter symbol interference and bandwidth-intra modal dispersion-material dispersion- waveguide dispersion-polarization mode dispersion-intermodal dispersion-dispersion optimization of single mode fiber-characteristics of single mode fiber-R-I Profile-cutoff wave length-dispersion calculation-mode field diameter.

**UNIT III OPTICAL SOURCES AND DETECTORS 9**

**Sources:** Intrinsic and extrinsic material-direct and indirect band gaps-LED-LED structures-surface emitting LED-Edge emitting LED-quantum efficiency and LED power-light source materials-modulation of LED-LASER diodes-modes and threshold conditions-Rate equations-external quantum efficiency-resonant frequencies-structures and radiation patterns-single mode laser-external modulation-temperature effort.

**Detectors:** PIN photo detector-Avalanche photo diodes-Photo detector noise-noise sources-SNR-detector response time-Avalanche multiplication noise-temperature effects-comparisons of photo detectors.

**UNIT IV OPTICAL RECEIVER, MEASUREMENTS AND COUPLING 9**

Fundamental receiver operation-preamplifiers-digital signal transmission-error sources-Front end amplifiers-digital receiver performance-probability of error-receiver sensitivity-quantum limit. Optical power measurement-attenuation measurement-dispersion measurement- Fiber Numerical Aperture Measurements- Fiber cut- off Wave length Measurements- Fiber diameter measurements-Source to Fiber Power Launching-Lensing Schemes for Coupling Management-Fiber to Fiber Joints-LED Coupling to Single Mode Fibers-Fiber Splicing-Optical Fiber connectors.

**UNIT V OPTICAL COMMUNICATION SYSTEMS AND NETWORKS 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-Optical ETHERNET-Soliton.

**TOTAL: 45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Realize basic elements in optical fibers, different modes and configurations.
- Analyze the transmission characteristics associated with dispersion and polarization techniques.

- Design optical sources and detectors with their use in optical communication system.
- Construct fiber optic receiver systems, measurements and coupling techniques.
- Design optical communication systems and its networks.

**TEXT BOOKS:**

1. P Chakrabarti, "Optical Fiber Communication", McGraw Hill Education (India) Private Limited, 2016 (UNIT I, II, III)
2. Gerd Keiser, "Optical Fiber Communication", McGraw Hill Education (India) Private Limited. Fifth Edition, Reprint 2013. (UNIT I, IV, V)

**REFERENCES:**

1. John M.Senior, —Optical fiber communication, Pearson Education, Second Edition.2007.
2. Rajiv Ramaswami, —Optical Networks — , Second Edition, Elsevier , 2004.
3. J.Gower, —Optical Communication System, Prentice Hall of India, 2001.
4. Govind P. Agrawal, —Fiber-optic communication systems, third edition, John Wiley & Sons, 2004.

**SEMESTER VII****19152C73          EMBEDDED AND REAL TIME SYSTEMS****L   T   P   C  
3   0   0   3****OBJECTIVES:****The student should be made to:**

- Understand the concepts of embedded system design and analysis
- Learn the architecture and programming of ARM processor
- Be exposed to the basic concepts of embedded programming
- Learn the real time operating systems

**UNIT I          INTRODUCTION TO EMBEDDED SYSTEM DESIGN          9**

Complex systems and micro processors– Embedded system design process –Design example: Model train controller- Design methodologies- Design flows - Requirement Analysis – Specifications-System analysis and architecture design – Quality Assurance techniques - Designing with computing platforms – consumer electronics architecture – platform-level performance analysis.

**UNIT II          ARM PROCESSOR AND PERIPHERALS          9**

ARM Architecture Versions – ARM Architecture – Instruction Set – Stacks and 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          EMBEDDED 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.

**UNIT IV          REAL TIME SYSTEMS          9**

Structure of a Real Time System — Estimating program run times – Task Assignment and Scheduling – Fault Tolerance Techniques – Reliability, Evaluation – Clock Synchronisation.

**UNIT V          PROCESSES AND OPERATING SYSTEMS          9**

Introduction – Multiple tasks and multiple processes – Multirate systems- Preemptive real time operating systems- Priority based scheduling- Interprocess communication mechanisms – Evaluating operating system performance- power optimization strategies for processes – Example Real time operating systems- POSIX-Windows CE. - Distributed embedded systems – MPSoCs and shared memory multiprocessors. – Design Example - Audio player, Engine control unit – Video accelerator.

**TOTAL:          45          PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Describe the architecture and programming of ARM processor
- Outline the concepts of embedded systems
- Explain the basic concepts of real time operating system design
- Model real-time applications using embedded-system concepts

**TEXT BOOKS:**

1. Marilyn Wolf, —Computers as Components - Principles of Embedded Computing System
2. Design, Third Edition —Morgan Kaufmann Publisher (An imprint from Elsevier), 2012. (UNIT I, II, III, V)
3. Jane W.S.Liu, Real Time Systems, Pearson Education, Third Indian Reprint, 2003. (UNIT IV)

**REFERENCES:**

1. Lyla B.Das, —Embedded Systems : An Integrated Approach|| Pearson Education, 2013.
2. Jonathan W.Valvano, —Embedded Microcomputer Systems Real Time Interfacing||, Third Edition Cengage Learning, 2012.
3. David. E. Simon, —An Embedded Software Primer||, 1st Edition, 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, —Embedded Real-Time Systems: Concepts, Design & Programming||, Dream Tech Press, 2005.
7. Sriram V Iyer, Pankaj Gupta, —Embedded Real Time Systems Programming||, Tata Mc Graw Hill, 2004.

# LIST OF OPEN ELECTIVES

## OPEN ELECTIVE – II (SEMESTER VII)

*OPEN ELECTIVE – II*  
**SEMESTER VII**

**19150OE74A INTRODUCTION TO C PROGRAMMING**

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### 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

### 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.

### 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.

### 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)

### 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)

**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. Reema Thareja, “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. Pradip Dey, Manas Ghosh, “Fundamentals of Computing and Programming in C”, First Edition, Oxford University Press, 2009.

**19150OE74B**

**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 S TACKS 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<sup>nd</sup> 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. Yashvant Kanetkar, “Data Structures Through C”, BPB publications, II edition, 2003

**19153OE74A**

**BASIC CIRCUIT THEORY**

**L T P C  
3 0 0 3**

**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 introduce Phasor diagrams and analysis of three phase circuits.

**UNIT I BASIC CIRCUITS ANALYSIS 9**

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 CIRCUITS 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 AC CIRCUITS 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: voltage and current division, source transformation –mesh and node analysis, Thevenins and Norton Theorems –Superposition Theorem –Maximum power transfer theorem –Reciprocity Theorem –Millman's theorem.

**UNIT IV THREE PHASE CIRCUITS 9**

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 9**

Series and parallel resonance –their frequency response –Quality factor and Bandwidth -Self and mutual inductance –Coefficient of coupling –Tuned circuits –Single tuned circuits.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Ability to introduce electric circuits and its analysis.
- Ability to impart knowledge on solving circuit equations using network theorems.
- Ability to introduce the phenomenon of resonance in coupled circuits.
- Ability to introduce Phasor diagrams and analysis of three phase circuits.

**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.



**19154OE74A**

**INDUSTRIAL SAFETY**

**L T P C  
3 0 0 3**

**OBJECTIVES :**

To impart knowledge on safety engineering fundamentals and safety management practices.

**UNIT I INTRODUCTION 9**

Evolution of modern safety concepts –Fire prevention –Mechanical hazards –Boilers, Pressure vessels, Electrical Exposure.

**UNIT II CHEMICAL HAZARDS 9**

Chemical exposure –Toxic materials –Ionizing Radiation and Non-ionizing Radiation - Industrial Hygiene –Industrial Toxicology.

**UNIT III ENVIRONMENTAL CONTROL 9**

Industrial Health Hazards –Environmental Control –Industrial Noise -Noise measuring instruments, Control of Noise, Vibration, -Personal Protection.

**UNIT IV HAZARD ANALYSIS 9**

System Safety Analysis –Techniques –Fault Tree Analysis (FTA), Failure Modes and Effects Analysis(FMEA), HAZOP analysis and Risk Assessment.

**UNIT V SAFETY REGULATIONS 9**

Explosions –Disaster management –catastrophe control, hazard control ,Safety education and training - Factories Act, Safety regulations Product safety –case studies.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Students must be able to identify and prevent chemical, environmental mechanical, fire hazard through analysis and apply proper safety techniques on safety engineering and management.

**TEXT BOOK:**

1. John V.Grimaldi, “Safety Management”, AITB S Publishers, 2003.

**REFERENCES:**

1. Safety Manual, “EDEL Engineering Consultancy”, 2000.
2. David L.Goetsch, “Occupational Safety and Health for Technologists”, 5th Edition, Engineers and Managers, Pearson Education Ltd., 2005.

**19154OE74B**

**TESTING OF MATERIALS**

**L T P C  
3 0 0 3**

**OBJECTIVE:**

To understand the various destructive and non destructive testing methods of materials and its industrial applications.

**UNIT I INTRODUCTION TO MATERIALS TESTING 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 MECHANICAL TESTING 9**

Introduction to mechanical testing, Hardness test (Vickers, Brinell, Rockwell), Tensile test, Impact test (Izod, Charpy) -Principles, Techniques, Methods, Advantages and Limitations, Applications. Bend test, Shear test, Creep and Fatigue test -Principles, Techniques, Methods, Advantages and Limitations, Applications.

**UNIT III NON DESTRUCTIVE TESTING 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 MATERIAL CHARACTERIZATION TESTING 9**

Macroscopic and Microscopic observations, Optical and Electron microscopy (SEM and TEM) - Principles, Types, Advantages and Limitations, Applications. Diffraction techniques, Spectroscopic Techniques, Electrical and Magnetic Techniques-Principles, Types, Advantages and Limitations, Applications.

**UNIT V OTHER TESTING 9**

Thermal Testing: Differential scanning calorimetry, Differential thermal analysis. Thermo-mechanical and Dynamic mechanical analysis: Principles, Advantages, Applications. Chemical Testing: X-Ray Fluorescence, Elemental Analysis by Inductively Coupled Plasma-Optical Emission Spectroscopy and Plasma-Mass Spectrometry.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Identify suitable testing technique to inspect industrial component.
- Ability to use the different technique and know its applications and limitations.

**TEXT BOOKS:**

1. Baldev Raj, T.Jayakumar, M.Thavasimuthu “Practical Non-Destructive Testing”, Narosa Publishing House, 2009.
2. Cullity, B. D., “Elements of X-ray diffraction”, 3rdEdition, Addison-Wesley Company Inc., New York, 2000.
3. P. Field Foster, “The Mechanical Testing of Metals and Alloys” 7thEdition, Cousens Press, 2007.

**REFERENCES:**

1. Metals Handbook: Mechanical testing, (Volume 8) ASM Handbook Committee, 9thEdition, American Society for Metals, 1978.
2. ASM Metals Handbook, “Non-Destructive Evaluation and Quality Control”, American Societyof Metals, Metals Park, Ohio, USA.
3. BrandonD.G., “Modern Techniques in Metallography”, Von Nostrand Inc. NJ, USA, 1986.





**19155OE74B**

**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 understandings 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.

**19152C75****ADHOC AND WIRELESS SENSOR NETWORKS****L T P C  
3 0 0 3****OBJECTIVES:**

- Learn Ad hoc network and Sensor Network fundamentals
- Understand the different routing protocols
- Have an in-depth knowledge on sensor network architecture and design issues
- Understand the transport layer and security issues possible in Ad hoc and Sensor networks
- Have an exposure to mote programming platforms and tools

**UNIT I AD HOC NETWORKS – INTRODUCTION AND ROUTING PROTOCOLS 9**

Elements of Ad hoc Wireless Networks, Issues in Ad hoc wireless networks, Example commercial applications of Ad hoc networking, Ad hoc wireless Internet, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, Table Driven Routing Protocols - Destination Sequenced Distance Vector (DSDV), On-Demand Routing protocols –Ad hoc On-Demand Distance Vector Routing (AODV).

**UNIT II SENSOR NETWORKS – INTRODUCTION & ARCHITECTURES 9**

Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSN application examples, Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Network Architecture - Sensor Network Scenarios, Transceiver Design Considerations, Optimization Goals and Figures of Merit.

**UNIT III WSN NETWORKING CONCEPTS AND PROTOCOLS 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 and Issues in Transport layer protocol.

**UNIT IV SENSOR NETWORK SECURITY 9**

Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, 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 SENSOR NETWORK PLATFORMS AND TOOLS 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: 45 PERIODS****OUTCOMES:****At the end of the course, the student would be able to:**

- Know the basics of Ad hoc networks and Wireless Sensor Networks
- Apply this knowledge to identify the suitable routing algorithm based on the network and user requirement
- Apply the knowledge to identify appropriate physical and MAC layer protocols
- Understand the transport layer and security issues possible in Ad hoc and sensor networks.
- Be familiar with the OS used in Wireless Sensor Networks and build basic modules

**TEXT BOOKS:**

1. C. Siva Ram Murthy and B. S. Manoj, —Ad Hoc Wireless Networks Architectures and 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. Feng Zhao, Leonidas Guibas, —Wireless Sensor Networks: an information processing approach, Elsevier publication, 2004.
2. Charles E. Perkins, —Ad Hoc Networking, Addison Wesley, 2000.
3. I.F. Akyildiz, W. Su, Sankarasubramaniam, E. Cayirci, —Wireless sensor networks: a survey, computer networks, Elsevier, 2002, 394 - 422.

# LIST OF ELECTIVES

## ELECTIVE – III (SEMESTER VII)

*ELECTIVE – III*  
**SEMESTER VII**

**19152E76A                      ADVANCED WIRELESS COMMUNICATION**

**L T P C**  
**3 0 0 3**

### **OBJECTIVES:**

- To expose the students to the importance of improving capacity of wireless channel using MIMO
- To enable understanding of channel impairment mitigation using space-time block and Trellis codes
- To teach advanced MIMO system like layered space time codes, MU-MIMO System and MIMO-OFDM systems

### **UNIT I                      CAPACITY OF WIRELESS CHANNELS**

**9**

The crowded spectrum, need for high data rate, MIMO systems – Array Gain, Diversity Gain, Data Pipes, 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 frequency selective channels.

### **UNIT II                      RADIO WAVE PROPAGATION**

**9**

Radio wave propagation – Macroscopic fading- free space and out door, small scale fading Fading measurements – Direct pulse measurements, spread spectrum correlation channel sounding frequency domain channel sounding, Antenna Diversity – Diversity combining methods.

### **UNIT III                      SPACE TIME BLOCK CODES**

**9**

Delay Diversity scheme, Alamoti space time code – Maximum likelihood decoding maximum ratio combining. Transmit diversity space time block codes for real signal constellation and complex signal constellation - decoding of STBC.

### **UNIT IV                      SPACE TIME TRELIS CODES**

**9**

Space time coded systems, space time code word design criteria, design of space time T C on slow fading channels, design of STTC on Fast Fading channels, performance analysis in slow and fast fading channels, effect of imperfect channel estimation and Antenna correlation on performance, comparison of STBC & STTC.

### **UNIT V                      LAYERED SPACE TIME CODES**

**9**

LST transmitter – Horizontal and Vertical LST receiver – ML Rx, Zero forcing Rx; MMSE Rx, SIC Rx, ZF V-blast Rx- MMSE V-blast Rx, Iterative Rx - capacity of MIMO – OFDM systems  
– capacity of MIMO multi user systems.

**TOTAL: 45 PERIODS**

### **OUTCOMES:**

#### **The student should be able to:**

- Comprehend and appreciate the significance and role of this course in the present contemporary world
- Apply the knowledge about the importance of MIMO in today's communication
- Appreciate the various methods for improving the data rate of wireless communication system

## REFERENCES:

1. Mohinder Jankiraman, Space-time codes and MIMO systems, Artech House, Boston, London. [www.artechhouse.com](http://www.artechhouse.com), ISBN 1-58053-865-7-2004
2. Paulraj Rohit Nabar, Dhananjay Gore, Introduction of space time wireless communication systems, Cambridge University Press, 2003.
3. David Tse and Pramod Viswanath, —Fundamentals of Wireless Communication, Cambridge University Press, 2005.
4. Sergio Verdu — Multi User Detection, Cambridge University Press, 1998.

**19152E76B**

**COGNITIVE RADIO**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

**The student should be made:**

- To understand the evolving software defined radio and cognitive radio techniques and their essential functionalities
- To study the basic architecture and standard for cognitive radio
- To understand the physical, MAC and Network layer design of cognitive radio
- To expose the student to evolving applications and advanced features of cognitive radio

**UNIT I INTRODUCTION TO SOFTWARE-DEFINED RADIO AND COGNITIVE RADIO 9**

Evolution of Software Defined Radio and Cognitive radio: goals, benefits, definitions, architectures, relations with other radios, issues, enabling technologies, radio frequency spectrum and regulations.

**UNIT II COGNITIVE RADIO ARCHITECTURE 9**

Cognition cycle – orient, plan, decide and act phases, Organization, SDR as a platform for Cognitive Radio – Hardware and Software Architectures, Overview of IEEE 802.22 standard for broadband wireless access in TV bands.

**UNIT III SPECTRUM SENSING AND DYNAMIC SPECTRUM ACCESS 9**

Introduction – Primary user detection techniques – energy detection, feature detection, matched filtering, cooperative detection and other approaches, Fundamental Tradeoffs in spectrum sensing, Spectrum Sharing Models of Dynamic Spectrum Access - Unlicensed and Licensed Spectrum Sharing, Fundamental Limits of Cognitive Radio.

**UNIT IV MAC AND NETWORK LAYER DESIGN FOR COGNITIVE RADIO 9**

MAC for cognitive radios – Polling, ALOHA, slotted ALOHA, CSMA, CSMA / CA, Network layer design – routing in cognitive radios, flow control and error control techniques.

**UNIT V ADVANCED TOPICS IN COGNITIVE RADIO 9**

Overview of security issues in cognitive radios, auction based spectrum markets in cognitive radio networks, public safety and cognitive radio, cognitive radio for Internet of Things.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Gain knowledge on the design principles on software defined radio and cognitive radio
- Develop the ability to design and implement algorithms for cognitive radio spectrum sensing and dynamic spectrum access
- Build experiments and projects with real time wireless applications
- Apply the knowledge of advanced features of cognitive radio for real world applications

**TEXT BOOKS:**

1. Alexander M. Wyglinski, Maziar Nekovee, Thomas Hou, —Cognitive Radio Communications and Networks, Academic Press, Elsevier, 2010. (Unit I to IV)
2. Huseyin Arslan (Ed.), —Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems, Springer, 2007. (Unit V)

**REFERENCES:**

1. Bruce Fette, —Cognitive Radio Technologyl, Newnes, 2006.
2. Kwang-Cheng Chen, Ramjee Prasad, — Cognitive Radio Networks, John Wiley and Sons, 2009.
3. Ezio Biglieri, Professor Andrea J. Goldsmith, Dr Larry J. Greenstein, Narayan B. Mandayam, H. Vincent Poor, —Principles of Cognitive Radiol , Cambridge University Press, 2012.

**19152E76C FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To understand the global trends and development methodologies of various types of products and 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 FUNDAMENTALS OF PRODUCT DEVELOPMENT 9**

**Global Trends Analysis and Product decision** - Social Trends - Technical Trends- Economical Trends - Environmental Trends - Political/Policy Trends - **Introduction to Product Development Methodologies and Management** - Overview of Products and Services - Types of Product Development - Overview of Product Development methodologies - Product Life Cycle – Product Development Planning and Management.

**UNIT II REQUIREMENTS AND SYSTEM DESIGN 9**

**Requirement Engineering** - Types of Requirements - Requirement Engineering – traceability Matrix and Analysis - Requirement Management - **System Design & Modeling** - Introduction to System Modeling - System Optimization - System Specification - Sub-System Design - Interface Design.

**UNIT III DESIGN AND TESTING 9**

**Conceptualization** - Industrial Design and User Interface Design - Introduction to Concept generation Techniques – **Challenges in Integration of Engineering Disciplines** - Concept Screening & Evaluation - **Detailed Design** - Component Design and Verification – **Mechanical, Electronics and Software Subsystems** - High Level Design/Low Level Design of S/W Program - Types of Prototypes, S/W Testing- Hardware Schematic, Component design, Layout and Hardware Testing – **Prototyping** - Introduction to Rapid Prototyping and Rapid Manufacturing - **System Integration, Testing, Certification and Documentation**

**UNIT IV SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT 9**

Introduction to Product verification processes and stages - Introduction to Product Validation processes and stages - Product Testing Standards and Certification - Product Documentation - **Sustenance** - Maintenance and Repair – Enhancements - **Product EoL** - Obsolescence Management – Configuration Management - EoL Disposal

**UNIT V BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY 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 and Software Systems – Product Development Trade-offs - Intellectual Property Rights and Confidentiality – Security and Configuration Management.

**TOTAL: 45 PERIODS**



**OUTCOMES:**

Upon completion of the course, the students will be able to:

- Define, formulate and analyze a problem
- Solve specific problems independently or as part of a team
- Gain knowledge of the Innovation & Product Development process in the Business Context
- Work independently as well as in teams
- Manage a project from start to finish

**TEXTBOOKS:**

1. Book specially prepared by NASSCOM as per the MoU.
2. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata McGraw Hill, Fifth Edition, 2011.
3. John W Newstorm and Keith Davis, "Organizational Behavior", Tata McGraw Hill, Eleventh Edition, 2005.

**REFERENCES:**

1. Hiriappa B, —Corporate Strategy – Managing the Business, Author House, 2013.
2. Peter F Drucker, —People and Performance, Butterworth – Heinemann [Elsevier], Oxford, 2004.
3. Vinod Kumar Garg and Venkita Krishnan N K, —Enterprise Resource Planning – Concepts, Second Edition, Prentice Hall, 2003.
4. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, Seventh Edition, 2013

**19152E76D**

**MACHINE LEARNING TECHNIQUES**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To understand the need for machine learning for various problem solving
- To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning
- To learn the new approaches in machine learning
- To design appropriate machine learning algorithms for problem solving

**UNIT I INTRODUCTION**

**9**

Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.

**UNIT II NEURAL NETWORKS AND GENETIC ALGORITHMS**

**9**

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.

**UNIT III BAYESIAN AND COMPUTATIONAL LEARNING**

**9**

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

**UNIT IV INSTANT BASED LEARNING**

**9**

K- Nearest Neighbour Learning – Locally weighted Regression – Radial Bases Functions – Case Based Learning.

**UNIT V ADVANCED LEARNING**

**9**

Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the students will be able to**

- Differentiate between supervised, unsupervised, semi-supervised machine learning approaches
- Apply specific supervised or unsupervised machine learning algorithm for a particular problem
- Analyse and suggest the appropriate machine learning approach for the various types of problem
- Design and make modifications to existing machine learning algorithms to suit an individual application
- Provide useful case studies on the advanced machine learning algorithms

**TEXT BOOK:**

1. Tom M. Mitchell, —Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.

**REFERENCES:**

1. Ethem Alpaydin, —Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
2. Stephen Marsland, —Machine Learning: An Algorithmic Perspective, CRC Press, 2009.

**19152E76E**

**ELECTRONICS PACKAGING AND TESTING**

**L T P C  
3 0 0 3**

**OBJECTIVE:**

- To introduce and discuss various issues related to the system packaging

**UNIT I OVERVIEW OF ELECTRONIC SYSTEMS PACKAGING 9**

Functions of an Electronic Package, Packaging Hierarchy, IC packaging: MEMS packaging, consumer electronics packaging, medical electronics packaging, Trends, Challenges, Driving Forces on Packaging Technology, Materials for Microelectronic packaging, Packaging Material Properties, Ceramics, Polymers, and Metals in Packaging, Material for high density interconnect substrates

**UNIT II ELECTRICAL ISSUES IN PACKAGING 9**

Electrical Issues of Systems Packaging, Signal Distribution, Power Distribution, Electromagnetic Interference, Transmission Lines, Clock Distribution, Noise Sources, Digital and RF Issues. Design Process Electrical Design: Interconnect Capacitance, Resistance and Inductance fundamentals; Packaging roadmaps - Hybrid circuits - Resistive, Capacitive and Inductive parasitics

**UNIT III CHIP PACKAGES 9**

IC Assembly - Purpose, Requirements, Technologies, Wire bonding, Tape Automated Bonding, Flip Chip, Wafer Level Packaging, reliability, wafer level burn – in and test. Single chip packaging: functions, types, materials processes, properties, characteristics, trends. Multi chip packaging: types, design, comparison, trends. System – in - package (SIP); Passives: discrete, integrated, and embedded

**UNIT IV PCB, SURFACE MOUNT TECHNOLOGY AND THERMAL CONSIDERATIONS 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 Design challenges. 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: System level electrical testing, Interconnection tests, Active Circuit Testing, Design for Testability

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Give a comprehensive introduction to the various packaging types used along with the associated thermal, speed, signal and integrity power issues
- Enable design of packages which can withstand higher temperature, vibrations and shock
- Design of PCBs which minimize the EMI and operate at higher frequency
- Analyze the concepts of Testing and testing methods

**TEXT BOOK:**

1. Tummala, Rao R., Fundamentals of Microsystems Packaging, McGraw Hill, 2001

**REFERENCES:**

1. Blackwell (Ed), The electronic packaging handbook, CRC Press, 2000.
2. Tummala, Rao R, Microelectronics packaging handbook, McGraw Hill, 2008.
3. Bosshart, Printed Circuit Boards Design and Technology, TataMcGraw Hill, 1988.
4. R.G. Kaduskar and V.B.Baru, Electronic Product design, Wiley India, 2011

5. R.S.Khandpur, Printed Circuit Board, Tata McGraw Hill, 2005
6. Recent literature in Electronic Packaging
7. Michael L. Bushnell & Vishwani D. Agrawal, Essentials of Electronic Testing for Digital, memory & Mixed signal VLSI Circuits, Kluwer Academic Publishers.2000.
8. M. Abramovici, M. A. Breuer, and A.D. Friedman, —Digital System Testing and Testable Design, Computer Science Press,1990

**19152E76F**

**MIXED SIGNAL IC DESIGN**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

**The student should be made to:**

- Study the mixed signal of submicron CMOS circuits
- Understand the various integrated based filters and topologies
- Learn the data converters architecture, modeling and signal to noise ratio
- Study the integrated circuit of oscillators and PLLs

**UNIT I SUBMICRON CMOS CIRCUIT DESIGN**

**9**

Submicron CMOS: Overview and Models, CMOS process flow, Capacitors and Resistors. Digital circuit design: The MOSFET Switch, Delay Elements, An Adder. Analog Circuit Design: Biasing, Op-Amp Design, Circuit Noise.

**UNIT II INTEGRATOR BASED CMOS FILTERS**

**9**

Integrator Building Blocks- low pass filter, Active RC integrators, MOSFET-C Integrators,  $g_m$ -C integrators, Discrete time integrators. Filtering Topologies: The Bilinear transfer function, The Biquadratic transfer function, Filters using Noise shaping.

**UNIT III DATA CONVERTER ARCHITECTURES**

**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.

**UNIT IV DATA CONVERTER MODELING AND SNR**

**9**

Sampling and Aliasing: A modeling approach, Impulse sampling, The sample and Hold, Quantization noise. Data converter SNR: An overview, Clock Jitter, Improving SNR using Averaging, Decimating filter for ADCs, Interpolating filter for DACs, Band pass and High pass sinc filters - Using feedback to improve SNR.

**UNIT V OSCILLATORS AND PLL**

**9**

LC oscillators, Voltage Controlled Oscillators. Simple PLL, Charge pumps PLLs, Non ideal effects in PLLs, Delay Locked Loops.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, student should be able to**

- Apply the concepts for mixed signal MOS circuit.
- Analyze the characteristics of IC based CMOS filters.
- Design of various data converter architecture circuits.
- Analyze the signal to noise ratio and modeling of mixed signals.
- Design of oscillators and phase lock loop circuit.

**REFERENCES:**

1. CMOS Mixed Signal Circuit Design by R.Jacob Baker, Wiley India, IEEE Press, reprint 2008.
2. CMOS Circuit Design, Layout and Simulation by R.Jacob Baker, Wiley India, IEEE Press, Second Edition, reprint 2009.
3. Design of Analog CMOS Integrated Circuits by Behzad Razavi, McGraw Hill, 33<sup>rd</sup> Re-print, 2016.

**19152E76G**

**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 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, Scenarios 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 Vulnerable India: A Geographical Study of Disasters, IAS 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.

**19152L77****EMBEDDED LABORATORY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**OBJECTIVES:****The student should be made to:**

- Learn the working of ARM processor
- Understand the Building Blocks of Embedded Systems
- Learn the concept of memory map and memory interface
- Write programs to interface memory, I/Os with processor
- Study the interrupt performance

**LIST OF EXPERIMENTS:**

1. Study of ARM evaluation system
2. Interfacing ADC and DAC.
3. Interfacing LED and PWM.
4. Interfacing real time clock and serial port.
5. Interfacing keyboard and LCD.
6. Interfacing EPROM and interrupt.
7. Mailbox.
8. Interrupt performance characteristics of ARM and FPGA.
9. Flashing of LEDS.
10. Interfacing stepper motor and temperature sensor.
11. Implementing zigbee protocol with ARM.

**TOTAL: 60 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Write programs in ARM for a specific Application
- Interface memory, A/D and D/A convertors with ARM system
- Analyze the performance of interrupt
- Write program for interfacing keyboard, display, motor and sensor.
- Formulate a mini project using embedded system



**OBJECTIVES:****The student should be made to:**

- Understand the working principle of optical sources, detector, fibers
- Develop understanding of simple optical communication link
- Understand the measurement of BER, Pulse broadening
- Understand and capture an experimental approach to digital wireless communication
- Understand actual communication waveforms that will be sent and received across wireless channel

**LIST OF OPTICAL EXPERIMENTS**

1. Measurement of connector, bending and fiber attenuation losses.
2. Numerical Aperture and Mode Characteristics of Fibers.
3. DC Characteristics of LED and PIN Photo diode.
4. Fiber optic Analog and Digital Link Characterization - frequency response(analog), eye diagram and BER (digital)

**LIST OF WIRELESS COMMUNICATION EXPERIMENTS**

1. Wireless Channel Simulation including fading and Doppler effects
2. Simulation of Channel Estimation, Synchronization & Equalization techniques
3. Analysing Impact of Pulse Shaping and Matched Filtering using Software Defined Radios
4. OFDM Signal Transmission and Reception using Software Defined Radios

**LIST OF MICROWAVE EXPERIMENTS**

1. VSWR and Impedance Measurement and Impedance Matching
2. Characterization of Directional Couplers, Isolators, Circulators
3. Gunn Diode Characteristics
4. Microwave IC – Filter Characteristics

**TOTAL: 60 PERIODS****OUTCOMES:****On completion of this lab course, the student would be able to**

- Analyze the performance of simple optical link by measurement of losses and Analyzing the mode characteristics of fiber
- Analyze the Eye Pattern, Pulse broadening of optical fiber and the impact on BER
- Estimate the Wireless Channel Characteristics and Analyze the performance of Wireless Communication System
- Understand the intricacies in Microwave System design



**REFERENCES:**

1. C.R.Paul,||Introduction to Electromagnetic Compatibility|| , John Wiley and Sons, Inc, 1992.
2. Bemhard Keiser, —Principles of Electromagnetic Compatibility||, 3rd Ed, Artech house, Norwood, 1986.
3. Don R. J.White Consultant Incorporate, —Handbook of EMI/EMCl, Vol I-V, 1988.

**19152E81B**

**LOW POWER SoC DESIGN**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

**The student should be made to:**

- Identify sources of power in an IC.
- Understand basic principle of System on Chip design
- Learn optimization of power in combinational and sequential logic machines for SoC Design
- Identify suitable techniques to reduce the power dissipation and design circuits with low power dissipation.

**UNIT I POWER CONSUMPTION IN CMOS 9**

Physics of power dissipation in CMOS FET devices – Hierarchy of limits of power – Sources of power consumption – Static Power Dissipation, Active Power Dissipation - Designing for Low Power, Circuit Techniques for Leakage Power Reduction - Basic principle of low power design, Logic level power optimization – Circuit level low power design.

**UNIT II SYSTEM-ON-CHIP DESIGN 9**

System-on-Chip Concept, Design Principles in SoC Architecture, SoC Design Flow, Platform-based and IP based SoC Designs, Basic Concepts of Bus-Based Communication Architectures. High performance algorithms for ASICs/ SoCs as case studies – Canonic Signed Digit Arithmetic, KCM, Distributed Arithmetic, High performance digital filters for sigma-delta ADC

**UNIT III POWER OPTIMIZATION OF COMBINATIONAL AND SEQUENTIAL LOGIC MACHINES FOR SOC 9**

Introduction to Standard Cell-Based Layout – Simulation - Combinational Network Delay - Logic and interconnect Design - Power Optimization - Switch Logic Networks. Introduction - Latches and Flip-Flops - Sequential Systems and Clocking Disciplines - Sequential System Design - Power Optimization - Design Validation - Sequential Testing.

**UNIT IV DESIGN OF LOW POWER CIRCUITS FOR SUB SYSTEM ON A SOC 9**

Subsystem Design Principles - Combinational Shifters – Adders – ALUs – Multipliers – High Density Memory – Field Programmable Gate Arrays - Programmable Logic Arrays - Computer arithmetic techniques for low power system – low voltage low power static Random access and dynamic Random access memories, low power clock, Inter connect and layout design

**UNIT V FLOOR PLANNING 9**

Floor-planning Methods – Block Placement & Channel Definition - Global Routing - switchbox Routing - Power Distribution - Clock Distributions - Floor-planning Tips - Design Validation - Off-Chip Connections – Packages, The I/O Architecture - PAD Design

**TOTAL:45 PERIODS**

**OUTCOME:**

**At the end of the course, the student should be able to:**

- Analyze and design low-power VLSI circuits using different circuit technologies for system on chip design

**TEXT BOOKS:**

1. J.Rabaey, —Low Power Design Essentials (Integrated Circuits and Systems)l, Springer, 2009
2. Wayne Wolf, —Modern VLSI Design – System – on – Chip Designl, Prentice Hall, 3rd Edition, 2008.

**REFERENCES:**

1. J.B.Kuo & J.H.Lou, —Low-voltage CMOS VLSI Circuitsl, Wiley, 1999.

2. A.Bellaowar & M.I.Elmasry,||Low power Digital VLSI Design, Circuits and Systems||, Kluwer, 1996.
3. Wayne Wolf, —Modern VLSI Design – IP based Design||, Prentice Hall, 4th Edition, 2008.
4. M.J.S. Smith : Application Specific Integrated Circuits, Pearson, 2003
5. Sudeep Pasricha and Nikil Dutt, On-Chip Communication Architectures System on Chip Interconnect, Elsevier, 2008
6. Recent literature in Low Power VLSI Circuits.
7. Recent literature in Design of ASICs

**19152E81C**

**PHOTONIC NETWORKS**

**L T P C**  
**3 0 0 3**

**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 OPTICAL SYSTEM COMPONENTS 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 OPTICAL NETWORK ARCHITECTURES 9**

Introduction to Optical Networks; SONET / SDH, Metropolitan-Area Networks, Layered Architecture; Broadcast and Select Networks – Topologies for Broadcast Networks, Media-Access Control Protocols, Wavelength Routing Architecture.

**UNIT III WAVELENGTH ROUTING NETWORKS 9**

The optical layer, Optical Network Nodes, Routing and wavelength assignment, Traffic Grooming in Optical Networks, Architectural variations- Linear Light wave networks, Logically Routed Networks.

**UNIT IV PACKET SWITCHING AND ACCESS NETWORKS 9**

Photonic Packet Switching – OTDM, Multiplexing and Demultiplexing, Synchronization, Broadcast OTDM networks, Switch-based networks, Contention Resolution Access Networks – Network Architecture overview, Optical Access Network Architectures and OTDM networks.

**UNIT V NETWORK DESIGN AND MANAGEMENT 9**

Transmission System Engineering – System model, Power penalty - transmitter, receiver, Optical amplifiers, crosstalk, dispersion, Wavelength stabilization, Overall design considerations, Control and Management – Network management functions, Configuration management, Performance management, Fault management, Optical safety, Service interface.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student would be able to:**

- Use the backbone infrastructure for our present and future communication needs
- Analyze the architectures and the protocol stack
- Compare the differences in the design of data plane, control plane, routing, switching, resource allocation methods, network management and protection methods in vogue

**REFERENCES:**

1. Rajiv Ramaswami and Kumar N. Sivarajan, —Optical Networks: A Practical Perspective, Harcourt Asia Pte Ltd., Second Edition 2004.
2. C. Siva Ram Moorthy and Mohan Gurusamy, —WDM Optical Networks: Concept, Design and Algorithms, Prentice Hall of India, 1st Edition, 2002.
3. P.E. Green, Jr., —Fiber Optic Networks, Prentice Hall, NJ, 1993.
4. Biswanath Mukherjee, —Optical WDM Networks, Springer Series, 2006.

**19152E81D**

**COMPRESSIVE SENSING**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To present the basic theory and ideas showing when it is possible to reconstruct sparse or nearly sparse signals from undersampled data
- To expose students to recent ideas in modern convex optimization allowing rapid signal recovery
- To give students a sense of real time applications that might benefit from compressive sensing ideas

**UNIT I INTRODUCTION TO COMPRESSED SENSING 9**

Introduction; Motivation; Mathematical Background; Traditional Sampling; Traditional Compression; Conventional Data Acquisition System; Drawbacks of Transform coding; Compressed Sensing (CS).

**UNIT II SPARSITY AND SIGNAL RECOVERY 9**

Signal Representation; Basis vectors; Sensing matrices; Restricted Isometric Property; Coherence; Stable recovery; Number of measurements.

**UNIT III RECOVERY ALGORITHMS 9**

Basis Pursuit algorithm: L1 minimization; Matching pursuit: Orthogonal Matching Pursuit(OMP), Stagewise OMP, Regularized OMP, Compressive Sampling Matching Pursuit (CoSaMP); Iterative Thresholding algorithm: Hard thresholding, Soft thresholding; Model based : Model based CoSaMP, Model based HIT.

**UNIT IV COMPRESSIVE SENSING FOR WSN 9**

Basics of WSN; Wireless Sensor without Compressive Sensing; Wireless Sensor with Compressive Sensing; Compressive Wireless Sensing: Spatial compression in WSNs, Projections in WSNs, Compressed Sensing in WSNs.

**UNIT V APPLICATIONS OF COMPRESSIVE SENSING 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:45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Appreciate the motivation and the necessity for compressed sensing technology.
- Design a new algorithm or modify an existing algorithm for different application areas in wireless sensor network.

**TEXT BOOKS:**

1. Radha S, Hemalatha R, Aasha Nandhini S, —Compressive Sensing for Wireless Communication: Challenges and Opportunities, River publication, 2016. (UNIT I-V)
2. Mark A. Davenport, Marco F. Duarte, Yonina C. Eldar and Gitta Kutyniok, —Introduction to Compressed Sensing, in Compressed Sensing: Theory and Applications, Y. Eldar and G. Kutyniok, eds., Cambridge University Press, 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.

2. Tao Wan.; Zengchang Qin.; , —An application of compressive sensing for image fusion|, 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 ecg compression on wireless body sensor nodes", IEEE Trans. Biomed. Eng., vol. 58, no. 9, pp.2456 -2466 2011.
4. Mohammadreza Balouchestani.; Kaamran Raahemifar.; and Sridhar Krishnan.;; —COMPRESSED SENSING IN WIRELESS SENSOR NETWORKS: SURVEY| , Canadian Journal on Multimedia and Wireless Networks Vol. 2, No. 1, February 2011.



**19152E81E**

**DIGITAL IMAGE PROCESSING**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To become familiar with digital image fundamentals
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition methods

**UNIT I DIGITAL IMAGE FUNDAMENTALS 9**

Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.

**UNIT II IMAGE ENHANCEMENT 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 IMAGE RESTORATION 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 IV IMAGE SEGMENTATION 9**

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.

**UNIT V IMAGE COMPRESSION AND RECOGNITION 9**

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

**TOTAL: 45  
PERIODS**

**OUTCOMES:**

**At the end of the course, the students should be able to:**

- Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.
- Operate on images using the techniques of smoothing, sharpening and enhancement.
- Understand the restoration concepts and filtering techniques.
- Learn the basics of segmentation, features extraction, compression and recognition methods for color models.

**TEXT BOOKS:**

1. Rafael C. Gonzalez, Richard E. Woods, ‘Digital Image Processing’, Pearson, Third Edition, 2010.
2. Anil K. Jain, ‘Fundamentals of Digital Image Processing’, Pearson, 2002.

## REFERENCES

1. Kenneth R. Castleman, ‘Digital Image Processing’, Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, ‘Digital Image Processing using MATLAB’, Pearson Education, Inc., 2011.
3. D.E. Dudgeon and R.M. Mersereau, ‘Multidimensional Digital Signal Processing’, Prentice Hall Professional Technical Reference, 1990.
4. William K. Pratt, ‘Digital Image Processing’, John Wiley, New York, 2002
5. Milan Sonka et al ‘Image processing, analysis and machine vision’, Brookes/Cole, Vikas Publishing House, 2nd edition, 1999.

**19152E81F**

**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**

**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.
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:**

[www.onlineethics.org](http://www.onlineethics.org)

[www.nspe.org](http://www.nspe.org)

[www.globalethics.org](http://www.globalethics.org)

[www.ethics.org](http://www.ethics.org)

## LIST OF ELECTIVES

### ELECTIVE – V (SEMESTER VIII)

*ELECTIVE – V*  
**SEMESTER VIII**

**19152E82A VIDEO ANALYTICS**

**L T P C**  
**3 0 0 3**

#### **OBJECTIVES:**

**The student should be made:**

- To understand the need for video Analytics
- To understand the basic configuration of video analytics
- To understand the functional blocks of a video analytic system
- To get exposed to the various applications of video analytics

#### **UNIT I VIDEO ANALYTIC COMPONENTS 9**

Need for Video Analytics-Overview of video Analytics- Foreground extraction- Feature extraction classifier - Preprocessing- edge detection- smoothening- Feature space-PCA-FLD-SIFT features

#### **UNIT II FOREGROUND EXTRACTION 9**

Background estimation- Averaging- Gaussian Mixture Model- Optical Flow based- Image Segmentation- Region growing- Region splitting-Morphological operations- erosion-Dilation-Tracking in a multiple camera environment

#### **UNIT III CLASSIFIERS 9**

Neural networks (back propagation) - Deep learning networks- Fuzzy Classifier- Bayesian classifier- HMM based classifier

#### **UNIT IV VIDEO ANALYTICS FOR SECURITY 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 & TRAFFIC MONITRING AND ASSISTANCE 9**

Customer behavior analysis - people counting- Traffic rule violation detection- traffic congestion identification for route planning- driver assistance- lane change warning

**TOTAL: 45 PERIODS**

#### **OUTCOMES:**

**At the end of the course, the student should be able to:**

- Design video analytic algorithms for security applications
- Design video analytic algorithms for business intelligence
- Design custom made video analytics system for the given target 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. Nilanjan Dey (Editor), Amira Ashour (Editor) and Suvojit Acharjee (Editor), Applied Video Processing in Surveillance and Monitoring Systems (IGI global) 2016

3. Zhihao Chen (Author), Ye Yang (Author), Jingyu Xue (Author), Liping Ye (Author), Feng Guo (Author), The Next Generation of Video Surveillance and Video Analytics: The Unified Intelligent Video Analytics Suite, CreateSpace Independent Publishing Platform, 2014
4. Caifeng Shan (Editor), Fatih Porikli (Editor), Tao Xiang (Editor), Shaogang Gong (Editor) Video Analytics for Business Intelligence, Springer, 2012

**19152E82B**

**DSP ARCHITECTURE AND PROGRAMMING**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

**The objective of this course is to provide knowledge on:**

- Basics on Digital Signal Processors
- Programmable DSP's Architecture, On-chip Peripherals and Instruction set
- Programming for signal processing applications
- Advanced Programmable DSP Processors

**UNIT I FUNDAMENTALS OF PROGRAMMABLE DSPs 9**

Introduction to Programmable DSPs, Architectural Features of PDSPs - Multiplier and Multiplier accumulator – Modified Bus Structures and Memory access – Multiple access memory – Multi-port memory – VLIW architecture- Pipelining – Special Addressing modes in P-DSPs – On chip Peripherals, Applications of Programmable DSPs.

**UNIT II TMS320C5X PROCESSOR 9**

Architecture of C5X Processor – Addressing modes – Assembly language Instructions - Pipeline structure, On-chip Peripherals – Block Diagram of DSP starter kit (DSK) – Software Tools, DSK on-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-chip peripherals, DSP Development System: DSP Starter Kit - Code Composer Studio - Support Files – Introduction to AIC23 codec and other on-board peripherals, Real-Time Programming Examples for Signals and Noise generation, Frequency analysis, Filter design.

**UNIT IV ADSP PROCESSORS 9**

Architecture of ADSP-21XX and ADSP-210XX series of DSP processors- Addressing modes and assembly language instructions – Application programs –Filter design, FFT calculation.

**UNIT V ADVANCED PROCESSORS 9**

Study of TI's advanced processors - TMS320C674x and TMS320C55x DSPs, ADSP's Blackfin and SigmaDSP Processors, NXP's DSP56Fxx Family of DSP Processors, Comparison of the features of TI, ADSP and NXP DSP family processors.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Analyze the concepts of Digital Signal Processors
- Demonstrate their ability to program the DSP processor for signal processing applications
- 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.

3. Rulph Chassaing and Donald Reay, Digital Signal Processing and Applications with the C6713 and C6416 DSK, John Wiley & Sons, Inc., Publication, 2012 (Reprint).
4. User guides Texas Instruments, Analog Devices and NXP.



**19152E82C**

**SATELLITE COMMUNICATION**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

**The student should be made to:**

- Understand the basics of satellite orbits
- Understand the satellite segment and earth segment
- Analyze the various methods of satellite access
- Understand the applications of satellites
- Understand the basics of satellite Networks

**UNIT I SATELLITE ORBITS**

**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 SPACE SEGMENT**

**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 SATELLITE LINK DESIGN**

**9**

Basic link analysis, Interference analysis, Rain induced attenuation and interference, Ionospheric characteristics, Link Design with and without frequency reuse.

**UNIT IV SATELLITE ACCESS AND CODING METHODS**

**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 SATELLITE APPLICATIONS**

**9**

INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. GPS Position Location Principles, Differential GPS, Direct Broadcast satellites (DBS/DTH).

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student would be able to:**

- Analyze the satellite orbits
- Analyze the earth segment and space segment
- Analyze the satellite Link design
- Design various satellite applications

**TEXT BOOKS:**

1. Dennis Roddy, —Satellite Communication, 4th Edition, Mc Graw Hill International, 2006.
2. Timothy,Pratt,Charles,W.Bostain,JeremyE.Allnutt,"SatelliteCommunication, 2<sup>nd</sup> Edition, Wiley Publications, 2002

**REFERENCES:**

1. Wilbur L.Pritchard, Hendri G. Snyderhoud, Robert A. Nelson, —Satellite Communication Systems Engineering, Prentice Hall/Pearson, 2007.
2. N.Agarwal, —Design of Geosynchronous Space Craft, Prentice Hall, 1986.

3. Bruce R. Elbert, —The Satellite Communication Applications, Hand Book, Artech House Boston London, 1997.
4. Tri T. Ha, —Digital Satellite Communication, II nd edition, 1990.
5. Emanuel Fthenakis, —Manual of Satellite Communications, Mc Graw Hill Book Co., 1984.
6. Robert G. Winch, —Telecommunication Trans Mission Systems, Mc Graw-Hill Book Co., 1983.
7. Brian Ackroyd, —World Satellite Communication and earth station Design, BSP Professional Books, 1990.
8. G.B.Bleazard, —Introducing Satellite communications—, NCC Publication, 1985.
9. M.Richharia, —Satellite Communication Systems-Design Principles, Macmillan 2003.

**19152E82D**

**SOFT COMPUTING**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To learn the basic concepts of Soft Computing
- To become familiar with various techniques like neural networks, genetic algorithms and fuzzy systems.
- To apply soft computing techniques to solve problems.

**UNIT I INTRODUCTION TO SOFT 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 ARTIFICIAL NEURAL NETWORKS 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 FUZZY SYSTEMS 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 GENETIC ALGORITHMS 9**

Basic Concepts- Working Principles -Encoding- Fitness Function - Reproduction - Inheritance Operators - Cross Over - Inversion and Deletion -Mutation Operator - Bit-wise Operators -Convergence of Genetic Algorithm.

**UNIT V HYBRID 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 Fuzzy BP - Fuzzy ArtMap: A Brief Introduction - Soft Computing Tools - GA in Fuzzy Logic Controller Design - Fuzzy Logic Controller

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of this course, the students should be able to**

- Apply suitable soft computing techniques for various applications.
- Integrate various soft computing techniques for complex problems.

**TEXT BOOKS:**

1. N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming", Oxford University Press, 2015.
2. S.N.Sivanandam , S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt.Ltd., 2nd Edition, 2011.
3. S.Rajasekaran, G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications ", PHI Learning Pvt.Ltd., 2017.

**REFERENCES:**

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, —Neuro-Fuzzy and Soft Computing|, Prentice-Hall of India, 2002.
2. Kwang H.Lee, —First course on Fuzzy Theory and Applications|, Springer, 2005.
3. George J. Klir and Bo Yuan, —Fuzzy Sets and Fuzzy Logic-Theory and Applications| Prentice Hall, 1996.
4. James A. Freeman and David M. Skapura, —Neural Networks Algorithms, Applications, and Programming Techniques|, Addison Wesley, 2003.

**19152E82E**

**PRINCIPLES OF SPEECH PROCESSING**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

**The student should be made:**

- To understand the speech production mechanism and the various speech analysis techniques and speech models
- To understand the speech compression techniques
- To understand the speech recognition techniques
- To know the speaker recognition and text to speech synthesis techniques

**UNIT I SPEECH SIGNAL CHARACTERISTICS & 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) - Code excited Linear predictive Coding (CELP)

**UNIT III SPEECH RECOGNITION 12**

LPC for speech recognition- Hidden Markov Model (HMM)- training procedure for HMM- subword unit 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 SPEAKER RECOGNITION 5**

Acoustic parameters for speaker verification- Feature space for speaker recognition-similarity measures- Text dependent speaker verification-Text independent speaker verification techniques

**UNIT V SPEAKER RECOGNITION AND TEXT TO SPEECH SYNTHESIS 5**

Text to speech synthesis(TTS)-Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness-role of prosody

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Design speech compression techniques
- Configure speech recognition techniques
- Design speaker recognition systems
- Design text to speech synthesis systems

**TEXT BOOKS:**

1. L. R. Rabiner and R. W. Schafer, Introduction to Digital Signal Processing, Foundations and Trends in Signal Processing Vol. 1, Nos. 1–2 (2007) 1–194
2. Ben Gold and Nelson Morgan —Speech and Audio signal processing- processing and perception of speech and music, John Wiley and sons 2006

**REFERENCES**

1. Lawrence Rabiner, Biiing and– Hwang Juang and B.Yegnanarayana —Fundamentals of Speech Recognition, Pearson Education, 2009

2. Claudio Becchetti and Lucio Prina Ricotti, —Speech Recognition, John Wiley and Sons, 1999
3. Donglos O shanhnessy —Speech Communication: Human and Machine —, 2nd Ed. University press 2001.

**19152E82F**

**FUNDAMENTALS OF NANO SCIENCE**

**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-thin films-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<sub>2</sub>, MgO, ZrO<sub>2</sub>, NiO, Nano alumina, CaO, AgTiO<sub>2</sub>, 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-Nanoindentation.

**UNIT V APPLICATIONS**

**7**

Nano InfoTech: Information storage- Nano computer, molecular switch, super chip, nanocrystal, Nano biotechnology: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targeted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nano sensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sun barrier 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.



# **PRIST DEEMED TO BE UNIVERSITY**

**Vallam, Thanjavur**

## **SCHOOL OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF  
ELECTRONICS & COMMUNICATION ENGINEERING**

# **PROGRAM HANDBOOK**

**B.TECH – PART TIME**

**[REGULATION 2019]**



### **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

A broad relation between the programme objective and the outcomes is given in the following table

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMME OUTCOMES												
	A	B	C	D	E	F	G	H	I	J	K	L	M
<b>1</b>	3	3	2	3	2	1	1	2	1	1	3	1	3
<b>2</b>	3	3	3	3	3	1	1	1	1	1	1	2	2
<b>3</b>	3	3	3	3	3	2	2	3	1	2	2	2	2

**Contribution            1: Reasonable            2: Significant            3: Strong**

**B.TECH (PART TIME) – ECE – R-2019****SEMESTER I – VII CURRICULUM****SEMESTER-I**

S.NO	SUB CODE	SUBJECT NAME	Periods Per Week			C
			L	T	P	
1	19148S11P	Transforms and Partial Differential Equations	3	1	0	4
2	19152C12P	Electromagnetic Theory	3	1	0	4
3	19152C13P	Digital Electronics	3	1	0	4
4	19152C14P	Electronic Circuits - I	3	0	0	3
5	19152C15P	Signals and Systems	4	0	0	4
<b>TOTAL CREDITS</b>						<b>19</b>

**SEMESTER-II**

S.NO	SUB CODE	SUBJECT NAME	Periods Per Week			C
			L	T	P	
1	19148S21P	Numerical Methods	3	1	0	4
2	19152C22P	Electrical Engineering and Control Systems	3	0	0	3
3	19152C23P	Linear Integrated Circuits	3	1	0	4
4	19152C24P	Electronic Circuits - II	3	1	0	4
5	19152C25P	Transmission Lines and Waveguides	4	0	0	4
<b>TOTAL CREDITS</b>						<b>19</b>

**SEMESTER-III**

S.NO	SUB CODE	SUBJECT NAME	Periods Per Week			C
			L	T	P	
1.	19148S31BP	Probability and Random Processes	3	1	0	4
2.	19152C32P	Microprocessor Interfacing and Applications	3	1	0	4
3.	19152C33P	Digital Signal Processing	3	1	0	4
4.	19152C34P	Communication Theory	3	1	0	4
5.	19152L35P	Digital Signal Processing and Microprocessor Lab	0	0	3	2
<b>TOTAL CREDITS</b>						<b>18</b>

**SEMESTER-IV**

S.NO	SUB CODE	SUBJECT NAME	Periods Per Week			C
			L	T	P	
1	19152C41P	Digital Communication	3	1	0	4
2	19152C42P	Antenna and Wave Propagation	3	1	0	4
3	19152C43P	Computer Networks	4	0	0	4
4	19152E44_P	<b>Elective-I</b>	4	0	0	4
5	19152L45P	Networks and Communication Lab	0	0	3	2
<b>TOTAL CREDITS</b>						<b>18</b>

**SEMESTER-V**

S.NO	SUB CODE	SUBJECT NAME	Periods Per Week			C
			L	T	P	
1	19152C51P	Optical Communication and Networks	4	0	0	4
2	19152C52P	Microwave Engineering	4	0	0	4
3	19152C53P	VLSI Design	3	1	0	4
4	19152E54_P	<b>Elective II</b>	4	0	0	4
5	19152L55P	Optical Communication and Microwave Lab	0	0	3	2
<b>TOTAL CREDITS</b>						<b>18</b>

**SEMESTER-VI**

S.NO	SUB CODE	SUBJECT NAME	Periods Per Week			C
			L	T	P	
1	19152C61P	Mobile and Wireless Communication	4	0	0	4
2	19152C62P	Medical Electronics	3	1	0	4
3	19152C63P	Microcontroller and Embedded Systems	3	1	0	4
4	19152E64_P	<b>Elective III</b>	4	0	0	4
5	19152L65P	VLSI and Embedded Systems Lab	0	0	3	2
<b>TOTAL CREDITS</b>						<b>18</b>

### SEMESTER-VII

S.NO	SUB CODE	SUBJECT NAME	Periods Per Week			C
			L	T	P	
1	19160S71P	Total Quality Management	3	0	0	3
2	19152C72P	Wireless Networks	3	1	0	4
3	19152C73P	Telecommunication Switching and Networks	4	0	0	4
4	19152E74_P	Elective IV	3	0	0	3
5	19152P75P	Project Work	0	0	12	6
<b>TOTAL CREDITS</b>						<b>20</b>

### LIST OF ELECTIVES

#### ELECTIVE-I (SEMESTER-IV)

S.No	Sub Code	Sub Name	Periods Per Week			C
			L	T	P	
1	19152E44AP	High Speed Networks	4	0	0	4
2	19152E44BP	Advanced Digital Signal Processing	4	0	0	4
3	19152E44CP	Speech Processing	4	0	0	4
4	19152E44DP	Fuzzy Logic and Neural Networks	4	0	0	4
5	19152E44EP	Advanced Electronic System Design	4	0	0	4

#### ELECTIVE-II (SEMESTER-V)

S.No	Sub Code	Sub Name	Periods Per Week			C
			L	T	P	
1	19152E54AP	Environmental Science and Engineering	4	0	0	4
2	19152E54BP	Optoelectronic Devices	4	0	0	4
3	19152E54CP	Radar and Navigational Aids	4	0	0	4
4	19152E54DP	Digital Image Processing	4	0	0	4
5.	19152E54EP	Engineering Acoustics	4	0	0	4

**ELECTIVE-III (SEMESTER-VI)**

S.No	Sub Code	Sub Name	Periods Per Week			C
			L	T	P	
1	19152E64AP	Principles Of Management	4	0	0	4
2	19152E64BP	Satellite Communication	4	0	0	4
3	19152E64CP	Robotics	4	0	0	4
4	19152E64DP	Remote sensing	4	0	0	4
5.	19152E64EP	Network Security	4	0	0	4

**ELECTIVE-IV (SEMESTER-VII)**

S.No	Sub Code	Sub Name	Periods Per Week			C
			L	T	P	
1	19152E74AP	Power Electronics	3	0	0	3
2	19152E74BP	Advanced Microprocessors	3	0	0	3
3	19152E74CP	Electromagnetic Interference and Compatibility	3	0	0	3
4	19152E74DP	Solid State Electronic Drives	3	0	0	3
5	19152E74EP	Computer Hardware and Interfacing	3	0	0	3

**B.TECH (PART TIME) – ECE – R-2019**

**COURSE STRUCTURE AND CREDITS DISTRIBUTION**

Sem.	Core Courses				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
<b>Total Credits</b>							<b>130</b>

**HOD**

**DEAN**

**DEAN -  
ACADEMIC AFFAIRS**

**TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS****3 1 0 4**

(Common to CSE, IT, ECE)

**AIM**

The course aims to develop the skills of the students in the areas of boundary 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**

At the end of the course the 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 forms and the frequently needed practical harmonic analysis that an engineer may have to make from discrete data.
- Have obtained capacity to formulate and identify certain boundary value problems encountered in engineering practices, decide on applicability of the Fourier series method of solution, solve them and interpret the results.
- Have grasped the concept of expression of a function, under certain conditions, as a double integral leading to identification of transform pair, and specialization on Fourier transform pair, their properties, the possible special cases with attention to their applications.

**UNIT I      FOURIER SERIES****9**

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**

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**

Z-transform - Elementary properties (without proof) – Inverse Z – transform – Convolution theorem -Formation of difference equations – Solution of difference equations using Z - transform.



**UNIT IV PARTIAL DIFFERENTIAL EQUATIONS****9**

Solution of First order partial differential equation reducible to standard forms – Lagrange’s linear equation – Linear partial differential equations of second order and higher order with constant coefficients.

**UNIT V BOUNDARY VALUE PROBLEMS****9**

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.

**TUTORIAL :15****TOTAL: 60****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.

**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.

**ELECTROMAGNETIC THEORY****3 1 0 4****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**

- To analyze fields a potentials due to static changes
- To evaluate static magnetic fields
- To understand how materials affect electric and magnetic fields
- To understand the relation between the fields under time varying situations
- To understand principles of propagation of uniform plane waves.

**UNIT I      STATIC ELECTRIC FIELDS****9**

Vector field. Introduction to Co-ordinate System – Rectangular – Cylindrical and Spherical Co-ordinate System – calculation of length area and volume. Definition of Curl, Divergence and Gradient – Meaning of Strokes theorem and Divergence theorem .

Coulomb's Law– Definition of Electric Field Intensity –Electric Field due to discrete charges – charges distributed uniformly on an infinite line – Electric Scalar Potential – Relationship between potential and electric field - Potential due to infinite uniformly charged line –Electric Flux Density – Gauss Law – Proof of Gauss Law.

**UNIT II      STATIC MAGNETIC FIELD****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 field intensity on the axis of a circular and rectangular loop carrying a current I –Calculation of field using Ampere's circuital law for symmetrical distributions a) infinitely long solenoid and b) coaxial cable. The Lorentz force equation for a moving charge and applications –Scalar and Vector Magnetic Potential.

**UNIT III      ELECTRIC AND MAGNETIC FIELDS IN MATERIALS      9**

Poisson's and Laplace's equation – Electric Polarization- Definition of Capacitance – Capacitance of various geometries using Laplace's equation – Electrostatic energy and energy density – Boundary conditions for electric fields – Electric current – Current density – point form of ohm's law –

Definition of Inductance - Inductance of loops– Definition of mutual inductance. Energy density in magnetic fields – Nature of magnetic materials – magnetization and permeability - magnetic boundary conditions.

#### **UNIT IV      TIME VARYING ELECTRIC AND MAGNETIC 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 Equation expressed in point form from Faraday's Law.

Poynting Vector Poynting Theorem and the flow of power – Power flow in a co-axial cable – Instantaneous Average and Complex Poynting Vector.

#### **UNIT V      ELECTROMAGNETIC WAVES      9**

Derivation of Wave Equation –. Properties of Uniform Plane Wave — Wave equation for a conducting medium– Plane waves Propagation in good dielectrics --- Plane waves Propagation in good conductors – Skin effect.

Linear, Elliptical and circular polarization –normal incidence and Oblique incidence – Reflection of Plane Waves by a perfect dielectric Brewster angle .Surface impedance

**TUTORIAL 15**

**TOTAL : 60**

#### **TEXTBOOKS**

1. William H.Hayt : “Engineering Electromagnetics” TATA 2003 (Unit I,II,III ).
2. E.C. Jordan & K.G. Balmain “Electromagnetic Waves and Radiating Systems.” Prentice Hall of India 2<sup>nd</sup> edition 2003. (Unit IV, V). McGraw-Hill, 9<sup>th</sup> reprint

#### **REFERENCES**

1. Ramo, Whinnery and Van Duzer: “Fields and Waves in Communications Electronics” John Wiley & Sons (3<sup>rd</sup> edition 2003)
2. .Narayana Rao, N : “Elements of Engineering Electromagnetics” 4<sup>th</sup> edition, Prentice Hall of India, New Delhi, 1998.
3. M.N.O.Sadiku: “Elements of Engineering Electromagnetics” Oxford University Press, Third edition.
4. David K.Chern: “Field and Wave Electromagnetics - Second Edition-Pearson Edition.
5. David J.Grithiths: “Introduction to Electrodynamics- III Edition-PHI.

**DIGITAL ELECTRONICS****3 1 0 4****AIM**

To learn the fundamental concepts those are useful for designing digital systems or circuits.

**OBJECTIVES**

- To introduce number systems and codes
- To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions
- To introduce the methods for simplifying Boolean expressions
- To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits
- To introduce the concept of memories devices.

**UNIT I:                    BOOLEAN ALGEBRA AND MINIMIZATION                    9**

Basic theorems – Boolean functions – Canonical and Standard forms – Minimization techniques – K-map up to five variables – NAND and NOR implementation – Exclusive OR function - Hardware Description Language (HDL).

**UNIT II:                    DIGITAL LOGIC FAMILIES                    9**

Switching operation of PN junction diode – bipolar and MOS devices – Bipolar logic families – RTL – DTL – DCTL – HTL – TTL – ECL – MOS and CMOS – Tristate logic –Interfacing of CMOS and TTL families.

**UNIT III:                    COMBINATIONAL LOGIC DESIGN                    9**

Design using gates – BCD arithmetic circuits – Binary adder – Subtractor – Multiplier – Divider – Design using MSI devices – Multiplexer and Demultiplexer as logic elements – Encoder and decoder – Parity checker – Parity generator – Code converter – Magnitude comparator.

**UNIT IV:                    SEQUENTIAL LOGIC DESIGN                    9**

Flip Flops and their conversions – Analysis and synthesis of synchronous sequential circuits – Excitation table – State table and state diagram – Design of synchronous counters – Analysis of asynchronous sequential circuits – Reduction of state and flow table – Race free state assignment – Design of Asynchronous counters – Timing diagram – Shift registers and their applications.

**UNIT V :****MEMORY DEVICES****9**

Classification of memories – ROM organization – PROM – EPROM – EEPROM – EAPROM – RAM organization – Write operation – Read operation – Memory cycle Timing wave forms – Memory decoding – Memory expansion – Static RAM Cell- Bipolar RAM cell – MOSFET RAM cell – Dynamic RAM cell – Programmable Logic Devices – Programmable Logic Array (PLA) – Programmable Array Logic (PAL) –Field Programmable Gate Arrays (FPGA).

**TUTORIAL 15****TOTAL : 60****TEXT BOOKS**

1. Morris Mano M., “Digital Design”, 3rd Edition, Pearson Education, 2007.
2. John M Yarbrough, “Digital Logic Applications and Design”, Thomson Learning, 2002.

**REFERENCES**

1. John F.Wakerly, “Digital Design”, 4th Edition, Pearson/PHI, 2006
2. Charles H.Roth, “ Fundamentals of Logic Design”, Thomson Learning, 2003.
3. Donald P.Leach and Albert Paul Malvino, “Digital Principles and Applications”, 6th Edition, TMH, 2003.

**ELECTRONIC CIRCUITS –I****3 0 0 3****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**

On completion of this course the student will understand

- The methods of biasing transistors
- Design of simple amplifier circuits
- Mid – band analysis of amplifier circuits using small - signal equivalent circuits to determine gain input impedance and output impedance
- Method of calculating cutoff frequencies and to determine bandwidth
- Design of power amplifiers and heat sinks
- Analysis and design of power supplies

**UNIT – I TRANSISTOR BIASING & STABILIZATION 9**

Biasing circuits for BJT- DC load line-AC load line – Stability factor- Methods of Transistor Biasing- Bias Compensation – Thermal runaway- heat sink- FET Biasing

**UNIT-II LOW FREQUENCY AMPLIFIER ANALYSIS & DESIGN 9**

Transistor- FET amplifiers - Low frequency Small signal hybrid parameter model :  $C_B, C_E, C_c$  Amplifier- Analysis of Transistor Amplifier Using h-parameter.  
JFET as an Amplifier- Analysis of low frequency common Source & Common Drain Amplifier Using h-parameter.

**UNIT – III MULTISTAGE AMPLIFIERS 9**

Cascading of BJT Amplifiers- Analysis of RC coupled Amplifiers Methods of Increasing Input impedance using Darlington and Boot strapping- Emitter coupled Differential Amplifier, Differential gain, CMRR, Transfer Characteristics – Cascode amplifier.

**UNIT – IV HIGH FREQUENCY ANALYSIS OF THE AMPLIFIERS 9**

Frequency response-Effect of Coupling and Bypass capacitor- Effect of internal transistor capacitance-Miller Effect – High Frequency  $\pi$  model for  $C_E$  Amplifier- $C_E$  Short circuit Current gain- Cut off frequencies  $f_a, f_\beta, f_T$  - Gain Band Width product.

**UNIT – V      POWER SUPPLIES****9**

Half wave, Full Wave, Rectifiers- Capacitor Filter- Linear Regulator: Shunt Regulator, Series Regulator- Shunt Regulator using Zener Diode- Switch Mode Power Supply.

**TUTORIAL 15****TOTAL : 60****TEXT BOOK**

1. Millman and Halkias.c.“Integrated Electronics” Tata McGraw -Hill,1991

**REFERENCE BOOKS**

1. David A. Bell,”Electonic Devices And Circuits “ Prentic Hall of India,1998.
2. Donal L. Schilling, Charles ,Belove “Electronic Circuits” Third Edition 2002.
3. Salivahanan “Electonic Devices And Circuits”
4. Boylestead, Robert L. and Louis Nasheresky- “Electonic Devices And Circuit Theory”-Pearson Education
5. J.B.Gupta - “Electonic Devices And Circuits”-S.K.Kataria and sons 2004.

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**SEMESTER I**

**SIGNALS AND SYSTEMS**

**4 0 0 4**

(Common to ECE & IT)

**AIM**

To study and analyze the characteristics of continuous, discrete signals and systems.

**OBJECTIVES**

- To study the properties and representation of discrete and continuous signals.
- To study the sampling process and analysis of discrete systems using z-transforms.
- To study the analysis and synthesis of discrete time systems.

**UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS 9**

Continuous time signals (CT signals), discrete time signals (DT signals) - step, Ramp, Pulse, Impulse, Exponential, Classification of CT and DT signals - periodic and aperiodic, Random signals, Classification of systems (CT systems and DT systems) Linear time invariant systems.

**UNIT II ANALYSIS OF CT SIGNALS 9**

Fourier Transform and Laplace Transform in Signal Analysis. Fourier series, Fourier Transform and Laplace Transform properties, Parseval's relation.

**UNIT III LTI-CT SYSTEMS 9**

Differential equation, Block diagram representation, Impulse response, Convolution Integral, Frequency response, Fourier Methods and Laplace transforms in analysis.

**UNIT IV SAMPLING THEOREM AND ANALYSIS OF DT- SIGNALS 9**

Sampling theorem – Reconstruction of a Signal from its samples, aliasing – discrete time processing of continuous time signals, sampling of band pass signals  
Z-transform definition – region of convergence – properties of ROC – Properties of z transform – Poles and Zeros – inverse z-transform, Relationship between z-transform and Fourier transform.

**UNIT V LTI-DT SYSTEMS 9**

Difference equations, Block diagram representation, Impulse response, Convolution SUM, Frequency response, Z-transform analysis.

**TUTORIAL 15**

**TOTAL : 60**



### **TEXT BOOK**

1. Alan V. Oppenheim, Alan S. Willsky with S. Hamid Nawab, Signals & Systems, 2<sup>nd</sup> edn., Pearson Education, 1997.

### **REFERENCES**

1. M. J. Roberts, Signals and Systems Analysis using Transform method and MATLAB, TMH 2003.
2. Simon Haykin and Barry Van Veen, Signals and Systems, John Wiley, 1999
3. K. Lindner, "Signals and Systems", McGraw Hill International, 1999.

**NUMERICAL METHODS**  
(Common to CSE, 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 of experimental data 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 function in the analytical form is too complicated or the huge amounts of data are given such as series of measurements, observations or some other empirical information.
- 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 characterized in the form of either nonlinear ordinary differential equations or partial differential equations. The methods introduced in the solution of ordinary differential equations and partial differential equations will be useful in attempting any engineering problem.

**UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9**

Newton Raphson's method – Iteration method – Solution of linear system by Gaussian elimination and Gauss-Jordon methods- Iterative methods: Gauss Jacobi and Gauss-Seidel methods- Inverse of a matrix by Gauss Jordon method – Eigenvalue of a matrix by power method.

**UNIT II INTERPOLATION 9**

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**

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**

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**

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.

**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. Kandasamy, P., Thilagavathy, K. and Gunavathy, K., “Numerical Methods”, 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., “Numerical Methods”, Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 1999.

**ELECTRICAL ENGINEERING AND CONTROL SYSTEMS****3 0 0 3****AIM**

To familiarize the students with concepts related to the operation analysis and stabilization of control systems

**OBJECTIVES**

- To understand the operation of Electrical machines and transformers
- To understand the open loop and closed loop (feedback ) systems
- To understand time domain and frequency domain analysis of control systems required for stability analysis.
- To understand the compensation technique that can be used to stabilize control systems

**UNIT-I: D.C MACHINES AND TRANSFORMERS****12**

Construction and operation of D.C. generators – emf equation – characteristics – principle of operation of D.C. motors. Principle of operation of transformers -parameters of transformers – regulation, losses and efficiency - introduction to three phase transformers.

**UNIT-II SPECIAL MACHINES****9**

Constructional details and principle of operation of single phase induction motors and Three Phase Induction motors– servomotor, stepper motor, variable reluctance motors.- applications.

**UNIT III INTRODUCTION TO CONTROL THEORY****6**

The control problem – differential equation of physical systems – control over system dynamics by feedback – regenerative feedback – transfer function – block diagram - algebra – signal flow graphs.

**UNIT IV TIME RESPONSE AND FREQUENCY RESPONSE ANALYSIS****12**

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 frequency response – polar plots , Bode plots – stability in frequency domain using Nyquist stability criterion – simple problems.

## **UNIT V STABILITY**

**6**

Concept of stability – stability conditions and criteria – Hurwitz and Routh criterion – relative Stability analysis.

**TUTORIAL :15**

**TOTAL :60**

### **TEXT BOOK:**

1. D.P.Kothari and I.J. Nagrath “Basic Electrical Engineering”, Tata McGraw Hill Ltd, second edition, 2002.
2. I.J.Nagrath and M.Gopal “Control system Engineering” New age International Publishing Company Ltd, third edition 2003.

### **REFERENCES:**

1. Stephen J.Chapman “Electrical Machinery Fundamentals”, McGraw Hill Publishing Company Ltd, third edition, 1999.
2. K.Murugesh Kumar, “Electric Machines”, Vikas Publishing House (P) Ltd, 2002.
3. M.Gopal “Control Systems – Principle and Design”, McGraw Hill Publishing company Ltd, second edition, 2003.

**LINEAR INTEGRATED CIRCUITS****3 1 0 4****AIM**

To teach the basic concepts in the design of electronic circuits using linear integrated circuits and their applications in the processing of analog signals.

**OBJECTIVES**

- To introduce the basic building blocks of linear integrated circuits.
- To teach the linear and non-linear applications of operational amplifiers.
- To introduce the theory and applications of analog multipliers and PLL.
- To teach the theory of ADC and DAC
- To introduce a few special function integrated circuits.

**UNIT I OP AMP CHARACTERISTICS AND APPLICATIONS 9**

Ideal op amp, IC op amp, DC characteristics: bias, offset and drift, AC characteristics: bandwidth, slew rate, noise and frequency compensation, basic op amp application: scale changer, inverter and non inverter, summer & subtractor, , differentiator & integrator, instrumentation amplifier, V to I and I to V converter, RC active filters: low pass and band pass filters op amp circuits using diodes: precision rectifier, clipper and clamper,

**UNIT II COMPARATORS AND SIGNAL GENERATORS 9**

Comparator and applications of comparator, regenerative comparator (Schmitt trigger), square wave generator (astable multivibrator), monostable multivibrator Triangular wave generator, saw tooth wave generator sine wave generators

**UNIT III ANALOG MULTIPLIER AND PLL 9**

Multiplier, Applications of multiplier: multiplying DC voltages, frequency doubling, phase angle detection, AM modulation/demodulation. PLL: Basic principles, analog and digital phase detector and comparator Voltage controlled Oscillator, Applications of PLL

**UNIT IV ADC AND DAC 9**

Analog switches, High speed sample and hold circuits, characteristics DAC, Types of D/A converter, Current driven DAC, Switches for DAC, characteristics of A/D converter Types of A/D converter, - Single slope, Successive approximation.

**UNIT V SPECIAL FUNCTION ICS****9**

555 timer functional diagram, Astable and Monostable Multivibrators using 555 Timer, Voltage regulators-linear and switched mode types, Switched capacitor filter, Frequency to Voltage converters, and Isolation Amplifiers, Fiber optic ICs and Opto-couplers.

**TUTORIAL 15****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.Michael Jacob, 'Applications and Design with Analog Integrated Circuits', Prentice Hall of India, 1996.
2. Ramakant A.Gayakwad, 'OP-AMP and Linear IC's', Prentice Hall / Pearson Education, 1994.
3. K.R.Botkar, 'Integrated Circuits'. Khanna Publishers, 1996.
4. Millman.J. and Halkias.C.C. 'Integrated Electronics', McGraw-Hill, 1972.
5. William D.Stanely, 'Operational Amplifiers with Linear Integrated Circuits' Pearson Education, 2004.

**ELECTRONIC CIRCUITS -II****3 1 0 4****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**

On completion of this course the student will understand

- The advantages and method of analysis of feed back amplifiers
- Analysis and design of RC and LC oscillators, tuned amplifiers, wave shaping circuits, multivibrators, blocking oscillators and time based generators.

**UNIT I : POWER AMPLIFIERS****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 distortion & Elimination, Heat sink.

**UNIT II: FEEDBACK AMPLIFIERS****9**

Feedback concept, Four basic types of feedback, Equivalent Circuits of voltage amplifier, Current Amplifier ,Trans conductance, Trans resistance amplifier, Transfer ratio for negative feedback, Effect of feedback on noise, distortion gain input & output, impedance of the amplifier. Method of identifying feedback topology, Analysis of four types of feedback amplifier.

**UNIT III: OSCILLATORS****9**

Theory of Oscillator, Closed loop gain of the circuits, Barhausen Criterion. Analysis & Design of RC Phase Shift Oscillators, Wien Bridge Oscillator, Hartley Oscillator Colpitts Oscillator, crystal Oscillator, frequency Stability.

**UNIT IV: TUNED AMPLIFIERS****9**

Tuned Circuit, Resonance, Q factor, Classification of tuned amplifier, Analysis of single tuned amplifier, Capacitance coupling, Effect of cascading single tuned amplifier on Band width, Double tuned amplifier, instability of tuned amplifiers- stabilization techniques, Narrow band neutralization using coil, Class C tuned amplifiers and their applications. Efficiency of Class C tuned Amplifier.



**UNIT V: WAVE SHAPING, SWEEP & MULTIVIBRATOR CIRCUITS 9**

RL & RC Integrator and Differentiator circuits. Voltage sweep circuit , Miller sweep generator, UJT saw tooth generator, current time base generator, Collector coupled Astable Multivibrator, Collector coupled Monostable Multivibrator - Bistable Multivibrator - Schmitt trigger circuits.

**TUTORIAL 15**

**TOTAL : 60**

**Text Books:**

1. Millman J. and Halkias C.C., " Integrated Electronics ", McGraw Hill 1991
2. Schilling Charles Belowe, " Electronic Circuits ", Third Edition, 2002.
3. Millman J. and Taub H., " Pulse Digital and Switching waveform ", McGraw Hill International.
4. Robert L. Boylest and Louis Nasheresky, "Electronic Devices and Circuits theory" 8<sup>th</sup> edn., PHI, 2002.

**References:**

1. Sedra / Smith, "Micro Electronic Circuits" Oxford University Press, 2004.
2. David A.Bell, "Solid State Pulse Circuits", Prentice Hall of India, 1992.

**TRANSMISSION LINES AND WAVEGUIDES****4 0 0 4****AIM**

To lay a strong foundation on the theory of transmission lines and wave guides by highlighting their applications.

**OBJECTIVES**

- To become familiar with propagation of signals through lines
- Understand signal propagation at Radio frequencies
- Understand radio propagation in guided systems
- To become familiar with resonators

**UNIT I TRANSMISSION LINE THEORY****9**

Different types of transmission lines – Definition of Characteristic impedance and Propagation Constant, General Solution of the transmission line –wavelength and velocity of propagation. Waveform distortion – distortion less transmission line –Input impedance of lossless lines – reflection on a line not terminated by  $Z_o$  - reflection factor and reflection loss – Numerical problems.

**UNIT II THE LINE AT RADIO FREQUENCIES****9**

Standing waves and standing wave ratio on a line – One-eighth wave line – The quarter wave line and impedance matching – the half wave line – The Smith Chart – Application of the Smith Chart – Problems using smith chart (how to use smith chart and mark impedances, finding input impedance, SWR, reflection coefficient, finding load impedance) single stub matching - Numerical problems.

**UNIT III GUIDED WAVES****9**

Waves between parallel planes of perfect conductors – Transverse electric and transverse magnetic waves – characteristics of TE and TM Waves – Transverse Electromagnetic waves – Velocities of propagation. – Wave impedances – Numerical problems.

**UNIT IV RECTANGULAR WAVEGUIDES****9**

Transverse Magnetic Waves in Rectangular Wave guides – Transverse Electric Waves in Rectangular Waveguides – characteristic of TE and TM Waves – cut-off wavelength and phase velocity - Dominant mode in rectangular waveguide –Wave impedance, Characteristic impedance - Numerical problems.

**UNIT V CIRCULAR WAVE GUIDES AND RESONATORS****9**

TM and TE waves in circular guides – wave impedances and characteristic impedance – Dominant mode in circular waveguide – excitation of modes – Microwave cavities,

Rectangular cavity resonators, circular cavity resonator – Q factor of cavity resonator for TE<sub>101</sub> mode - Numerical problems.

**TUTORIAL 15**

**TOTAL: 60**

**TEXT BOOKS**

1. J.D.Ryder “Networks, Lines and Fields”, PHI, New Delhi, 2003. (Unit I & II)
2. E.C. Jordan and K.G.Balmain “Electro Magnetic Waves and Radiating System, PHI, New Delhi, 2003. (Unit III, IV & V)

**REFERENCES**

1. Ramo, Whineery and Van Duzer: “Fields and Waves in Communication Electronics” John Wiley, 2003.
2. David M.Pozar: Microwave Engineering – 2<sup>nd</sup> Edition – John Wiley.
3. David K.Cheng,Field and Waves in Electromagnetism, Pearson



**UNIT V      CORRELATION AND SPECTRAL DENSITIES****9**

Auto correlation - Cross correlation - Properties – Power spectral density – Cross spectral density - Properties – Relationship between cross power spectrum and cross correlation function – Auto correlation and cross correlation functions of input and output.

**TUTORIAL 15****TOTAL : 60****TEXT BOOKS**

1. Ross, S., “A First Course in Probability”, Fifth edition, Pearson Education, Delhi, 2002.
2. Peebles Jr. P.Z., “Probability Random Variables and Random Signal Principles”, Tata McGraw-Hill Publishers, Fourth Edition, New Delhi, 2002. (Chapters 6, 7 and 8).

**MICROPROCESSOR, INTERFACING AND APPLICATIONS****3 1 0 4****AIM**

To learn the architecture programming ,interfacing and applications of microprocessors.

**OBJECTIVES**

- To introduce the architecture and programming of 8085 microprocessor.
- To introduce the interfacing of peripheral devices with 8085 microprocessor.
- To introduce the architecture and programming of 8086 microprocessor.
- To introduce the applications, programming with 8085 microprocessor.

**UNIT I 8085 CPU****9**

8085 Architecture – Instruction set – Addressing modes — Assembly language programming – Interrupts – Memory interfacing – Interfacing, I/O devices.

**UNIT II PERIPHERALS INTERFACING****9**

Interfacing Serial I/O (8251) - parallel I/O (8255) –Keyboard and Display controller (8279) – ADC/DAC interfacing

**UNIT III 8086 CPU****9**

Intel 8086 Internal Architecture – 8086 Addressing modes- Instruction set- 8086 Assembly language Programming–Interrupts.

**UNIT IV 8086 SYSTEM DESIGN****9**

8086 signals and timing – MIN/MAX mode of operation – Addressing memory and I/O – Multiprocessor configurations – System design using 8086

**UNIT V 8085 APPLICATIONS****9**

Stepper motor control – DC motor control –Traffic light control —Digital Clock – Square wave generation

**TUTORIAL 15****TOTAL : 60****TEXT BOOKS**

1. Ramesh S Gaonkar, Microprocessor Architecture, Programming and application with 8085, 4<sup>th</sup> Edition, Penram International Publishing, New Delhi, 2000. (Unit I, II)
2. John Uffenbeck, The 80x86 Family, Design, Programming and Interfacing, Third Edition. Pearson Education, 2002.

3. S.P.Chowdhury , Sunetra Chowdhury, Microprocessor & Peripherals ,First Edition ,Scitech Publications(INDIA )Pvt. Ltd.(Unit V)

#### **REFERENCES**

1. A.K. Ray and K.M.Burchandi, Intel Microprocessors Architecture Programming and Interfacing, McGraw Hill International Edition, 2000(Unit III,IV)
2. Kenneth J Ayala, The 8051 Microcontroller Architecture Programming and Application, 2<sup>nd</sup> 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.

**DIGITAL SIGNAL PROCESSING****3 1 0 4****AIM**

To study the signal processing methods and processors.

**OBJECTIVES**

- To study DFT and its computation
- To study the design techniques for digital filters
- To study the finite word length effects in signal processing
- To study the non-parametric methods of power spectrum estimations
- To study the fundamentals of digital signal processors.

**UNIT I FAST FOURIER TRANSFORM****9**

Discrete Time Fourier Transform (DTFT), Introduction to DFT – Efficient computation of DFT Properties of DFT – FFT algorithms – Radix-2 and Radix-4 FFT algorithms – Decimation in Time – Decimation in Frequency algorithms

**UNIT II IIR FILTER DESIGN****9**

Structure of IIR – System Design of Discrete time IIR filter from continuous time filter – IIR filter design by Impulse Invariance. Bilinear transformation – Approximation derivatives – Design of IIR filter in the Frequency domain.

**UNIT III FIR FILTER DESIGN****9**

Symmetric & Antisymmetric FIR filters – Linear phase filter – Windowing technique – Rectangular, Hamming– Frequency sampling techniques

**UNIT IV FINITE WORD LENGTH EFFECTS****9**

Quantization noise – derivation for quantization noise power – Fixed point and binary floating point number representation – comparison – over flow error – truncation error – co-efficient quantization error - limit cycle oscillation – signal scaling

**UNIT V POWER SPECTRUM ESTIMATION****9**

Computation of Energy density spectrum – auto correlation and power spectrum of random signals. Periodogram – use of DFT in power spectrum estimation – Non parametric methods for power spectral estimation: Bartlett methods –Application of DSP – Model of Speech Wave Form – Vocoder.

**TUTORIAL 15****TOTAL : 60**



### **TEXT BOOK**

1. John G Proakis and Dimtris G Manolakis, “Digital Signal Processing Principles, Algorithms and Application”, PHI/Pearson Education, 2000, 3<sup>rd</sup> Edition.

### **REFERENCES**

1. Alan V Oppenheim, Ronald W Schafer and John R Buck, “Discrete Time Signal Processing”, PHI/Pearson Education, 2000, 2<sup>nd</sup> Edition.
2. Johny R.Johnson, “Introduction to Digital Signal Processing”, Prentice Hall of India/Pearson Education, 2002.
3. Sanjit K.Mitra, “Digital Signal Processing: A Computer – Based Approach”, Tata McGraw-Hill, 2001, Second Edition.

**COMMUNICATION THEORY****3 1 0 4****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**

- To provide various Amplitude modulation and demodulation systems.
- To provide various Angle modulation and demodulation systems.
- To provide some depth analysis in noise performance of various receiver.
- To study some basic information theory with some channel coding theorem.

**UNIT 1                      AMPLITUDE MODULATION SYSTEMS                      10**

Review of spectral characteristics of periodic and non-periodic signals – Generation and demodulation of AM, DSBSC, SSB and VSB signals – Comparison of amplitude modulation systems – Frequency translation – FDM – Non-linear distortion.

**UNIT II                      ANGLE MODULATION SYSTEMS                      8**

Phase and frequency modulation – Single tone – Narrow band and wideband FM – Transmission bandwidth – Generation and demodulation of FM signal.

**UNIT III                      NOISE THEORY                      8**

Review of probability – Random variables and random process – Gaussian process – Noise – Shot noise – Thermal noise and white noise – Narrow band noise – Noise temperature – Noise figure.

**UNIT IV                      PERFORMANCE OF CW MODULATION SYSTEMS                      10**

Superheterodyne radio receiver and its characteristic – SNR – Noise in DSBSC systems using coherent detection – Noise in AM system using envelope detection FM system – FM threshold effect – Pre-emphasis and de-emphasis in FM – Comparison of performances.

**UNIT V                      INFORMATION THEORY                      9**

Discrete messages and information content – Concept of amount of information – Average information – Entropy – Information rate – Source coding to increase average information per bit – Shannon-fano coding – Huffman coding – Lempel-Ziv (LZ) coding – Shannon's theorem – Channel capacity – Bandwidth – S/N trade-off – Mutual information and channel capacity – Rate distortion theory – Lossy source coding.

**TUTORIAL 15****TOTAL : 60****TEXT BOOKS**

1. Dennis Roddy and John Coolen., “Electronic Communication”, 4th Edition, 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, John Wiley and Sons, 2001.
2. Bruce Carlson., “Communication Systems”, 3rd Edition, TMH, 1996.
3. Lathi, B. P., “Modern Digital and Analog Communication Systems”, 3rd Edition, Oxford Press, 2007.
4. John G. Proakis, Masoud Salehi., “Fundamentals of Communication Systems”, 5th Edition, Pearson Education, 2006.

**DIGITAL SIGNAL PROCESSING AND MICRO PROCESSOR LAB**

**0 0 3 2**

**PART-I DSP LAB**

**Using Processor & MATLAB:**

1. Study of various addressing modes of DSP using simple programming examples
2. Sampling of input signal and display
3. Implementation of FIR filter
4. Calculation of FFT
5. Linear & Circular Convolution

**PART-II MICROPROCESSOR LAB**

1. Programs for 8/16 bit Arithmetic operations (Using 8085).
2. Programs for Sorting and Searching (Using 8085, 8086).
3. Parallel Communication between two MP Kits using Mode 1 and Mode 2 of 8255.
4. Interfacing and Programming 8253
5. Serial Communication between two MP Kits using 8251.
6. Interfacing and Programming of Stepper Motor and DC Motor Speed control

**DIGITAL COMMUNICATION****3 1 0 4****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 learn baseband pulse transmission, which deals with the transmission of pulse-amplitude, modulated signals in their baseband form.
- To learn error control coding which encompasses techniques for the encoding and decoding of digital data streams for their reliable transmission over noisy channels.

**UNIT I: Digital communication Introduction and Pulse modulation 9**

Block Diagram of digital communication systems Advantages, Disadvantages, Sampling, Aliasing, Pulse Amplitude Modulation, Pulse Duration and Pulse position Modulation, Pulse Coded Modulation, Delta Modulation, TDM

**UNIT II: Baseband Pulse Transmission 9**

Matched Filters , Intersymbol Interference , Nyquist Pulse Shaping, M-ary PAM Transmission Linear Equalizers , Adaptive Equalizers

**UNIT III: Digital Bandpass Transmission 9**

Representations of Bandpass Signals and Systems Correlation, Signal-space representations ,Detection of Known Signals in AWGN , Generation ,detection, spectra, applications, signal space diagram of FSK, PSK, MSK

**UNIT IV: Spread Spectrum Communications 9**

Advantages, characteristic of Spread Spectrum Communication. Direct Sequence spread spectrum systems, Frequency Hopping spread spectrum communication, Pseudo Noise sequences: Types and Characteristics, code-division multiplexing (CDM). Application to CDMA wireless communication systems

**UNIT V: Error Control coding 9**

Linear block codes, convolutional codes, Hamming codes

**TUTORIAL 15****TOTAL: 60****Textbook:**

1. S. Haykin, *Communication Systems*, Fourth Edition, 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-Hill Science/Engineering/Math; 4 edition 2000



**TUTORIAL 15****TOTAL: 60****Text Books:**

1. EDWARD C.JORDAN- Electromagnetic waves and Radiation systems – Asia Publication House, PHI, 1978, Reprint 2003.

**Reference Books:**

1. Jhon .D. Kraus and Ronald Marhefka- Antenna-T McGraw Hill – 2002
2. R.E.Collins-Antennas and Radio Propagation- McGrawhill- 1987
3. Ballany – Antenna Theory- Jhon wiley & sons – 2<sup>nd</sup> edition 2003.



**COMPUTER NETWORKS****4 0 0 4****AIM**

To introduce the concept, terminologies, and technologies used in modern data communication and computer networking.

**OBJECTIVES**

- To introduce the students the functions of different layers.
- To introduce IEEE standard employed in computer networking.
- To make students to get familiarized with different protocols and network components.

**UNIT I DATA COMMUNICATIONS 8**

Components – Direction of Data flow – networks – Components and Categories – types of Connections – Topologies – Protocols and Standards – ISO / OSI model – Transmission Media – Coaxial Cable – Fiber Optics – Line Coding – Modems – RS232 Interfacing sequences.

**UNIT II DATA LINK LAYER 12**

Error – detection and correction – Parity – LRC – CRC – Hamming code – Flow Control and Error control: stop and wait – go back N ARQ – selective repeat ARQ- sliding window techniques – HDLC.

LAN: Ethernet IEEE 802.3, IEEE 802.4, and IEEE 802.5 – IEEE 802.11–FDDI, SONET – Bridges.

**UNIT III NETWORK LAYER 10**

Internetworks - Packet Switching and Datagram approach – IP addressing methods – Subnetting – Routing – Distance Vector Routing – Link State Routing – Routers.

**UNIT IV TRANSPORT LAYER 8**

Duties of transport layer – Multiplexing – Demultiplexing – Sockets – User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control – Quality of services (QOS) – Integrated Services.

**UNIT V APPLICATION LAYER 7**

Domain Name Space (DNS) – SMTP, FDP, HTTP, WWW – Security – Cryptography.

**TOTAL : 45**

### **TEXT BOOKS**

1. Behrouz A. Foruzan, “Data communication and Networking”, Tata McGraw-Hill, 2004.

### **REFERENCES**

1. James .F. Kurose & W. Rouse, “Computer Networking: A Topdown Approach Featuring”, Pearson Education.
2. Larry L.Peterson & Peter S. Davie, “COMPUTER NETWORKS”, Harcourt Asia Pvt. Ltd., Second Edition.
3. Andrew S. Tannenbaum, “Computer Networks”, PHI, Fourth Edition, 2003.
4. William Stallings, “Data and Computer Communication”, Sixth Edition, Pearson Education, 2000.

**Part I: NETWORKS**

1. PC to PC Communication  
Parallel Communication using 8 bit parallel cable  
Serial communication using RS 232C
2. Ethernet LAN protocol  
To create scenario and study the performance of CSMA/CD protocol ethrol simulation
3. Token bus and token ring protocols  
To create scenario and study the performance of token bus and token ring protocols through simulation
4. Wireless LAN protocols  
To create scenario and study the performance of network with CSMA / CA protocol and compare with CSMA/CD protocols.
5. Implementation and study of stop and wait protocol

**Part II: COMMUNICATION**

1. Modulation and Demodulation Characteristics of AM/FM Transmitter And Reciever.
2. Pulse modulation- PAM / PWM /PPM
3. Pulse code modulation
4. Digital modulation –ASK, PSK, QPSK, FSK
5. Experiments on Antenna:  
To plot and analyse the radiation patterns of the following antennas.
  - Dipole
  - Half Wave Dipole
  - Monopole
  - Yagi Antenna
6. Experiments on Coaxial Line Section:
  - Measurement of VSWR
  - . Stub matching

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**ELECTIVE - I  
SEMESTER IV**

**HIGH SPEED NETWORKS**

**4 0 0 4**

**AIM**

To highlight the features of different technologies involved in High Speed Networking and their performance.

**OBJECTIVES**

- Students will get an introduction about ATM and Frame relay.
- Students will be provided with an up-to-date survey of developments in High Speed Networks.
- Enable the students to know techniques involved to support real-time traffic and congestion control.

Students will be provided with different levels of quality of service (Q.S) to different applications.

**UNIT I HIGH SPEED NETWORKS**

**9**

Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture, ATM Cell – ATM Service Categories – AAL.

High Speed LANs: Fast Ethernet, Gigabit Ethernet, Wireless LANs: applications, requirements – Architecture of 802.11

**UNIT II LAN SWITCHING TECHNOLOGY**

**9**

Switching concepts, switch forwarding techniques, switch path control, LAN switching, cut through forwarding, store and forward, Virtual LANs

**UNIT III TCP AND ATM CONGESTION CONTROL**

**9**

TCP Flow control – TCP Congestion Control – Retransmission – Timer Management – Exponential RTO backoff – KARN's Algorithm — 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,– GFR traffic management.

**UNIT IV INTEGRATED AND DIFFERENTIATED SERVICES**

**9**

Integrated Services Architecture – Approach, Components, Services- Queuing Discipline, FQ, PS, BRfq, GPS, WFQ – Random Early Detection, Differentiated Services

**UNIT V      IP SWITCHING****9**

Addressing model, IP Switching types-flow driven and topology driven solutions, IP Over ATM address and next hop resolution, multicasting,

**TOTAL : 45****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

**19152E44BP**

***ELECTIVE - I***  
**SEMESTER IV**

**ADVANCED DIGITAL SIGNAL PROCESSING**

**4 0 0 4**

**AIM**

To introduce the student to advanced digital signal processing techniques.

**OBJECTIVES**

- To study the parametric methods for power spectrum estimation.
- To study adaptive filtering techniques using LMS algorithm and to study the applications of adaptive filtering.
- To study multirate signal processing fundamentals.
- To study the analysis of speech signals.
- To introduce the student to wavelet transforms.

**UNIT I DISCRETE RANDOM SIGNAL PROCESSING**

Discrete Random Processes-, Autocorrelation and Auto covariance matrices. Parseval's Theorem, Wiener - Khintchine Relation- Power Spectral Density-Periodogram - Parameter estimation: Bias and consistency.

**UNIT II SPECTRUM ESTIMATION**

Non-Parametric Methods-Correlation Method, Periodogram Estimator, Performance Analysis of Estimators –Unbiased Consistent Estimators-; Bartlett, Blackman –Tukey method.

Parametric Methods - AR, MA, and ARMA model based spectral estimation.

**UNIT III LINEAR ESTIMATION AND PREDICTION**

Linear prediction- Forward and backward predictions, - Levinson-Durbin algorithms. Least mean squared error criterion -Wiener filter for filtering and prediction, FIR Wiener filter and Wiener IIR filters, Discrete Kalman filter

**UNIT IV ADAPTIVE FILTERS**

FIR adaptive filters -adaptive filter based on steepest descent method-Widrow-Hoff LMS adaptive algorithm Adaptive recursive filters (IIR). RLS adaptive filters-Exponentially weighted RLS-sliding window RLS.

**UNIT V MULTIRATE DIGITAL SIGNAL PROCESSING**

Mathematical description of change of sampling rate - Interpolation and Decimation, Decimation by an integer factor - Interpolation by an integer factor, Filter implementation

for sampling rate conversion- Application to sub band coding and Filter bank implementation of wavelet expansion of signals.

**REFERENCES:**

1. Monson H.Hayes, Statistical Digital Signal Processing and Modeling, John Wiley and Sons, Inc., Singapore, 2002.
2. John G. Proakis, Dimitris G.Manolakis, Digital Signal Processing Pearson Education, 2002.
3. John G. Proakis et.al., 'Algorithms for Statistical Signal Processing', Pearson Education, 2002.
4. Dimitris G.Manolakis et.al., 'Statistical and adaptive signal Processing', McGraw Hill, Newyork,2000.

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**ELECTIVE - I  
SEMESTER IV**

**SPEECH PROCESSING**

**4 0 0 4**

**AIM**

To introduce the characteristics of Speech signals and the related time and frequency domain methods for speech analysis and speech compression

**OBJECTIVE**

- To introduce the models for speech production
- To develop time and frequency domain techniques for estimating speech parameters
- To introduce a predictive technique for speech compression
- To understand speech recognition, synthesis and speaker identification.

**UNIT I: NATURE OF SPEECH SIGNAL 9**

Speech production mechanism – Classification of speech – Sounds – Nature of speech signal – Models of speech production

**Speech Signal Processing:** Purpose of speech processing – Digital models for speech signal – Digital processing of speech signals – Significance – Short time analysis.

**UNIT II: TIME DOMAIN METHODS FOR SPEECH PROCESSING 9**

Time domain parameters of speech – Methods for extracting the parameters – Zero crossings – Auto correlation function – Pitch estimation.

**UNIT III: FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING 9**

Short time fourier analysis – Filter bank analysis – Spectrographic analysis – Format extraction – Pitch extraction – Analysis – Synthesis systems.

**UNIT IV: LINEAR PREDICTIVE CODING OF SPEECH 9**

Formulation of linear prediction problem in time domain – Solution of normal equations – Interpretation of linear prediction in auto correlation and spectral domains.

**UNIT V: HOMOMORPHIC SPEECH ANALYSIS 9**

Central analysis of speech – Format and pitch estimation – Applications of speech processing – Speech recognition – Speech synthesis and speaker verification.

**Total: 45**

**TEXTBOOK**

1. Rabiner L.R. and Schafer R.E, “Digital Processing of Speech Signals”, Prentice Hall, 1978.



## **REFERENCES**

1. Flanagan J.L, "Speech Analysis Synthesis and Perception", 2nd Edition, Springer Verlag, 1972.
2. Witten I.H., "Principles of Computer Speech", Academic Press, 1983.

**19152E44DP**

**ELECTIVE - I  
SEMESTER IV**

**FUZZY LOGIC AND NEURAL NETWORKS**

**4 0 0 4**

**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**

- To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience
- To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems
- To provide the mathematical background for carrying out the optimization associated with neural network learning
- To familiarize with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations
- To introduce case studies utilizing the above and illustrate the intelligent behavior of programs based on soft computing

**UNIT I: Primer on Fuzzy Sets**

**9**

Crisp sets, from crisp sets to fuzzy sets , Linguistic variables ,Membership functions  
Some terminology , Set theoretic operations for crisp sets , Set theoretic operations for fuzzy sets , membership functions

**UNIT II: Fuzzy Logic Systems**

**9**

Introduction , Rules , Fuzzy Inference Engine , Fuzzification and Its Effect on Inference  
Fuzzifier , Fuzzy inference engine, Defuzzification, Centroid defuzzifier , Center-of-sums defuzzifier

**UNIT III: Neural Nets Introduction and Overview**

**9**

Perceptrons,Least Mean Square Learning Systems , Multilayer Neural Networks Back-  
Propagation The Practical Application of Back-Propagation  
Error Rate and Complexity Fit Estimation Improving on Standard Back-Propagation

**UNIT IV: Radial Basis Function Networks**

**9**

Ill-Posed Problems and the Regularization Technique , Stabilizers and Basis Functions,  
Generalized Radial Basis Function Networks, Moving Centers Learning, Regularization

with Nonradial Basis Functions, Orthogonal Least Squares, Optimal Subset Selection by Linear

**UNIT V: ANFIS: Adaptive Neuro-Fuzzy Inference Systems**

**9**

Introduction , ANFIS Architecture , Hybrid Learning Algorithm , Learning Methods that Cross-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), Neural Networks: A Comprehensive Foundation, 2nd ed., Upper Saddle River, NJ: Prentice Hall, ISBN 0-13-273350-1.
2. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani (1997) " Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence, | Prentice Hall

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**ELECTIVE - I  
SEMESTER IV**

**ADVANCED ELECTRONIC SYSTEM DESIGN 4 0 0 4**

**AIM**

To get knowledge about usage of electronic devices in Communication Engineering and Power supplies.

**OBJECTIVE**

- To study RF component such as resonator, filter, transmission lines, etc...
- To learn design of RF amplifiers using transistors.
- To study modern Power Supplies using SCR and SMPS technology
- To learn about signal shielding & grounding techniques and study of A/D and D/A Converters.
- To learn knowledge about fabrication of PCBs using CAD.

**UNIT I: INTRODUCTION TO RF DESIGN 9**

RF behaviour of passive components – Chip components and circuit board considerations – Review of transmission lines – Impedance and admittance transformation – Parallel and series connection of networks – ABCD and scattering parameters – Analysis of amplifier using scattering parameter – RF filter – Basic resonator and filter configurations – Butterworth and chebyshev filters – Implementation of microstrip filter design – Band pass filter and cascading of band pass filter elements.

**UNIT II: RF TRANSISTOR AMPLIFIER DESIGN 9**

Impedance matching using discrete components – Microstrip line matching networks – Amplifier classes of operation and biasing networks – Amplifier power gain– Unilateral design( $S_{12}=0$ ) – Simple input and output matching networks – Bilateral design – Stability circle and conditional stability – Simultaneous conjugate matching for unconditionally stable transistors – Broadband amplifiers – High power amplifiers and multistage amplifiers.

**UNIT III: DESIGN OF POWER SUPPLIES 9**

DC power supply design using transistors and SCR's – Design of crowbar and foldback protection circuits – Switched Mode Power Supplies(SMPS) – Forward – Fly back-buck and boost converters – Design of transformers and control circuits for SMPS.

**UNIT IV: DESIGN OF DATA ACQUISITION SYSTEMS 9**

Amplification of low level signals – Grounding – Shielding and guarding techniques – Dual slope – Quad slope and high speed A/D converters – Microprocessors compatible

A/D converters – Multiplying A/D converters and logarithmic A/D converters – Sample and hold – Design of two and four wire transmitters.

**UNIT V: DESIGN OF PRINTED CIRCUIT BOARDS 9**

Introduction to technology of Printed Circuit Boards (PCB) – General lay out and rules and parameters – PCB design rules for digital – High frequency – Analog – Power electronics and microwave circuits – Computer Aided Design(CAD) of PCB's.

**Total: 45**

**TEXT BOOKS:**

1. Reinhold Luduig and Pavel Bretchko, "RF Circuit Design – Theory and Applications", Pearson Education, 2000.
2. Sydney Soclof, "Applications of Analog Integrated Circuits", PHI, 1990.
3. Walter C. Bosshart, "Printed Circuit Boards – Design and Technology", TMH, 1983.

**REFERENCES**

1. Keith H. Billings, "Handbook of Switched Mode Supplies", TMH Publishing Co., 1989.
2. Michael Jaacob, "Applications and Design with Analog Integrated Circuits", PHI, 1991.
3. Otmar Kigenstein, "Switched Mode Power Supplies in Practice", John Wiley and Sons, 1989.
4. Muhammad H. Rashid, "Power Electronics – Circuits, Devices and Applications",

**OPTICAL COMMUNICATION AND NETWORKS****4 0 0 4****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 understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors. Design optimization of SM fibers, RI profile and cut-off wave length.
- To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes and different fiber amplifiers.
- To learn the fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration.
- To learn fiber slicing and connectors, noise effects on system performance, operational principles WDM and solutions.

**UNIT I INTRODUCTION TO OPTICAL FIBERS****9**

Evolution of fiber optic system- Element of an Optical Fiber Transmission link- Ray Optics-Optical Fiber Modes and Configurations –fiber types Mode theory of Circular Wave guides- Overview of Modes- Key model concepts- Linearly Polarized Modes – Single Mode Fibers-

**UNIT II SIGNAL DEGRADATION OPTICAL FIBERS****9**

Attenuation – Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides-Information Capacity determination – Group Delay-Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers -Mode Coupling

**UNIT III FIBER OPTICAL SOURCES AND COUPLING****9**

Direct and indirect Band gap materials-LED structures –Quantum efficiency Modulation of a LED, lasers Diodes-Modes and Threshold condition Fiber amplifiers- Power Fibre – to- Fibre joints, Fibre splicing.

**UNIT IV FIBER OPTICAL RECEIVERS****9**

PIN and APD diodes –Photo detector noise, SNR, Detector Response time, Avalanche Multiplication Noise –Comparison of Photo detectors –Fundamental Receiver Operation – preamplifiers, Error Sources –Receiver Configuration –Probability of Error

**UNIT V DIGITAL TRANSMISSION SYSTEM****9**

Point-to-Point links System considerations –Link Power budget –Rise - time budget – Noise Effects on System Performance-Operational Principles of WDM, Solitons-. Basic on concepts of SONET/SDH Network.

**TOTAL : 45****TEXT BOOK**

1. Gerd Keiser, “Optical Fiber Communication” McGraw –Hill International, Singapore, 3<sup>rd</sup> ed., 2000

**REFERENCES**

1. J.Senior, “Optical Communication, Principles and Practice”, Prentice Hall of India, 1994.
2. J.Gower, “Optical Communication System”, Prentice Hall of India, 2001.

**MICROWAVE ENGINEERING****4 0 0 4****Aim**

To enable the student to become familiar with active & passive microwave devices & components used in Microwave communication systems.

**Objectives**

- To study passive microwave components and their S- Parameters.
- To study Microwave semiconductor devices & applications.
- To study Microwave sources and amplifiers.

**Unit – I: Introduction****9**

Radio Spectrum – Microwave Frequency and its characteristics – Transmission media for microwave signals – Waveguides – Scattering Parameters for microwave network (two ports)

**Unit – II: Passive Microwave Devices****9**

Isolators, Attenuators, Directional Couplers – Waveguide Tees – E- plane, H-Plane and Magic Tee – Matched Terminators – S – parameters for all the components

**Unit – III: Microwave Sources****9**

Klystron Oscillator – Magnetron Oscillator– TWTA Amplifier – Power output and efficiency equations for all the devices

**Unit – IV: Semiconductor Microwave Devices****9**

PIN Diode – Varactor Diode (Manley – Rowe Power Relation) – Tunnel Diode – Gunn Diode – Applications of all the diodes –

**Unit – V Microwave Measurements****9**

Power Measurements – Frequency Measurements – VSWR Measurements (High and Low VSWR) – Attenuation Measurements – Insertion Loss Measurements

**TOTAL : 45****Text Book:**

1. Samuel Y.LIAO : Microwave Devices and Circuits – Prentice Hall of India – 3<sup>rd</sup> Edition (2003)
2. Annapurna Das and Sisir K.Das: Microwave Engineering – Tata McGraw-Hill (2000) (UNIT V)



**Reference:**

1. R.E. Collin : Foundations for Microwave Engg. – IEEE Press Second Edition (2002)
2. David M.POZAR : Microwave Engg. – John Wiley & Sons – 2<sup>nd</sup> Edition (2003)
3. P.A.RIZZI – Microwave Engg. (Passive )

**VLSI DESIGN****3 1 0 4****AIM**

To introduce the technology, design concepts and testing of Very Large Scale Integrated Circuits.

**OBJECTIVES**

- To learn the basic CMOS circuits.
- To learn the CMOS process technology.
- To learn techniques of chip design using programmable devices.
- To learn the concepts of designing VLSI subsystems.
- To learn the concepts of modeling a digital system using Hardware Description Language.

**UNIT I CMOS TECHNOLOGY****9**

An overview of Silicon semiconductor technology, Basic CMOS technology : nwell, P well, Twin tub and SOI Process. Interconnects, circuit elements: Resistors, capacitors, Electrically alterable ROMs, bipolar transistors, Latch up and prevention.

**UNIT II MOS TRANSISTOR THEORY****9**

NMOS, PMOS Enhancement transistor, Threshold voltage, Body effect, MOS DC equations, channel length modulation, Mobility variation, MOS models, small signal AC characteristics, complementary CMOS inverter DC characteristics, Noise Margin, Rise time, fall time

**UNIT III SPECIFICATION USING VERILOG HDL****9**

Basic Concepts: VLSI Design flow, identifiers, gate primitives, value set, ports, gate delays, , Behavioral and RTL modeling: Operators, timing controls, Procedural assignments conditional statements, Data flow modeling and RTL. Structural gate level description of decoder, equality detector, comparator, priority encoder, D-latch, D-ff, half adder, Full adder, Ripple Carry adder.

**UNIT IV CMOS CHIP DESIGN****9**

Logic design with CMOS: MOSFETS as switches, Basic logic gates in CMOS, Complex logic gates, Transmission gates: Muxes and latches, CMOS chip design options: Full custom ASICs, Std. Cell based ASICs, Gate Array based ASICs Channelled, Channelless and structured GA, Programmable logic structures; 22V10, Programming of PALs, ASIC design flow.

**UNIT V      CMOS TESTING****9**

Need for testing, Design strategies for test, Chip level and system level test techniques.

**TUTORIAL 15****TOTAL : 60****TEXT BOOKS**

1. Weste & Eshraghian: Principles of CMOS VLSI design (2/e) Addison Wesley, 1993 for UNIT I through UNIT IV.
2. Samir Palnitkar; Verilog HDL – Guide to Digital design and synthesis, III edition, Pearson Education, 2003 for UNIT V

**REFERENCES**

1. M.J.S.Smith : Application Specific integrated circuits, Pearson Education, 1997.
2. Wayne Wolf, Modern VLSI Design, Pearson Education 2003.
3. Bob Zeidmin ; Introduction to verilog, Prentice Hall, 1999
4. J . Bhaskar : Verilog HDL Primer, BSP, 2002.

**OPTICAL COMMUNICATION AND MICROWAVE LAB****0 0 3 2****Part I: Experiments pertaining to Fiber optics**

1. Numerical aperture determination for fibers and Attenuation Measurement in Fibers.
2. Mode Characteristics of Fibers – SM Fibers.
3. Coupling Fibers to Semi-Conductor Sources – Connectors & Splices.
4. Fiber optic communication links.
5. LED & Photo Diode Characteristics.

**Part II: Experiments pertaining to Microwave**

1. VSWR Measurements – Determination of terminated impedance
2. Determination of guide wavelength, frequency measurement.
3. Radiation Pattern of Horns, Paraboloids.
4. Microwave Power Measurement.
5. Characteristics of Gunn diode Oscillator.

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***ELECTIVE- II***  
**SEMESTER V**

**ENVIRONMENTAL SCIENCE AND ENGINEERING 4004**

**UNIT:I INTRODUCTION TO ENVIRONMENTAL STUDIES AND  
NATURAL RESOURCES 9**

Definition, Scope and importance – Need for public awareness – Forest resources – Water resources – Energy resources – Land resources – Role of an individual in conservation of natural resources – Equitable use of resource for sustainable life styles.

**UNIT:II ECOSYSTEM AND BIODIVERSITY 9**

Concept of an ecosystem – structure and Function of An ecosystem - Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains Food web and ecological pyramids. Introduction to Biodiversity – Value 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 – Insitu and Excitu conservation of Biodiversity.

**UNIT:III ENVIRONMENTAL POLLUTION 9**

Definition – Causes, effects and control measure of : - Air pollution - Water Pollution - Soil Pollution - Marine Pollution - Noise Pollution -Thermal Pollution - Nuclear hazard – Solid Waste management – Role of Individual in prevention of pollution – Disaster management.

**UNIT:IV SOCIAL ISSUES AND THE ENVIRONMENT 9**

From Un sustainable to sustainable development – water conservation, Rain water harvesting, water shed Management – Global warming – Ozone layer Depletion – Acid rain – Nuclear Accidents and holocaust – Environment Protection Act, Issues involved in enforcement legislation.

**UNIT :V HUMAN POPULATION AND THE ENVIRONMENT 9**

Population growth – Population explosion – Family welfare programme – Environment and human health – Human rights – value education – HIV/AIDS– Role of Information Technology in Environment and human health.

**Total = 45**

**TEXT BOOK**

1. Gilbert M Masters,“ Introduction to Environmental Engineering and science, ”Second Edition , Pearson Education Pvt, Ltd, 2007.
2. Miller T.G.Jr. “ Environmental science, ”, Wadworth Publishing Co.

## **REFERENCES**

1. Kurian Joseph, "Essentials of Environmental studies", First edition, Pearson Education, 2004.
2. Bharucha Erach, "The Biodiversity of India ," Mapin Publishing Pvt,Ltd.

**OPTO ELECTRONIC DEVICES****4 0 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 learn the principle of optical detection mechanism in different detection devices.
- To understand different light modulation techniques and the concepts and applications of optical switching.
- To study the integration process and application of opto electronic integrated circuits in transmitters and receivers.

**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 Display (LCD) – Numeric displays – Laser emission – Absorption – Radiation – Population inversion – Optical feedback – Threshold condition – Laser modes – Classes of lasers – Mode locking – Laser applications.

**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.

**Total: 45**

**TEXTBOOK**

1. Wilson J and Haukes J., “Opto Electronics – An Introduction”, PHI Pvt. Ltd., 1995.

**REFERENCES**

1. Bhattacharya, “Semiconductor Opto Electronic Devices”, PHI Pvt Ltd., 1995.
2. Jasprit Singh, “Opto Electronics – As Introduction to Materials and Devices”, TMH International Edition, 1998.



**RADAR AND NAVIGATIONAL AIDS****4 0 0 4****AIM**

To make the student understand the principles of Radar and its use in military and civilian environment

Also to make the student familiar with navigational aids available for navigation of aircrafts and ships.

**OBJECTIVES**

- To derive and discuss the Range equation and the nature of detection.
- To apply doppler principle to radars and hence detect moving targets, cluster, also to understand tracking radars
- To refresh principles of antennas and propagation as related to radars, also study of transmitters and receivers.
- To understand principles of navigation, in addition to approach and landing aids as related to navigation
- To understand navigation of ships from shore to shore.

**UNIT I****INTRODUCTION TO RADAR****9**

Basic radar – The simple form of the radar equation – Radar block diagram – Radar frequencies – Applications of radar – The origins of radar – The radar equation – Introduction – Detection of signals in noise – Receiver noise and the signal-to-noise ratio – Probability density functions – Probabilities of detection and false alarm – Integration of radar pulses – Radar cross section of targets – Radar cross section fluctuations – Transmitter power – Pulse repetition frequency – Antenna parameters – System losses – Other radar equation considerations

**UNIT II:****MTI AND PULSE DOPPLER RADAR****9**

Introduction to Doppler and MTI radar – Delay-line cancellers – Staggered pulse repetition frequencies – Doppler filter banks – Digital MTI processing – Moving target detector – Limitations to MTI performance – MTI from a moving platform (AMIT) – Pulse Doppler radar – Other Doppler radar topics – Tracking with radar – Mono pulse tracking – Conical scan and sequential lobing – Limitations to tracking accuracy – Low – Angle tracking – Tracking in range – Other tracking radar topics – Comparison of trackers – Automatic tracking with surveillance radars (ADT).

**UNIT III****9**

Detection of signals in noise – Introduction – Matched – Filter receiver – Detection – Detectors – Automatic detector – Integrators – Constant – False – Alarm rate receivers – The radar operator – Signal management – Propagation radar waves – Atmospheric – Standard propagation – Nonstandard propagation – The radar antenna – Reflector antennas – Electronically steered phased array antennas – Phase shifters – Frequency – Scan arrays – Radar transmitters – Introduction – Linear beam power tubes – Solid state RF power sources – Magnetron – Crossed field amplifiers – Other RF power sources – Other aspects of radar transmitter – Radar receivers – The radar receiver – Receiver noise figure – Super heterodyne receiver – Duplexers and receiver protectors – Radar displays.

**UNIT IV****9**

Introduction – Four methods of navigation – Radio direction finding – The loop antenna – Loop input circuits – An aural null direction finder – The goniometer – Errors in direction finding – Adcock direction finders – Direction finding at very high frequencies – Automatic direction finders – The commutated aerial direction finder – Range and accuracy of direction finders – Radio ranges – The Lf/Mf four course radio range – Vhf omni directional range (Vor) – Vor receiving equipment – Range and accuracy of Vor – Recent developments – Hyperbolic systems of navigation (loran and decca) – Loran-A equipment – Range and precision of standard loran – Loran-C – The decca navigation system – Decca receivers – Range and accuracy of decca – The omega system

**UNIT V****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) – Doppler navigation – The Doppler effect – Beam configurations – Doppler frequency equations – Track stabilization – Doppler spectrum – Components of the Doppler navigation system – Doppler range equation – Accuracy of Doppler navigation systems – Inertial navigation – Principles of operation – Navigation over the earth – Components of an inertial navigation system – Earth co-ordinate mechanization – Strapped – Down systems – Accuracy of inertial navigation systems – Satellite navigation system – The transit system – Navstar Global Positioning System (GPS)

**Total: 45****TEXTBOOK**

1. Merrill I. Skolnik, “Introduction to Radar Systems”, 3rd Edition, TMH, 2003.

**REFERENCES**

1. Peyton Z. Peebles, “Radar Principles”, John wiley, 2004
2. Toomay J.C, “Principles of Radar”, 2nd Edition, PHI, 2004

**19152E54DP**

***ELECTIVE- II***  
**SEMESTER V**

**DIGITAL IMAGE PROCESSING**

**4 0 0 4**

**AIM**

To introduce the student to various image processing techniques.

**OBJECTIVES**

- To study the image fundamentals and mathematical transforms necessary for image processing.
- To study the image enhancement techniques
- To study image restoration procedures.
- To study the image compression procedures.
- To study the image segmentation and representation techniques.

**UNIT - I: DIGITAL IMAGE FUNDAMENTALS**

**9**

Elements of visual perception – Image sampling, Quantization – Basic relationship between pixels- monochrome vision model- color space model-convolution.

**UNIT – II IMAGE TRANSFORM**

**9**

Basic geometric transforms-Introduction to Fourier transform and DFT – properties of 2D Fourier transform – FFT- Separable image transforms – Walsh – Hadamard- Discrete cosine and Haar Transforms

**UNIT-III: IMAGE ENHANCEMENT AND RESTORATION TECHNIQUES**

**9**

Spatial domain methods- Basic gray level transformation-Histogram equalization-Spatial filtering-Laplacian filtering- Frequency Domain filters- homomorphic filtering-Model of image degradation/Restoration process- Noise models.

**UNIT IV:IMAGE COMPRESSION**

**9**

Lossless compression-: Variable length coding- LZW coding- -Predictive coding-DPCM. Lossy compression- Transform coding-- Image compression standards-JPEG,MPEG.

**UNIT – V:IMAGE SEGMENTATION & REPRESENTATION**

**9**

Edge detection – Thresholding- region based segmentation- Boundary representation – chain codes- Boundary segments – boundary descriptors-: simple descriptors-Fourier descriptors- Regional descriptors- Texture.

**TOTAL : 45**

**Text Book:**

1. Rafael C. Gonzalez, Richard E. Woods 2<sup>nd</sup> edition – Digital Image processing – Pearson education 2003.

**Reference books:**

1. William K. Pratt, Digital Image processing, John Wiley (2001)
2. Image processing Analysis and Machine Vision - Millman Sonka, Vaclav hlavac, Roger Boyle, Broos/Colic, Thompson Learnfy (1999)
3. A.K. Jain PHI, (1995) – Fundamentals of Digital Image processing

19152E54EP

***ELECTIVE- II***  
**SEMESTER V**  
**4 0 0 4**

**ENGINEERING ACOUSTICS**

**AIM**

This course aims at providing an overview of engineering acoustics.

**OBJECTIVE**

- To provide mathematical basis for acoustics waves
- To introduce the concept of radiation reception absorption and attenuation of acoustic waves.
- To present the characteristic behaviour of sound in pipes, resonators and filters.
- To introduce the properties of hearing and speech
- To describe the architecture and environmental inclusive of reverberation and noise.
- To give a detailed study on loud speakers and microphones.

**UNIT I:**

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 and oblique incidence – Method of images.

**UNIT II: RADIATION AND RECEPTION OF ACOUSTIC WAVES 9**

Radiation from pulsating sphere – Acoustic reciprocity – Continuous line source – Radiation impedance – Fundamental properties of transducers.

**Absorption and attenuation of sound:** Absorption from viscosity – Complex sound speed and absorption – Classical absorption co-efficient

**UNIT III: PIPE RESONATORS AND FILTERS 9**

Resonance in pipes – Standing wave pattern absorption of sound in pipes – Long wavelength limit – Helmholtz resonator – Acoustic impedance – Reflection and transmission 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 – The ear – Fundamental properties of hearing – Loudness level and loudness – Pitch and frequency – Voice.

**UNIT IV: ARCHITECTURAL ACOUSTICS 9**

Sound in enclosure – A simple model for the growth of sound in a room – Reverberation time – Sabine, sound absorption materials – Measurement of the acoustic output of sound sources in live rooms – Acoustics factor in architectural design.

**Environmental Acoustics:** Weighted sound levels speech interference – Highway noise Noise induced hearing loss – Noise and architectural design specification and measurement of some isolation design of portions.

**UNIT V: TRANSDUCTION 9**

Transducer as an electives network – Canonical equation for the two simple transducers transmitters – Moving coil loud speaker – Loudspeaker cabinets – Horn loud speaker, receivers – Condenser – Microphone – Moving coil electrodynamic microphone Piezoelectric microphone – Calibration of receivers.

**Total: 45**

**TEXT BOOK**

1. Lawrence E. Kinsler, Austin R. Frey, Alan B. Coppens and James V. Sanders, “Fundamentals of Acoustics”, 4<sup>th</sup> Edition, Wiley, 2000.

**REFERENCE**

1. Berarek L., “Acoustics”, TMH, 2002.

**MOBILE AND WIRELESS COMMUNICATION****4 0 0 4****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 also covers small propagation effects such as fading, time delay spread and Doppler spread and describes how to measures and model the impact that signal bandwidth 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.

**UNIT I: PRINCIPLES OF WIRELESS COMMUNICATION 10**

Digital modulation techniques – Linear modulation techniques – Spread spectrum modulation – Performance of modulation – Multiple access techniques – TDMA – FDMA – CDMA – SDMA – Overview of cellular networks – Cellular concept – Handoff strategies – Path loss – Fading and Doppler effect.

**UNIT II: WIRELESS PROTOCOLS 11**

Issues and challenges of wireless networks – Location management – Resource management – Routing – Power management – Security – Wireless media access

techniques – ALOHA – CSMA – Wireless LAN – MAN – IEEE 802.11 (a–b–e–f–g–h–i) – Bluetooth. Wireless routing protocols – Mobile IP – IPv4 – IPv6 – Wireless TCP. Protocols for 3G & 4G cellular networks – IMT – 2000 – UMTS – CDMA2000 – Mobility management and handover technologies – All-IP based cellular network

**UNIT III: TYPES OF WIRELESS NETWORKS 9**

Mobile networks – Ad-hoc networks – Ad-hoc routing – Sensor networks – Peer-Peer networks – Mobile routing protocols – DSR – AODV – Reactive routing – Location aided routing – Mobility models – Entity based – Group mobility – Random way – Point mobility model.

**UNIT IV: ISSUES AND CHALLENGES 9**

Issues and challenges of mobile networks – Security issues – Authentication in mobile applications – Privacy issues – Power management – Energy awareness computing. Mobile IP and Ad-hoc networks – VoIP applications.

**UNIT V: SIMULATION 6**

Study of various network simulators (GloMoSim – NS2 – Opnet) – Designing and evaluating the performance of various transport and routing protocols of mobile and wireless networks using network simulator (any one).

**Total: 45**

**REFERENCES**

1. Theodore S. Rappaport, “Wireless Communications, Principles and Practice”, Prentice Hall, 1996.
2. Stallings W., “Wireless Communications & Networks”, Prentice Hall, 2001.
3. Schiller J., “Mobile Communications”, Addison Wesley, 2000.
4. Lee W. C. Y., “Mobile Communications Engineering: Theory and Applications”, 2nd Edition, TMH, 1997.
4. Pahlavan K. and Krishnamurthy P., “Principles of Wireless Networks”, Prentice Hall, 2002.
5. Black U. D., “Mobile and Wireless Networks”, PHI, 1996.
6. Charles E. Perkins, “Ad – Hoc Networking”, Addison – Wesley, December 2000
7. IEEE Journals and Proceedings



**MEDICAL ELECTRONICS****3 1 0 4****AIM**

To make students to understand the applications of electronics in diagnostic and therapeutic area.

**OBJECTIVE**

- To study the methods of recording various biopotentials
- To study how to measure biochemical and various physiological information
- To understand the working of units which will help to restore normal functioning
- To understand the use of radiation for diagnostic and therapy
- To understand the need and technique of electrical safety in Hospitals

**UNIT I ELECTRO- PHYSIOLOGY AND BIO- POTENTIAL RECORDING 9**

The origin of bio-potentials – Bio-potential electrodes – Biological amplifiers – ECG – EEG – EMG – PCG – EOG – Lead systems and recording methods – Typical waveforms and signal characteristics.

**UNIT II BIO- CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT 9**

PH – PO<sub>2</sub> – PCO<sub>2</sub> – PHCO<sub>3</sub> – Electrophoresis – Colorimeter – Photometer – Auto analyzer – Blood flow meter – Cardiac output – Respiratory measurement – Blood pressure – Temperature – Pulse – Blood cell counters.

**UNIT III ASSIST DEVICES AND BIO- TELEMETRY 9**

Cardiac pacemakers – DC defibrillator – Telemetry principles – Frequency selection – Bio-telemetry – Radio – Pill and tele-stimulation.

**UNIT IV RADIOLOGICAL EQUIPMENTS 9**

Ionising radiation – Diagnostic X-ray equipments – Use of radio isotope in diagnosis – Radiation therapy.

**UNIT V RECENT TRENDS IN MEDICAL INSTRUMENTATION 9**

Thermo graph – Endoscopy unit – Laser in medicine – Diathermy units – Electrical safety in medical equipment.

**TUTORIAL 15****TOTAL: 60**

### **TEXTBOOK**

1. Leslie Cromwell, “Biomedical Instrumentation and Measurement”, PHI, 2002.

### **REFERENCES**

1. Khandpur R.S., “Handbook of Biomedical Instrumentation”, TATA McGraw-Hill, 1997.
2. Joseph J. Carr and John M. Brown, “Introduction to Biomedical Equipment Technology”, John Wiley and Sons, 1997.

**MICRO CONTROLLER AND EMBEDDED SYSTEMS 3 1 0 4****Aim**

To make students familiar about microcontroller, programming and its applications.

**Objective**

- To study 8051 architecture
- To write assembly language programming
- To study the embedded architecture and real time applications.

**UNIT I 8051 MICROCONTROLLER 9**

8051 Micro controller hardware- I/O pins, ports and circuits- External memory –Counters and Timers-Serial Data I/O- Interrupts-

**UNIT II 8051 PROGRAMMING AND APPLICATIONS 9**

8051 instruction set – Addressing modes – Assembly language programming – I/O port programming -Timer and counter programming – Serial Communication – Interrupt programming –8051 Interfacing:, Stepper Motors.

**UNIT III 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)

**UNIT IV DEVICES AND BUSES FOR DEVICES NETWORK 9**

I/O Devices - Device I/O Types– Synchronous - Iso-synchronous and Asynchronous Communications from Serial Devices -Communication Devices - UART and HDLC - Parallel Port Devices - Timer and Counting Devices - ‘12C’, ‘CAN’ - I/O Serial high speed buses- ISA.

**UNIT V EMBEDDED ARCHITECTURE 9**

Embedded computers, characteristics of embedded, computing applications- challenges in embedded computing systems design, embedded design process, requirements and specifications, architectural design

**TUTORIAL 15****TOTAL : 60**

### **TEXT BOOKS**

1. Ramesh S.Gaonkar, “Microprocessor - Architecture, Programming and Applications 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. Douglas V.Hall, “Microprocessors and Interfacing: Programming and Hardware”, TMH, Third edition
2. Yu-cheng Liu, Glenn A.Gibson, “Microcomputer systems: The 8086 / 8088 Family architecture, Programming and Design”, PHI 2003
3. Mohamed Ali Mazidi, Janice Gillispie Mazidi, “The 8051 microcontroller and embedded systems”, Pearson education, 2004.
4. Steve Heath, Embedded Systems Design, Second Edition-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 System Design – Harcourt India, Morgan Kaufman Publishers, First Indian Reprint 2001

**VLSI AND EMBEDDED SYSTEMS LAB****0 0 3 2****PART -I: VLSI LAB**

1. Study of Simulation using tools using Digital Logic Circuits.
2. Study of Synthesis tools using Digital Logic Circuits.
3. Study of development tool for FPGA using Verilog and Schematic Entry.
4. Design and Simulation of 8bit Signed Multiplier.
5. Place and Route and back annotation for FPGA.

**PART-II: EMBEDDED LAB**

1. Programming using Arithmetic, instruction of 8051 microcontroller.
2. Programming and verifying Timer operations in 8051 microcontroller.
3. ARM-7 based On board LED testing
4. ARM 7 Based ADC testing
5. ARM 7 based DAC testing

19152E64AP

***ELECTIVE -III***  
**SEMESTER VI**

**PRINCIPLES OF MANAGEMENT**

(Common to all Branches)

**4 0 0 4**

<b>UNIT I - Nature of Management</b>	<b>9</b>
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	
<b>UNIT II - Development of Management Thought</b>	<b>9</b>
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	
<b>UNIT III - Planning and organizing</b>	<b>9</b>
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	
<b>UNIT IV - Direction and Coordination</b>	<b>9</b>
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	
<b>UNIT V – Controlling</b>	<b>9</b>
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 : 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

**19152E64BP**

***ELECTIVE -III***  
**SEMESTER VI**

**SATELLITE COMMUNICATION**

**4 0 0 4**

**AIM**

To enable the student to become familiar with satellites and satellite services.

**OBJECTIVES**

- Overview of satellite systems in relation to other terrestrial systems.
- Study of satellite orbits and launching.
- Study of earth segment and space segment components
- Study of satellite access by various users.
- Study of DTH and compression standards.

**UNIT I : ELEMENTS OF ORBITAL MECHANICS**

**9**

Equation of motion – Orbital elements – Orbital perturbation – Tracking and orbit determination – orbit control.

Satellite Launch systems: Fundamentals of Rocket propulsion – Multistage rockets – Huffman transfer orbit circularization

**UNIT II: ELEMETS OF COMMUNICATION SATELLITE DESIGN**

**9**

Space environment – Spacecraft configuration – Spacecraft subsystems – Payload – Reliability consideration – Spacecraft integration – Testing facilities – Spacecraft operations.

**UNIT – III : SATELLITE COMMUNICATION SYSTEMS**

**9**

Types of systems – FSS,BSS- Noise interference ,inter modulation –CDMA- Packet satellite networks – The INSAT system - The INTELSAT/INMARSAT system.

**UNIT – IV: EARTH STATION DESIGN**

**9**

Earth station configuration option – Site selection – Antenna systems – Tracking systems – Receiver subsystems – Low noise amplifiers – Down converters – Transmitter subsystems – Up converters- High power amplifiers - Terminal equipment .

**UNIT - V: PERFORMANCE MEASUREMENTS**

**9**

Spacecraft checkout – Ground station measurements –System coordination and control .Elements of Frequency coordination and management : The ITU/IFRB requirements – Satellite system characterization – Ground system characteristics .

**TOTAL : 45**



**Text book:**

1. B.N.AGARWAL :Deign of Geosynchronous spacecraft, Prentice Hall

**Reference Books:**

1. R.F.FILIPOWASKY and E.K.MUCHIDORF: Space communication Systems  
Mcgraw Hill
2. DENNIS RODDY – Satellite communication
3. K.MIYA :Satellite communication technology – Lattice and company



6. Fu K.S, Gonzally R.C, Lee C.S.G., “Robotics Control, Sensing, Vision and Intelligence”, TMH Book Company, 1997.
7. Barry Leatham and Jones, “Elements of Industrial Robotics”, Pittman Publishing, 1987.
8. Mikell P. Groover, Mitchell Weiss, Roger N. Nagel, Nicholas G. Odrey, “Industrial Robotic Technology Programming and Applications”, TMH Book Company, 1986.
9. Bernard Hodges and Paul Hallam, “Industrial Robotics”, British Library Cataloguing Publication, 1990.

**19152E64DP**

***ELECTIVE -III***  
**SEMESTER VI**

**REMOTE SENSING**

**4 0 0 4**

**AIM:**

To understand the basics for remote sensing.

**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.
- The newest technology in the field will also be discussed.
- The course will be taught with an emphasis on the geographical applications of remote sensing; however, in certain instances other disciplines will be introduced as well.

**UNIT I :**

**REMOTE SENSING**

**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 – Electro Magnetic Radiation (EMR) – EMR spectrum – Visible, Infra Red (IR), Near IR, Middle IR, Thermal IR and Microwave – Black Body Radiation – Planck’s law – Stefan-Boltzman law.

**UNIT II:**

**EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIALS**

**9**

Atmospheric characteristics – Scattering of EMR – Raleigh, Mie, Non-selective and Raman Scattering – EMR Interaction with Water vapour and ozone – Atmospheric Windows – Significance of Atmospheric windows – EMR interaction with Earth Surface Material – Radiance, Irradiance, Incident, Reflected, Absorbed and Transmitted Energy – Reflectance – Specular and Diffuse Reflection Surfaces – Spectral Signature – Spectral Signature curves – EMR interaction with water, soil and Earth Surface: Imaging spectrometry and spectral characteristics.

**UNIT – III :**

**OPTICAL AND MICROWAVE REMOTE SENSING**

**9**

Satellites – Classification – Based on Orbits and purpose – Satellite Sensors – Resolution – Description of Multi Spectral Scanning – Along and Across Track Scanners – Description of Sensors in Land sat, SPOT, IRS series – Current Satellites – Radar

Speckle – Back Scattering – Side Looking Airborne Radar – Synthetic Aperture Radar – Radiometer – Geometrical characteristics ; Sonar remote sensing systems.

**UNIT – IV: GEOGRAPHIC INFORMATION SYSTEM 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 – Comparison of Raster and Vector data structure – Analysis using Raster and Vector data – Retrieval, Reclassification, Overlaying, Buffering – Data Output – Printers and Plotters.

**UNIT - V: MISCELLANEOUS TOPICS 9**

Visual Interpretation of Satellite Images – Elements of Interpretation – Interpretation Keys Characteristics of Digital Satellite Image – Image enhancement – Filtering – Classification – Integration of GIS and Remote Sensing – Application of Remote Sensing and GIS – Urban Applications – Integration of GIS and Remote Sensing – Application of Remote Sensing and GIS – Water resources – Urban Analysis – Watershed Management – Resources Information Systems. Global positioning system – an introduction.

**TOTAL : 45 PERIODS**

**TEXT BOOK:**

1. M.G. Srinivas(Edited By), Remote Sensing Applications, Narosa Publishing House, 2001. (Units 1 & 2).
2. Anji Reddy, Remote Sensing and Geographical Information Systems, BS Publications, 2001 (Units 3, 4, & 5).

**REFERENCE BOOKS:**

1. Jensen, J.R., Remote Sensing of the environment, Prentice Hall, 2000.
2. Kang-Tsung Chang, “Introduction to Geographic Information Systems” , TMH, 2002.
3. Lillesand T.M. and Kiefer R.W., “Remote Sensing and Image Interpretation”, John Wiley and Sons, Inc, New York, 1987.
4. Burrough P A, “Priciples of GIS for land resource assessment”, Oxford.
5. Mischael Hord, “Remote Sensing and Methods and Applications” , John Wiley & Sons, New York, 1986.
6. Signal, “Remote Sensing”, Tata McGraw-Hill, NewDelhi, 1990.
7. Floyd F. Sabins, Remote Sensing, “Priciples and interpretation”, W H Freeman and Company 1996.

**NETWORK SECURITY****4 0 0 4****AIM**

To understand the principles of encryption algorithms; conventional and public key cryptography. To have a detailed knowledge about authentication, hash functions and application level security mechanisms.

**OBJECTIVES**

- To know the methods of conventional encryption.
- To understand the concepts of public key encryption and number theory
- To understand authentication and Hash functions
- To know the network security tools and applications.
- To understand the system level security used.

**UNIT I: SYMMETRIC CIPHERS 9**

Overview – Classical encryption techniques – Block ciphers and data encryption standard – Finite fields – Advanced encryption standard – Contemporary symmetric ciphers – Confidentiality using symmetric encryption.

**UNIT II: PUBLIC-KEY ENCRYPTION AND HASH FUNCTIONS 9**

Number theory – Public-key cryptography and RSA – Keym – Diffie-hellman key exchange – Elliptic curve cryptography – Message authentication and hash functions – Hash algorithms – Digital signatures and authentication protocols.

**UNIT III: NETWORK SECURITY PRACTICE 9**

Authentication applications – Kerberos-X.509 authentication service – Electronic mail security – Pretty good privacy – S/MIME – IP security – IP security architecture – Authentication header – Encapsulating security payload – Key management.

**UNIT IV: SYSTEM SECURITY 9**

Intruders – Intrusion detection – Password management – Malicious software – Firewalls – Firewall design principles – Trusted systems.

**UNIT V: WIRELESS SECURITY 9**

Wireless LAN security standards – Wireless LAN security factors and issues.

**Total: 45**

### **TEXT BOOK**

1. William Stallings, “Cryptography and Network Security – Principles and Practices”, 3rd Edition, Pearson Education, 2003.

### **REFERENCES**

1. Atul Kahate, “Cryptography and Network Security”, 2nd Edition, TMH, 2007.
2. Bruce Schneier, “Applied Cryptography”, 2nd Edition, John Wiley and Sons Inc, 2001.
3. Stewart S. Miller, “Wi-Fi Security”, TMH, 2003.
4. Charles B. Pfleeger and Shari Lawrence Pfleeger, “Security in Computing”, 3<sup>rd</sup> Edition, Pearson Education, 2003.

**TOTAL QUALITY MANAGEMENT****3 0 0 3****OBJECTIVE**

- To understand the Total Quality Management concept and principles and the various tools available to achieve Total Quality Management.
- To understand the statistical approach for quality control.
- 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 - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

**2. TQM PRINCIPLES****9**

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

**3. STATISTICAL PROCESS CONTROL (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.

**4. TQM TOOLS****9**

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.

**5. QUALITY SYSTEMS****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 : 45**



### **TEXT BOOK**

1. Dale H.Besterfield, et al., Total Quality Management, Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6.

### **REFERENCES**

1. James R.Evans & William M.Lindsay, The Management and Control of Quality, (5<sup>th</sup> Edition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).
2. Feigenbaum.A.V. "Total Quality Management, McGraw-Hill, 1991.
3. Oakland.J.S. "Total Quality Management Butterworth – Heinemann Ltd., Oxford. 1989.
4. Narayana V. and Sreenivasan, N.S. Quality Management – Concepts and Tasks, New Age International 1996.
5. Zeiri. "Total Quality Management for Engineers Wood Head Publishers, 1991

**WIRELESS NETWORKS****3 1 0 4****AIM**

To study some fundamental concepts in wireless networks.

**OBJECTIVES**

- To understand physical as wireless MAC layer alternatives techniques.
- To learn planning and operation of wireless networks.
- To study various wireless LAN and WAN concepts.
- To understand WPAN and geo-location systems.

**UNIT I: PHYSICAL AND WIRELESS MAC LAYER ALTERNATIVES 9**

**Wired transmission techniques:** Design of wireless modems – Power efficiency – Out of band radiation – Applied wireless transmission techniques – Short distance base band transmission – VWB pulse transmission – Broad modems for higher speeds – Diversity and smart receiving techniques – Random access for data oriented networks – Integration of voice and data traffic.

**UNIT II: WIRELESS NETWORK PLANNING AND OPERATION 9**

Wireless networks topologies – Cellular topology – Cell fundamentals signal to interference ratio calculation – Capacity expansion techniques – Cell splitting – Use of directional antennas for cell sectoring – Micro cell method – Overload cells – Channels allocation techniques and capacity expansion FCA – Channel borrowing techniques – DCA – Mobility management – Radio resources and power management securities in wireless networks.

**UNIT III: WIRELESS WAN 9**

Mechanism to support a mobile environment – Communication in the infrastructure – IS-95 CDMA forward channel – IS-95 CDMA reverse channel – Pallert and frame formats in IS-95, IMT-2000 – Forward channel in W-CDMA and CDMA-2000 – Reverse channels in W-CDMA and CDMA-2000 – GPRS and higher data rates – Short Messaging Service in GPRS mobile application protocols.

**UNIT IV: WIRELESS LAN 9**

Historical overviews of the LAN industry – Evolution of the WLAN industry – Wireless Home Networking – IEEE 802.11 – The PHY layer – MAC layer – Wireless ATM – HYPER LAN – HYPER LAN – 2.

**UNIT V: WPAN AND GEOLOCATION SYSTEMS 9**

IEEE 802.15 WPAN – Home RF – Bluetooth – Interface between Bluetooth and 802.11  
– Wireless geolocation technologies for wireless geolocation – Geolocation standards for  
E.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. Jochen Schiller, “Mobile Communications”, 2nd Edition, Person Education, 2003.
2. Wang X. and Poor H.V., “Wireless Communication Systems”, Pearson Education, 2004.
3. Mallick M., “Mobile and Wireless Design Essentials”, Wiley Publishing Inc. 2003.
4. Nicopolitidis P, Obaidat M.S, Papadimitria G.I, Pomportsis A.S., “Wireless Networks”, John Wiley and Sons, 2003.



**UNIT IV INTEGRATED DIGITAL NETWORKS****9**

Subscriber loop characteristics, Local access wire line and wire less PCM / TDM carrier standards transmission line codes, Synchronous, Asynchronous, SONET / SDH, Integrated Digital Network (IDN) environment – Principles of Integrated Services Digital Network (ISDN)

**UNIT V DATA NET WORKS****9**

Data transmission in PSTN – Connection oriented and Connection less protocols – packet switching – ISO-OSI architecture-Satellite based data networks –LAN, WAN – standards – TCP / IP – Internet

**TOTAL : 45****TEXT BOOKS:**

1. Viswanathan. T, “Telecommunication Switching System and Networks”, Prentice Hall of India Ltd., 1994.
2. Behrouz Forouzan, “Introduction to Data Communication and Networking”, McGraw-Hill, 1998.

**REFERENCES**

1. L.S.Lawton, “Integrated Digital Networks, Galgotta Publication Pvt., Ltd., New Delhi,1996.
2. Syed R. Ali, “Digital Switching Systems”, McGraw-Hill Inc., New York, 1998.



**REFERENCES:**

1. Ned Mohan, Tore M.Undeland, William P.Robbins, "Power Electronics, Converters, Applications and Design", John Wiley & Sons, 1994.
2. Muhamed H.Roshid, "Power Electronics Circuits, Devices and Application", Prentice Hall of India, 1995.
3. B.K.Bose, "Modern Power Electronics", Jaico Publishing House, 1999.
4. Sen, Power Electronics", Tata McGraw-Hill, 1987

**19152E74BP**

***ELECTIVE – IV***  
**SEMESTER VII**

**ADVANCED MICROPROCESSORS**

**3 0 0 3**

**AIM**

To learn the architecture and programming of advanced Intel family microprocessors and microcontrollers.

**OBJECTIVES**

- To introduce the concepts in internal programming model of Intel family of microprocessors.
- To introduce the programming techniques using MASM, DOS and BIOS function calls.
- To introduce the basic architecture of Pentium family of processors.
- To introduce the architecture programming and interfacing of 16 bit microcontrollers.
- To introduce the concepts and architecture of RISC processor and ARM.

**UNIT I          ADVANCED MICROPROCESSOR ARCHITECTURE          9**

Internal microprocessor architecture – Real mode memory addressing – Protected mode memory addressing – Memory paging – Data addressing modes – Program memory addressing modes – Stack memory addressing modes – Data movement instructions – Program control instructions – Arithmetic and logic instructions.

**UNIT II          MODULAR PROGRAMMING AND ITS CONCEPTS          9**

Modular programming – Using keyboard and video display – Data conversions – Disk files – Interrupt hooks – Using assembly languages with C/ C++

**UNIT III                          PENTIUM PROCESSORS                          9**

Introduction to pentium microprocessor – Special pentium registers – Pentium memory management – New pentium instructions – Pentium processor – Special pentium pro features – Pentium IV processor

**UNIT IV                          16– BIT MICRO CONTROLLER                          9**

8096/8097 architecture – CPU registers – RALU – Internal program and data memory timers – High speed input and output – Serial interface – I/O ports – Interrupts – A/D converter – Watch dog timer – Power down feature – Instruction set – External memory interfacing – External I/O interfacing.



**UNIT V****RISC PROCESSORS AND ARM****9**

The RISC revolution – Characteristics of RISC architecture – The Berkeley RISC – Register windows – Windows and parameter passing – Window overflow – RISC architecture and pipelining – Pipeline bubbles – Accessing external memory in RISC systems – Reducing the branch penalties – Branch prediction – ARM processors – ARM registers – ARM instructions – ARM built-in shift mechanism – ARM branch instructions – Sequence control – Data movement and memory reference instructions.

**TOTAL: 45****TEXT BOOKS**

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. John Peatman, “Design with Microcontroller”, TMH Publishing Co Ltd, 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.

**ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY****3 0 0 3****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 and their solution methods in PCB level / Subsystem and system level design.
- To measure the emission. immunity level from different systems to couple with the prescribed EMC standards

**UNIT I****BASIC CONCEPTS****9**

Definition of EMI and EMC with examples – Classification of EMI/EMC – CE – RE – CS – RS – Units of parameters – Sources of EMI – EMI coupling modes – CM and DM – ESD phenomena and effects – Transient phenomena and suppression.

**UNIT II****EMI MEASUREMENTS****9**

Basic principles of RE, CE, RS and CS measurements – EMI measuring instruments – Antennas – LISN – Feed through capacitor – Current probe – EMC analyzer and detection technique open area site – Shielded anechoic chamber – TEM cell.

**UNIT III****EMC STANDARD AND REGULATIONS****8**

National and international standardizing organizations – FCC – CISPR – ANSI – DOD – IEC – CENELEC – FCC – CE and RE standards – CISPR – CE and RE standards – IEC/EN – CS standards – Frequency assignment – Spectrum conversion.

**UNIT IV****EMI CONTROL METHODS AND FIXES****10**

Shielding – Grounding – Bonding – Filtering – EMI gasket – Isolation transformer – Opto-isolator.

**UNIT V****EMC DESIGN AND INTERCONNECTION TECHNIQUES****9**

Cable routing and connection – Component selection and mounting – PCB design – Trace routing – Impedance control – Decoupling – Zoning and grounding

**TOTAL: 45**

### **TEXT BOOKS**

1. Prasad Kodali V., “Engineering Electromagnetic Compatibility”, S. Chand and Co, 2000.
2. Clayton R. Paul, “Introduction to Electromagnetic Compatibility” , Wiley and Sons, 1992.

### **REFERENCES**

1. Keiser, “Principles of Electromagnetic Compatibility”, 3rd Edition, Artech House, 1994.
2. Donwhite Consultant Incorporate , “Handbook Of EMI / EMC” , Vol I , 1985

**19152E74DP**

***ELECTIVE – IV***  
**SEMESTER VII**

**SOLID STATE ELECTRONIC DRIVES**

**3 0 0 3**

**AIM**

To have fundamental knowledge 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.
- To study energy band structure of semiconductor devices.
- 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.
- To learn photoelectric effect and fabrication of opto electronic devices.

**UNIT I: CRYSTAL PROPERTIES AND GROWTH SEMICONDUCTORS 9**

Semiconductor materials – periodic Structures – Crystal Lattices – Cubic lattices – Planes and Directions – Diamond lattice – Bulk Crystal Growth – Starting Material – Growth of Single Crystal Ingots – Wafers – Doping – Epitaxial Growth – Lattice Matching in Epitaxial Growth – Vapor – Phase Epitaxy – Atoms and Electronics – Introduction to Physical Models – Experimental Observations – Photoelectric Effect – Atomic spectra – Bhr model – Quantum Mechanics – Probability and Uncertainty Principle – Schrodinger Wave Equation – Potential Well Equation – Potential well Problem – Tunneling.

**UNIT II: ENERGY BANDS AND CHARGE CARRIERS IN SEMICONDUCTORS AND JUNCTIONS 9**

Energy bands in Solids, Energy Bands in Metals, Semiconductors, and Insulators – Direct and Indirect Semiconductors – Variation of Energy Bands with Alloy Composition - Charge Carriers in Semiconductors – Electrons and Holes – Electrons and holes in Quantum Wells – Carrier Concentrations – Fermi Level – Electron and Hole Concentrations at Equilibrium – Temperature Dependence of Carrier Concentrations – Compensation and Space Charge Neutrality – Drift of Carrier in Electric and Magnetic Fields conductivity and Mobility – Drift and Resistance – Effects of Temperature and

Doping on Mobility – High Field effects – Hall Effect – invariance of Fermi level at equilibrium – Fabrication of p-n junctions, Metal semiconductor junctions.

**UNIT III: METAL OXIDE SEMICONDUCTOR FET 9**

GaAS MESFET – High Electron Mobility Transistor – Short channel Effects – Metal Insulator Semiconductor FET – Basic Operation and Fabrication – Effects of Real Surfaces – Threshold Voltage – MOS capacitance Measurements – Current – Voltage Characteristics of MOS Gate Oxides – MOS Field Effect Transistor – Output Characteristics – 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 – Induced Barrier Lowering – short channel and Narrow width Effect – Gate Induced Drain Leakage.

**UNIT IV: OPTO ELECTRON DEVICES 9**

Photodiodes – Current and Voltage in illuminated Junction – Solar Cells – Photo detectors – Noise and Bandwidth of Photo detectors – Light Emitting Diodes – Light Emitting Material – Fiber Optic Communication Multilayer Heterojunctions for LEDS – Lasers – Semiconductor lasers – Population Inversion at a Junction Emission Spectra for p-n junction – Basic Semiconductor laser – Materials for Semiconductor laser.

**UNIT V HIGH FREQUENCY AND HIGH POWER DEVICES 9**

Tunnel Diode, IMPATT Diode, operation of TRAPATT and BARITT Diodes, Gunn Diode – transferred – electron mechanism, formation and drift of space charge domains, p-n-p-n diode, Semiconductor Controlled Rectifier, Insulated Gate Bipolar Transistor.

**TOTAL: 45**

**TEXT BOOKS**

1. Ben. G. Streetman & Sanjan Banerjee, Solid State Electronic Devices, 5<sup>th</sup> Edition, PHI, 2003.

**REFERENCES**

1. Donald A. Neaman, Semiconductor Physics and Devices, 3<sup>rd</sup> Edition, TMH, 2002.
2. Yannis Tsividis, Operation & Mode line of MOS Transistor, 2<sup>nd</sup> Edition, Oxford University Press, 1999.
3. Nandita Das Gupta & aamitava Das Gupta, Semiconductor Devices Modeling Technology, PHI, 2004.
4. D.K. Bhattacharya & Rajinish Sharma, Solid State Electronic Devices, Oxford University Press, 2007.

**COMPUTER HARDWARE AND INTERFACING 3 0 0 3****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**

- To introduce issues related to CPU and memory.
- To understand the components on the motherboard
- To understand different storage media
- To introduce the features of different I/O peripheral devices and their interfaces.

**UNIT I CPU AND MEMORY 9**

CPU essentials – processor modes – modern CPU concepts – Architectural performance features – the Intel’s CPU – CPU over clocking – over clocking requirements – over clocking the system – over clocking the Intel processors – Essential memory concepts – memory organizations – memory packages – modules –memory.

**UNIT II MOTHERBOARDS 9**

Pentium4 mother board -form factor – upgrading a mother board – chipsets – north bridge – south bridge –motherboard BIOS – POST – BIOS features – BIOS and Boot sequences – BIOS shortcomings and compatibility issues – power supplies and power management – concepts of switching regulation – potential power problems – power management.

**UNIT III STORAGE DEVICES 9**

The floppy drive – magnetic storage – magnetic recording principles – data and disk organization – floppy drive – hard drive – data organization and hard drive – sector layout –CDROM electronics – DVD-ROM – DVD media – DVD drive and decoder.

**UNIT IV I/O PERIPHERALS 9**

Parallel port – signals and timing diagram – IEEE1284 modes – asynchronous communication - serial port signals – video adapters – graphic accelerators – 3D graphics accelerator issues

**UNIT V      BUS ARCHITECTURE****9**

Buses – Industry standard architecture (ISA), peripheral component Interconnect (PCI) – Accelerated Graphics port (AGP) – plug-and-play devices – SCSI concepts – USB architecture.

**TOTAL: 45****TEXT BOOK**

1. Stephen J. Bigelow, “Trouble Shooting, maintaining and Repairing PCs”, Tata McGraw-Hill, New Delhi, 2001.

**REFERENCES**

1. Craig Zacker & John Rourke, “The complete reference:PC hardware”, Tata McGraw-Hill, New Delhi, 2001.
2. Mike Meyers, “Introduction to PC Hardware and Trouble 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.



# **PRIST DEEMED TO BE UNIVERSITY**

**Vallam, Thanjavur**

**SCHOOL OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF  
ELECTRONICS & COMMUNICATION ENGINEERING**

## **PROGRAM HANDBOOK**

**M.TECH – COMMUNICATION SYSTEMS  
[FULL TIME]**

**[REGULATION 2019]**



**M.TECH. COMMUNICATION SYSTEMS - FULL TIME-R-2019**

**SEMESTER I – IV CURRICULUM**

**SEMESTER I**

S.N	SUB CODE	SUBJECT	L	T	P	C
<b>Theory</b>						
1	19248S11B	Applied Mathematics for Electronics Engineering	3	1	0	4
2	19271C12	Statistical Signal Processing	3	1	0	4
3	19271C13	Modern Digital Communication Systems	3	1	0	4
4	19271C14	Communication Protocol Engineering	4	0	0	4
5	19271C15	Advanced Radiation Systems	4	0	0	4
6	<b>19271E16_</b>	<b>Elective-I</b>	3	0	0	3
<b>Practical</b>						
7	19271L17	Communication Systems Lab - I	0	0	3	3
<b>Research Skill Development (RSD) Course</b>						
8	19271CRS	Research Led Seminar	1	0	0	1
<b>Total</b>			<b>21</b>	<b>3</b>	<b>3</b>	<b>27</b>

**SEMESTER II**

S.N	SUB CODE	SUBJECT	L	T	P	C
<b>Theory</b>						
1	19271C21	Mobile Communication Networks	4	0	0	4
2	19271C22	Advanced Microwave Systems	4	0	0	4
3	19271C23	Fiber Optic Networking	4	0	0	4
4	<b>19271E24_</b>	<b>Elective-II</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
5	<b>19271E25_</b>	<b>Elective-III</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Practical</b>						
6	19271L26	Communication Systems Lab - II	0	0	3	3
7	192TECWR	Technical Writing /Seminars	0	0	3	3
<b>Research Skill Development (RSD) Course</b>						
8	19271CRM	Research Methodology	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
9	19271CBR	Participation in Bounded Research	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
<b>Total</b>			<b>23</b>	<b>0</b>	<b>6</b>	<b>29</b>

**SEMESTER III**

S.N	SUB CODE	SUBJECT	L	T	P	C
<b>Theory</b>						
1	19271C31	Wireless Sensor Networks	4	0	0	4
2	<b>19271E32_</b>	<b>Elective – IV</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
3	<b>19271E33_</b>	<b>Elective – V</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
4	<b>19271E34_</b>	<b>Elective – VI</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

S.N	SUB CODE	SUBJECT	L	T	P	C
<b>Project</b>						
5	19271P35	Project Phase – I	0	0	10	10
<b>Research Skill Development (RSD) Course</b>						
6	19271CSR	Design / Socio - Technical Project	0	0	6	6
<b>Total</b>			13	0	16	29

#### SEMESTER IV

S.N	SUB CODE	SUBJECT	L	T	P	C
1	19271P41	Project Phase – II	0	0	15	15
<b>Total</b>			0	0	15	15
<b>TOTAL NO. OF CREDITS</b>						<b>100</b>

#### LIST OF ELECTIVES

##### Elective-I (SEMESTER – I)

S.N	SUB CODE	SUBJECT	L	T	P	C
1.	19271E16A	Internetworking and Multimedia	3	0	0	3
2.	19271E16B	Digital Image Processing	3	0	0	3
3.	19271E16C	LASER Communication	3	0	0	3

##### Elective-II (SEMESTER – II)

S.N	SUB CODE	SUBJECT	L	T	P	C
1.	19271E24A	High Speed Switching Architecture	3	0	0	3
2.	19271E24B	DSP Processor Architecture and Programming	3	0	0	3
3.	19271E24C	Digital Speech Processing	3	0	0	3

##### Elective-III (SEMESTER – II)

S.N	SUB CODE	SUBJECT	L	T	P	C
1.	19271E25A	Digital Communication Receivers	3	0	0	3
2.	19271E25B	Soft Computing	3	0	0	3
3.	19271E25C	Communication Network Security	3	0	0	3

##### Elective-IV (SEMESTER – III)

S.N	SUB CODE	SUBJECT	L	T	P	C
1.	19271E32A	Software Defined Radio	3	0	0	3
2.	19271E32B	Satellite Communication	3	0	0	3
3.	19271E32C	CDMA Systems	3	0	0	3

##### Elective-V (SEMESTER – III)

S.N	SUB CODE	SUBJECT	L	T	P	C
1.	19271E33A	Wavelets and Multi Resolution Processing	3	0	0	3
2.	19271E33B	High Performance Communication Networks	3	0	0	3

S.N	SUB CODE	SUBJECT	L	T	P	C
3.	19271E33C	Advanced Microprocessors and Microcontrollers	3	0	0	3

**Elective-VI (SEMESTER – III)**

S.N	SUB CODE	SUBJECT	L	T	P	C
1.	19271E34A	Simulation of Communication Networks	3	0	0	3
2.	19271E34B	Medical Imaging	3	0	0	3
3.	19271E34C	Mobile ADHOC Networks	3	0	0	3

**M.TECH. COMMUNICATION SYSTEMS - FULL TIME-R-2019**

**Course Structure and 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	01	10	01	06	03	09	-	-	29
IV	-	-	01	15	-	-	-	-	-	-	15
<b>Total Credits</b>											<b>100</b>

\*RSD-Research Skill Development

**HOD**

**DEAN**

**DEAN -  
ACADEMIC AFFAIRS**

**19248S11B APPLIED MATHEMATICS FOR ELECTRONICS ENGINEERING****L T P C****31 0 4****AIM:**

The primary aim of this course is to demonstrate various analytical skills in applied mathematics and extensive experience with the tactics of problem solving and logical thinking applicable in communication engineering.

**OBJECTIVES:**

The primary objective of this course will help the students to identify, formulate, abstract, and solve problems 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.

**UNIT I CALCULUS OF VARIATIONS****9**

Functional – Euler’s equation-Variational problems involving one unknown function-several unknown functions-functional dependent on higher order derivatives-several independent variables-isoperimetric problems.

**UNIT II INTEGRAL TRANSFORMS AND WAVE EQUATIONS****9**

Fourier transform pairs, 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.

**UNIT III LINEAR PROGRAMMING****9**

Simplex algorithm-two phase method-duality-transportation and assignment problems-inventory-scheduling.

**UNIT IV RANDOM PROCESS AND QUEUING THEORY****9**

Classification – auto correlation-cross correlation-ergodicity-power spectral density function-Poisson process.Single and multiple server Markovian queuing models- customer impatience-queuing applications.

**UNIT V TESTING OF HYPOTHESIS****9**

Sampling distributions-Testing of hypothesis of normal, t, chi square, F distributions for testing mean and variance- large sample test. Analysis of variance – one way classification.

**Tutorial :15****Total:60****OUTCOMES:**

**After completing this course, students should demonstrate competency in the following skills:**

- Concepts on vector spaces, linear transformation, inner product spaces, eigenvalues and generalized eigenvectors.

- Apply various methods in linear algebra to solve systems of linear equations.
- 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.
- Numerical solution of differential equations by single and multistep methods.
- Computation of probability, random variables and their associated distributions, correlations and regression.
- Conceptualize the principle of optimality and sub-optimization, formulation and computational procedure of dynamic programming.
- Exposing the basic characteristic features of a queuing system and acquiring skills in analyzing queuing models.
- Using discrete time Markov chains to model computer systems.

### **BOOKS FOR REFERENCES :**

1. Grewal.B.S. “Higher Engineering Mathematics”, Khanna Publications, 2005.
2. Kapoor.J.N. &Saxena.H.C., Mathematical Statistics, S.Chand& Co., New Delhi.
3. Taha.H.A. “Operation Research – An Introduction”, 6<sup>th</sup> Edition, PHI, 1997.
4. M.K. Venkataraman, “Higher Mathematics for Engineering & Science”, National Publishing Company, 2000.
5. Kandasamy, “Engineering Mathematics Volume II, S.Chand& Co.
6. P.K. Guptha, D.S. Hira, Operations Research, S.Chand& Co., 1999
7. T.Veerarajan, Probability, Statistics and Random Processes, TMH, 2002

**19271C12****STATISTICAL SIGNAL PROCESSING****L T P C****310 4****AIM:**

The student comprehends mathematical description and modelling of discrete time random signals.

**OBJECTIVES:**

- The student is conversant with important theorems and algorithms.
- The student learns relevant figures of merit such as power, energy, bias and consistency.
- The student is familiar with estimation, prediction and filtering concepts and techniques.

**UNIT I DISCRETE RANDOM SIGNAL PROCESSING****9**

Discrete Random Processes-, Autocorrelation and Autocovariance matrices. Parseval's Theorem, Wiener - Khintchine Relation- Power Spectral Density-Periodogram -, Parameter estimation: Bias and consistency.

**UNIT II SPECTRUM ESTIMATION****9**

Non-Parametric Methods-Correlation Method, Periodogram Estimator, Performance Analysis of Estimators –Unbiased Consistent Estimators-; Bartlett, Blackman –Tukey method. Parametric Methods - AR, MA, and ARMA model based spectral estimation.

**UNIT III SIGNAL MODELING AND OPTIMUM FILTERS****9**

Introduction- Least square method – Pade approximation – Prony's method – Levinson Recursion – Lattice filter - FIR Wiener filter – Filtering – Linear Prediction – Non Causal and Causal IIR Wiener Filter -- Mean square error – Discrete Kalman filter

**UNIT IV ADAPTIVE FILTERS****9**

FIR adaptive filters -adaptive filter based on steepest descent method-Widrow-Hoff LMS adaptive algorithm Adaptive recursive filters (IIR). RLS adaptive filters-Exponentially weighted RLS-sliding window RLS.

**UNIT V MULTIRATE DIGITAL SIGNAL PROCESSING****9**

Mathematical description of change of sampling rate - Interpolation and Decimation, Decimation by an integer factor - Interpolation by an integer factor, Filter implementation for sampling rate conversion- Application to sub band coding and Filter bank implementation of wavelet expansion of signals.

**Total:45 Periods****OUTCOMES:**

- Formulate time domain and frequency domain description of Wide Sense Stationary process in terms of matrix algebra and relate to linear algebra concepts.
- State Parseval's theorem, W-K theorem, principle of orthogonality, spectral factorization theorem, Widrow-Hoff LMS algorithm and Shannon's sampling theorem, and define linear 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 versus 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's theorem, W-K theorem and normal equations.
- Design AR, MA, ARMA models, Wiener filter, anti aliasing and anti imaging filters, and develop FIR adaptive filter and polyphase filter structures.
- Simulate spectral estimation algorithms and basic models on computing platforms.

#### **BOOKS FOR REFERENCES :**

1. Monson H.Hayes, Statistical Digital Signal Processing and Modeling, John Wiley and Sons, Inc., Singapore, 2002.
2. John G. Proakis, Dimitris G. Manolakis, Digital Signal Processing Pearson Education, 2002.
3. John G. Proakis et al., 'Algorithms for Statistical Signal Processing', Pearson Education, 2002.
4. Dimitris G. Manolakis et al., 'Statistical and adaptive signal Processing', McGraw Hill, New York, 2000.

**AIM:**

To understand the basics of signal-space analysis and digital transmission.

**OBJECTIVES:**

- To understand the coherent and noncoherent receivers and its impact on different channel characteristics.
- To understand the different Equalizers
- To understand the different block coded and convolutional coded digital communication systems.
- To understand the basics of Multicarrier and Multiuser Communications.

**UNIT I COHERENT AND NON-COHERENT COMMUNICATION: 9**

Coherent receivers – Optimum receivers in WGN – IQ modulation & demodulation – Non coherent receivers in random phase channels; M-FSK receivers – Rayleigh and Rician channels – Partially coherent receives – DPSK; M-PSK; M-DPSK, -BER Performance Analysis.

**UNIT II BANDLIMITED CHANNELS AND DIGITAL MODULATIONS: 9**

Eye pattern; demodulation in the presence of ISI and AWGN; Equalization techniques – IQ modulations; QPSK; QAM; QBOM; -BER Performance Analysis. – Continuous phase modulation; CPM; CPFSK; MSK, OFDM. OFDM signal processing; Peak Power Problem: PAP reduction schemes-Clipping, Filtering, Coding and Scrambling.

**UNIT III BLOCK CODED DIGITAL COMMUNICATION: 9**

Architecture and performance – Binary block codes; Orthogonal; Biorthogonal; Transorthogonal – Shannon's channel coding theorem; Channel capacity; Matched filter; Concepts of Spread spectrum communication – Coded BPSK and DPSK demodulators – Linear block codes; Hamming; Golay; Cyclic; BCH ; Reed – Solomon codes.

**UNIT IV CONVOLUTIONAL CODED DIGITAL COMMUNICATION: 9**

Representation of codes using Polynomial, State diagram, Tree diagram, and Trellis diagram – Decoding techniques using Maximum likelihood, Viterbi algorithm, Sequential and Threshold methods – Error probability performance for BPSK and Viterbi algorithm, Turbo Coding. Model of spread Spectrum Digital Communication System-Direct Sequence Spread Spectrum Signals, Error rate performance of the coder, Generation of PN Sequences- Frequency-Hopped Spread Spectrum Signals, Performance of FH Spread Spectrum Signals in an AWGN Channel- Synchronization of Spread Spectrum Systems.

**UNIT V MULTICARRIER AND MULTIUSER COMMUNICATIONS 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.



**OUTCOMES:**

**Upon Completion of the course, the students will be able to:**

- Develop the ability to understand the concepts of signal space analysis for coherent and non- coherent receivers.
- Conceptually appreciate different Equalization techniques
- Possess knowledge on different block codes and convolutional codes.
- Comprehend the generation of OFDM signals and the techniques of multiuser detection.

**BOOKS FOR REFERENCES :**

1. M.K.Simon, S.M.Hinedi and W.C.Lindsey, Digital communication techniques; Signalling and detection, Prentice HallIndia, New Delhi. 1995.
2. Simon Haykin, Digital communications, John Wiley and sons, 1998
3. Wayne Tomasi, Advanced electronic communication systems, 4th Edition Pearson Education Asia, 1998
4. B.P.Lathi Modern digital and analog communication systems, 3rd Edition, Oxford University press 1998.
5. John G. Proakis, Digital Communications, 4th Edition, McGraw-Hill, New york , 2001

**19271C14 COMMUNICATION PROTOCOL ENGINEERING  
4 0 04****L T P C****AIM:**

To expose the students to the layered architecture for communication networks and the specific functionality of the network layer.

**OBJECTIVES:**

- To enable the student to understand the basic principles of routing 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.

**UNIT I NETWORK INTRODUCTION****9**

Introduction: Communication model, Communication Software, Communication Subsystems, Communication Protocol Definition/Representation Formal and Informal Protocol Development Methods, Protocol Engineering Phases Error Control, Flow Control Type of Transmission Errors, Linear Block Code, Cyclic Redundancy Checks, Introduction to Flow Control, Window Protocols

**UNIT II NETWORK REFERENCE MODEL****9**

Sequence Numbers, Negative Acknowledgments, Congestion Avoidance Network Reference Model: Layered Architecture, Network Services and Interfaces, Protocol Functions Encapsulation, Segmentation, Reassembly, Multiplexing, Addressing, OSI Model Layer Functions, TCP/IP Protocol Suite, Application Protocols

**UNIT III PROTOCOL SPECIFICATIONS****9**

Components of protocol, Specifications of Communication service, Protocol entity, Interface, Interactions, Multimedia protocol, Internet protocol, SDL, SDL based protocol- other protocol specification languages

**UNIT IV PROTOCOL CONFORMANCE/PERFORMANCE TESTING****9**

Conformance testing methodology and framework, Conformance test architectures, Test sequence generation methods, Distributed architecture by local methods, Conformance testing with TTCN, systems with semi controllable interfaces - RIP, SDL based tools for conformance testing, SDL based conformance testing of MPLS Performance testing, SDL based performance testing of TCP and OSPF, Interoperability testing, SDL based interoperability testing of CSMA/CD and CSMA/CA protocol using Bridge, Scalability testing

**UNIT V PROTOCOL SYNTHESIS AND IMPLEMENTATION****9**

Protocol synthesis, Interactive synthesis algorithm, Automatic synthesis algorithm, Automatic synthesis of SDL from MSC, Protocol Re-synthesis; Requirements of protocol implementation, Object based approach to protocol implementation, Protocol compilers, Tool for protocol engineering

**COURSE OUTCOMES:**

- 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.

**BOOKS FOR REFERENCES :**

1. PallapaVenkataram and SunilkumarS.Manvi, “Communication protocol Engineering”, EasternEconomy edition, 2004
2. Richard Lai and Jirachiefpattana, “Communication Protocol Specification and Verification”, KluwerPublishers, Boston, 1998.
3. Tarnay, K., “Protocol Specification and Testing”, Plenum, New York, 1991.
4. Mohamed G. Gouda, “Elements of Network Protocol Design”, John Wiley & Sons, Inc. New York,USA, 1998
5. V.Ahuja, “Design and Analysis of Computer Communication networks”, McGraw-Hill, London,1982.
6. G.J.Holtzmann, “Design and validation of Computer protocols”, Prentice Hall, New York, 1991.

**AIM:**

To enhance the student's knowledge in the area of various antenna design.

**OBJECTIVES:**

- To understand antenna radiation and its parameters.
- To enhance the student's knowledge in the area of various antenna design.
- To design monopole, dipole and patch antenna and to impart the knowledge about modern antennas.

**UNIT I ANTENNA FUNDAMENTALS****9**

Antenna fundamental parameters, Radiation integrals ,Radiation from surface and line current distributions – dipole, monopole, loop antenna; Mobile phone antenna- base station, handset antenna; Image; Induction ,reciprocity theorem, Broadband antennas and matching techniques, Balance to unbalance transformer, Introduction to numerical techniques.

**UNIT II RADIATION FROM APERTURES****9**

Field equivalence principle, Radiation from Rectangular and Circular apertures, Uniform aperture distribution on an infinite ground plane; Slot antenna; Horn antenna; Reflector antenna, aperture blockage, and design consideration.

**UNIT III ANTENNA SYNTHESIS****9**

Synthesis problem-Line source based beam synthesis methods (Fourier transform and Woodward-Lawson sampling method – Linear array shaped beam synthesis method – Low side lobe, narrow main beam synthesis methods - discretization of continuous sources. Schelkunoff polynomial method

**UNIT IV APERTURE ANTENNAS****9**

Radiation from apertures - Huygens Principle. Rectangular apertures- techniques for evaluating gain, Circular apertures and their design considerations- Babinet's principle Fraunhofer and Fresnel diffraction.Complimentary screens and slot antennas. Slot and dipoles as dual antennas. Fourier transform of aperture antenna theory.

**UNIT V HORN, MICROSTRIP, REFLECTOR ANTENNAS.****9**

E and H plane sectoral Horns. Pyramidal horns. Conical and corrugated Horns. Multimode horns. Phasecenter.Microstrip antennas – feeding methods. Rectangular patch- Transmission line model – Circular patch Parabolic Reflector antennas – Prime focus and cassegrain reflectors. Equivalent focal length of Cassegrain antennas. Spillover and taper efficiencies. Optimum illumination.

**Total:45 Periods****OUTCOMES:**

- Ability to understand antenna concepts
- Ability to design antenna for various applications

- Knowledge of modern antenna design

**BOOKS FOR REFERENCES :**

1. Balanis, C.A., “Antenna Theory” Wiley,2003
2. Warren L. Stutzman and Gary A. Thiele,“ Antenna theory and design”John Wiley and sons 1998
3. Jordan, E.C., “ Electromagnetic waves and Radiating systems”. PHI 2003
4. Krauss, J.D., “ Radio Astronomy” McGraw-Hill 1966, for the last unit (reprints available)
5. Krauss, J.D.,Fleisch,D.A., “Electromagnetics” McGraw-Hill,1999

**OBJECTIVES:**

- To acquire knowledge on Transmission line and S- parameter estimation of microwave devices.
- To introduce the basics of Microstrip Patch Antenna and its analysis.
- To study & measure the performance of digital communication systems.
- To provide a comprehensive knowledge of Wireless Communication.
- To learn about the design of digital filters and its adaptive filtering algorithms.

**LIST OF EXPERIMENTS:**

1. Antenna Radiation Pattern measurement.
2. Simulation of Modulation and Coding in a AWGN Communication Channel using Simulation Packages.
3. Implementation of Adaptive Filters, period gram and multistage multirate system in DSP Processor
4. Performance evaluation of Digital Data Transmission through Fiber Optic Link.
5. Study of Spread Spectrum Techniques.
6. Simulation of QMF using Simulation Packages.
7. Implementation of Video Link using Optical Fiber.
8. Implementation of Linear and Cyclic Codes.

**TOTAL :45 PERIODS**

**OUTCOMES:**

**Upon the completion of course, students are able to**

- Measure and analyze various transmission line parameters.
- Design Microstrip patch antennas.
- Implement the adaptive filtering algorithms
- To generate and detect digital communication signals of various modulation techniques using MATLAB.



video across Internet, Multimedia transport across ATM networks and IP network, Multimedia across wireless networks.

**Total:45 Periods**

## **Outcomes**

Upon completion of the subject, students will be able to:

- Understand the state-of-art developments in Internet technologies and applications
- Understand the development of next generation Internet
- Appreciate the principles used in designing Internet protocols for multimedia applications, and so understand why standard protocols are designed the way that they are
- Be able to solve problems for the design of multimedia applications on Internet.

## **BOOKS FOR REFERENCES :**

1. Jon Crowcroft, Mark Handley, Ian Wakeman, Internetworking Multimedia, Harcourt Asia Pvt. Ltd.Singapore, 1998.
2. B.O. Szuprowicz, Multimedia Networking, McGraw Hill, Newyork. 1995.
3. Tay Vaughan, Multimedia - Making it to work, 4ed, Tata McGraw Hill ,NewDelhi, 2000.
4. K.R.Rao, Zoran S. Bojkovic and Dragorad A. Milovanovic, Multimedia Communication systems, PHI ,



**19271E16B**

**DIGITAL IMAGE PROCESSING**

**L T P C**  
**3 0 0 3**

**AIM:**

The aim of this course is to explain the fundamentals of digital image processing.

**OBJECTIVES:**

- To understand the image fundamentals.
- To understand the various image segmentation techniques.
- To extract features for image analysis.
- To introduce the concepts of image registration and image fusion.

**UNIT I DIGITAL IMAGE FUNDAMENTALS**

**9**

Elements of digital image processing systems - Elements of visual perception - Psycho visual model- Brightness - Contrast - Hue - Saturation - Mach band effect - Color image fundamentals – RGBHSI models - Image sampling - Quantization - Dither - Two-dimensional mathematical preliminaries.

**UNIT II IMAGE TRANSFORMS**

**9**

1D DFT - 2D transforms - DFT - DCT - Discrete Sine - Walsh - Hadamard - Slant - Haar - KLT SVD - Wavelet Transform.

**UNIT III ENHANCEMENT AND RESTORATION**

**9**

Histogram modification and specification techniques - Noise distributions - Spatial averaging - Directional Smoothing – Median - Geometric mean - Harmonic mean – Contra harmonic and Yp mean filters - Homomorphic filtering - Color image enhancement - Image Restoration – Degradation model - Unconstrained and Constrained restoration - Inverse filtering - Removal of blur caused by uniform linear motion - Wiener filtering - Geometric transformations - Spatial transformations -Gray Level interpolation.

**UNIT IV IMAGE SEGMENTATION AND RECOGNITION**

**9**

Edge detection - Image segmentation by region growing - Region splitting and merging – Edge linking - Image Recognition - Patterns and pattern classes - Matching by minimum distance classifier - Matching by correlation - Back Propagation Neural Network - Neural Network applications in Image Processing.

**UNIT V IMAGE COMPRESSION**

**9**

Need for data compression - Huffman - Run Length Encoding - Shift codes - Arithmetic coding - Vector Quantization - Block Truncation Coding - Transform Coding - DCT and Wavelet - JPEG -MPEG – Standards - Concepts of Context based Compression.

**Total:45 Periods**

**OUTCOMES:**

**Upon Completion of the course, the students will be able to**

- Explain the fundamentals of digital image processing.

- Describe image various segmentation and feature extraction techniques for image analysis.
- Discuss the concepts of image registration and fusion.

### **BOOKS FOR REFERENCES :**

1. Rafael C. Gonzalez, Richard E. Woods, 'Digital Image Processing', Second Edition, Pearson Education Inc., 2004.
2. Anil K. Jain, 'Fundamentals of Digital Image Processing', Prentice Hall of India, 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. William K. Pratt, "Digital Image Processing", John Wiley, New York, 2002.
6. MilmanSonka, Vaclav Hlavac, Roger Boyle, "Image Processing Analysis and Machine Vision", 2nd edition, Brooks/Cole, Vikas Publishing House, 1999.

**19271E16C**

**LASER COMMUNICATION**  
**3 0 0 3**

**L T P C**

**AIM:**

The aim of this course is to gain knowledge about light and its propagation

**OBJECTIVES:**

- To study the nonlinear optic devices.
- To learn about holography.
- To study the different types of laser and its effects.

**UNIT I LASER COMMUNICATIONS 9**

Atmospheric low loss windows, optical sources and detectors for these windows, Characteristics of source and detectors. Optical transmitting and receiving antennas.

**UNIT II SYSTEM DESIGN 9**

Link equation, Transmitter terminal, Antenna design, Antenna gain, Beam width, C/N, Optical detectors, Optical modulation formats, Deriving error statistics, Signal requirements for acquisition and tracking, Fundamentals of system design.

**UNIT III SEMICONDUCTOR AND METAL LASER SOURCES FOR SATELLITE COMMUNICATIONS 9**

Performance and Geometries, output wavelength control, Semiconductor laser lifetime, Direct and indirect modulation techniques and radiation effects.

**UNIT IV OPTICAL RECEIVERS AND SYSTEM DESIGN 9**

Direct detection, coherent detection and demodulation. Gimbals in transceiver design, Receiver options and optics; Lasers; antennas / Telescope, Internal optical systems, Transmitter analysis.

**UNIT V LASER BEAM POINTING CONTROL 9**

Acquisition and Tracking systems, System description, Acquisition methodology, racking and pointing control system, RF cross link system design, link equation.

**Total:45 Periods**

**Outcomes:**

Students are able to

- Recognize and classify the structures of Optical fiber and types.
- Discuss the channel impairments like losses and dispersion.
- Analyze various coupling losses.
- Classify the Optical sources and detectors and to discuss their principle.
- Familiar with Design considerations of fiber optic systems.
- To perform characteristics of optical fiber, sources and detectors, design as well as conduct experiments in software and hardware, analyze the results to provide valid conclusions.

**BOOKS FOR REFERENCES :**

1. Morris Katzman, "Laser Satellite Communications", Prentice Hall Inc, New York, 1991.
2. J. Franz and V.K.Jain, "Optical Communication Systems", Narosa Publication, New Delhi, 1994.

**19271C21****MOBILE COMMUNICATION NETWORKS  
4 0 0 4****L T P C****AIM:**

The aim of this course is to provide the basic cellular system concepts.

**OBJECTIVES:**

- To understand the basic cellular system concepts.
- To have an insight into the various propagation models and the speech coders used in mobile communication.
- To understand the multiple access techniques and interference reduction techniques in mobile communication

**UNIT I WIRELESS CHANNEL PROPAGATION AND MODEL****9**

Propagation of EM signals in wireless channel—Reflection, diffraction and Scattering—Small scale fading—channel classification—channel models—COST-231 Hata model, Longley-Rice Model, NLOS Multipath Fading Models: Rayleigh, Rician, Nakagami, Composite Fading—shadowing Distributions, Link power budget Analysis

**UNIT II OPERATION AND PROPAGATION MODELS AND AIR PROTOCOLS****9**

Operation of first, second, and third generation wireless networks: cellular systems, medium access techniques, Mobile networks Elementary Principles of cellular Telephony Channel Division Techniques (TDMA, FDMA, CDMA) Cellular Coverage Methods Network Planning and Resource Allocation, Network Dimensioning, Mobility Management Procedures

**UNIT III MOBILE NETWORK ARCHITECTURE****9**

General Architecture definition, Mobile Terminals (MT, SIM)  
Radio Section (BTS, BSC) Core Network (MSC, G-MSC, VLR, HLR, AuC)  
User and Control Plane Protocol Stack, MAP & SS#7, The Key Role of Signaling Interfaces and Network Entities Relation The Physical Channel, The Logical Channels Terminal, Call and Network Management Procedures, Network Planning.

**UNIT IV WIRELESS LOCAL AREA NETWORKS****9**

Wireless Local Area Networks, General Characteristics of the Hiperlan System, 802.11 Standard, Basic DCF access scheme DCF Access Scheme with Handshaking, PCF Access Scheme, The 802.11a Standard, Mobile Ad Hoc Networks, Wireless Sensor Networks, Routing Energy Efficiency, Localization, Clustering.

**UNIT V SECURITY ISSUES IN WIRELESS NETWORKS****9**

Security in Wireless Networks, Secure routing, Key Pre-distribution and Management, Encryption and Authentication, Security in Group Communication, Trust Establishment and Management, Denial of Service Attacks, Energy-aware security mechanisms, Location verification, Security on Data fusion.

**Total:45 Periods**

**Outcomes :**

- Discuss cellular radio concepts.
- Identify various propagation effects.
- To have knowledge of the mobile system specifications.
- Classify multiple access techniques in mobile communication.
- Outline cellular mobile communication standards.
- Analyze various methodologies to improve the cellular capacity

**BOOKS FOR REFERENCES :**

1. W. Stallings, "Wireless Communications and Networks", Second Edition Prentice Hall, 2007.
2. V.K. Garg, "IS-95 CDMA and CDMA 2000", Prentice Hall PTR, 2000.
3. T.S. Rappaport, "Wireless Communications: Principles & Practice", Second Edition, Prentice Hall, 2002.
4. Leon-Garcia and I. Widjaja, "Communication Networks, Fundamental Concepts and Key Architectures", McGraw-Hill, 2000.
5. J. Schiller, "Mobile Communications", Addison Wesley, 2000.
6. Fred Halsall, "Multimedia Communications, Applications, Networks, Protocols and Standards", Addison Wesley, 2001.
7. Uyles Black, "Mobile and Wireless Networks", Prentice Hall PTR, 1996.

**19271C22****ADVANCED MICROWAVE SYSTEMS****L T PC  
4 00 4****AIM:**

The aim of this course is to explain fundamentals of microwave integrated circuits.

**OBJECTIVES:**

- To understand the fundamentals of Microwave integrated circuits.
- To understand the various components for Wireless Communications.
- To know the basic techniques needed for analysis of Microwave systems.

**UNIT I INTRODUCTION TO MONOLITHIC MICROWAVE INTEGRATED CIRCUITS 9**

Introduction to Monolithic Microwave Integrated Circuits (MMICs), their advantages over discrete circuits, materials, MMIC fabrication techniques, MOSFET fabrication. Thin film formation.

**UNIT II MICROSTRIP ANALYSIS 9**

Planar transmission lines for MICs. Method of conformal transformation for microstrip analysis, concept of effective dielectric constant, Effective dielectric constant for microstrip, Losses in Microstrip

**UNIT III SLOT LINE ANALYSIS 9**

Slot Line Approximate analysis and field distribution, Transverse resonance method and evaluation of slot line impedance, comparison with micro strip line.

**UNIT IV LUMPED ELEMENTS FOR MICS 9**

Lumped Elements for MICs: Use of Lumped Elements, Capacitive elements, Inductive elements and Resistive elements.

**UNIT V MICROWAVE SEMICONDUCTOR DEVICES & MICROWAVE PASSIVE COMPONENTS 9**

Microwave semiconductor Devices & Microwave passive components Parametric amplifiers, tunnel diode, varactor diode, PIN diode, Gunn diode, their principle of operation, performance characteristics & applications, scattering parameter calculations of E plane-Tee, Magic Tee, Directional Coupler.

**Total:45 Periods****OUTCOMES:**

- Capability to design Microwave circuits.
- To be able to analyze microwave integrated circuits.

**REFERENCES:**

1. Gupta,K.C, and Amarjitsingh “Microwave Integrated Circuits” John Wiley and sons – Wiley EasternReprint, 1978.
2. Hoffmann, R.K “Handbook of Microwave Integrated Circuits” Artech House, 1987.

**AIM:**

The aim of the course is to design and analyze network components.

**OBJECTIVES:****The students should be made to understand:**

- Optical system components like optical amplifiers, wavelength converters.
- Up-to-date survey of development in Optical Network Architectures.
- Packet switching.
- Network design perspectives.
- Different Optical Network management techniques and functions.

**UNIT I OPTICAL FIBER COMMUNICATION AND TRANSMISSION CHARACTERISTICS 9**

Introduction, Historical development, general system, advantages, disadvantages, and applications of optical fiber communication, optical fiber waveguides, Ray theory, cylindrical fiber single 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 modal dispersion, Inter modal dispersion.

**UNIT II OPTICAL SOURCES AND DETECTORS, OPTICAL AMPLIFIERS AND 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.

**UNIT III FIBER COUPLERS AND CONNECTORS AND ANALOG AND DIGITAL LINKS 9**

Introduction, fiber alignment and joint loss, single mode fiber joints, fiber splices, fiber connectors and fiber couplers.

Analog links – Introduction, overview of analog links, CNR, multichannel transmission techniques, 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, Power penalties, nodal noise and chirping.

**UNIT IV OPTICAL RECEIVER 9**

Introduction, Optical Receiver Operation, receiver sensitivity, quantum limit, eye diagrams, coherent detection, burst mode receiver operation, Analog receivers.

## **UNIT V WDM CONCEPTS AND COMPONENTS**

**9**

WDM concepts, overview of WDM operation principles, WDM standards, Mach-Zehnder interferometer, multiplexer, Isolators and circulators, direct thin film filters, active optical components, MEMS technology, variable optical attenuators, tunable optical fibers, dynamic gain equalizers, optical drop multiplexers, polarization controllers, chromatic dispersion compensators, tunable light sources.

**Total:45 Periods**

### **OUTCOMES:**

**At the end of the course, the student should be able to:**

- Design and Analyze Network Components
- Assess and Evaluate optical networks

### **BOOKS FOR REFERENCES :**

1. Rajiv Ramaswami and Kumar Sivarajan, Optical Networks: A practical perspective, MorganKaufmann, 2nd edition, 2001.
2. VivekAlwayn, Optical Network Design and Implementation, Pearson Education, 2004.
3. Hussein T.Mouftab and Pin-Han Ho, Optical Networks: Architecture and Survivability, Kluwer Academic Publishers, 2002.
4. Biswanath Mukherjee, Optical Communication Networks, McGraw Hill, 1997



# LIST OF ELECTIVES

## ELECTIVE – II (SEMESTER II)

### *ELECTIVE -II* **SEMESTER II**

**19271E24A HIGH SPEED SWITCHING ARCHITECTURE**  
**300 3**

**L T P C**

#### **AIM:**

To expose the student to the advances in packet switching architectures and IP addressing and switching solutions and approaches to exploit and integrate the best features of different architectures for high speed switching.

#### **OBJECTIVES:**

- To enable the student to understand the basics of switching technologies and their 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.

#### **UNIT I HIGH SPEED NETWORK**

**9**

LAN and WAN network evolution through ISDN to BISDN - Transfer mode and control of BISDN -SDH multiplexing structure - ATM standard; ATM adaptation layers.

#### **UNIT II LAN SWITCHING TECHNOLOGY**

**9**

Switching concepts; Switch forwarding techniques; switch path control - LAN switching; cut through forwarding; store and forward - virtual LANs.

#### **UNIT III ATM SWITCHING ARCHITECTURE**

**9**

Switch models - Blocking networks – basic and enhanced banyan networks - sorting networks – merge sorting – rearrangeable networks - full and partial connection networks – non-blocking networks –recursive network – construction and comparison of non-blocking network - switches with deflection routing – shuffle switch - tandem banyan.

#### **UNIT IV MULTIMEDIA COMMUNICATION STANDARDS**

**9**

Objective of MPEG- 7 standard, Functionalities and systems of MPEG-7, MPEG-21 Multimedia Framework Architecture, - Content representation, Content Management and usage, Intellectual property management, Audio visual system- H322: Guaranteed QOS LAN systems; MPEG\_4 video Transport across internet.

#### **UNIT V IP SWITCHING**

**9**

Addressing mode - IP switching types-flow driven and topology driven solutions - IP Over ATM address and next hop resolution – multicasting - IPv6 over ATM.

**Total:45 Periods**

#### **OUTCOMES:**

- The student would be able to identify suitable switch architectures for a specified networking scenario and demonstrate its blocking performance.

- 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

### **BOOKS FOR REFERENCES :**

1. Achille Patavina, Switching Theory: Architectures and performance in Broadband ATM Networks. John Wiley & Sons Ltd., New York. 1998.
2. Christopher Y Metz, Switching protocols & Architectures. McGraw Hill, New York. 1998.
3. Ranier Handel, Manfred N Huber, Stefan Schroder. ATM Networks-concepts, protocols, applications, 3rd Edition, Addison Wesley, New York, 1999.
4. John A. Chiong: Internetworking ATM for the internet and enterprise networks. McGraw Hill, New York, 1998.

**19271E24B**

**DSP PROCESSOR ARCHITECTURE AND PROGRAMMING**

**L T P C**

**3 0 0 3**

**AIM:**

The aim of this course is to provide in-depth knowledge on digital signal processor basics.

**OBJECTIVES:**

The objective of this course is to provide in-depth knowledge on

- Digital Signal Processor basics
- Third generation DSP Architecture and programming skills
- Advanced DSP architectures and some applications.

**UNIT I FUNDAMENTALS OF PROGRAMMABLE DSPs 9**

Multiplier and Multiplier accumulator (MAC) – Modified Bus Structures and Memory access in Programmable DSPs – Multiple access memory – Multi-port memory – VLIW architecture- Pipelining –Special Addressing modes in P-DSPs – On chip Peripherals.

**UNIT II TMS320C3X PROCESSOR 9**

Architecture – Data formats - Addressing modes – Groups of addressing modes- Instruction sets -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

**UNIT III ADSP PROCESSORS I 9**

Architecture of ADSP-21XX and ADSP-210XX series of DSP processors- Addressing modes and assembly language instructions – Application programs –Filter design, FFT calculation.

**UNIT IV ADVANCED PROCESSORS 9**

Architecture of TMS320C54X: Pipeline operation, Addressing modes and assembly language instructions Introduction to Code Composer studio

**UNIT V ADVANCED PROCESSORS II 9**

Architecture of TMS320C6X - Architecture of Motorola DSP563XX – Comparison of the features of DSP family processors.

**Total:45Periods**

**OUTCOMES:**

**Students should be able to:**

- Become Digital Signal Processor specialized engineer
- DSP based System Developer

**BOOKS FOR REFERENCES :**

1. B.Venkataramani and M.Bhaskar, “Digital Signal Processors – Architecture, Programming and Applications” – Tata McGraw – Hill Publishing Company Limited. New Delhi, 2003.

2. User guides Texas Instrumentation, Analog Devices, Motorola.

**19271E24C**

**DIGITAL SPEECH PROCESSING**

**L T P C**  
**3 0 0 3**

**AIM:**

To illustrate the concepts of speech signal representations and coding.

**OBJECTIVES:**

- To introduce speech production and related parameters of speech.
- To understand different speech modeling procedures such as Markov and their implementation issues.
- To gain knowledge about text analysis and speech synthesis.

**UNIT I MECHANICS OF SPEECH**

**9**

Speech production mechanism – Nature of Speech signal – Discrete time modelling of Speech production – 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 perception of sound – Peripheral auditory system – Psycho acoustics

**UNIT II TIME DOMAIN METHODS FOR SPEECH PROCESSING**

**9**

Time domain parameters of Speech signal – Methods for extracting the parameters Energy, Average Magnitude – Zero crossing Rate – Silence Discrimination using ZCR and energy – Short Time Auto Correlation Function – Pitch period estimation using Auto Correlation Function

**UNIT III FREQUENCY DOMAIN METHOD FOR SPEECH PROCESSING**

**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 –

**UNIT IV LINEAR PREDICTIVE ANALYSIS OF SPEECH**

**9**

Formulation of Linear Prediction problem in Time Domain – Basic Principle – Auto correlation method– Solution of LPC equations — Durbin’s Recursive algorithm – lattice formation and solutions – Comparison of different methods — Formant analysis – VELP – CELP.

**UNIT V APPLICATION OF SPEECH & AUDIO SIGNAL PROCESSING**

**9**

Algorithms: Spectral Estimation, dynamic time warping, hidden Markov model – Music analysis – Pitch Detection – Feature analysis for recognition – Music synthesis – Automatic Speech Recognition – Feature Extraction for ASR — ASR systems– Voice response system – Speech Synthesis: Text to speech, voice over IP.

**Total:45 Periods**

**OUTCOMES:**

**Students will be able to:**

- Model speech production system and describe the fundamentals of speech.
- Extract and compare different speech parameters.

- Choose an appropriate statistical speech model for a given application.
- Design a speech recognition system.
- Use different text analysis and speech synthesis techniques.

**BOOKS FOR REFERENCES :**

1. Ben Gold and Nelson Morgan, Speech and Audio Signal Processing, John Wiley and Sons Inc. , Singapore, 2004
2. L.R.Rabiner and R.W.Schaffer – Digital Processing of Speech signals – Prentice Hall - 1978
3. Quatieri – Discrete-time Speech Signal Processing – Prentice Hall – 2001.
4. J.L.Flanagan – Speech analysis: Synthesis and Perception – 2<sup>nd</sup> edition – Berlin – 1972
5. I.H.Witten – Principles of Computer Speech – Academic Press – 1982



- Design adaptive equalization algorithms to satisfy the evolving demands in digital communication.

#### **BOOKS FOR REFERENCES :**

1. Heinrich Meyer, Mare Moeneclacy and Stefan.A. Fechtel, “Digital Communication Receivers”, Voll&II, John Wiley, New York, 1997
2. John. G. Proakis, “Digital Communication”, 4th ed., McGraw Hill, New York, 2001
3. E.A. Lee and D.G. Messerschmitt, “Digital Communication”, 2nd edition, Allied Publishers, NewDelhi, 1994
4. Simon Marvin, “Digital Communication Over Fading channel; An unified approach to performanceAnalysis”, John Wiley, New York, 2000
5. Bernard Sklar, “Digital Communication Fundamentals and Applications, Prentice Hall, 1998



**19271E25B**

**SOFT COMPUTING**

**L T P C  
3 0 0 3**

**AIM:**

The aim of this course is to know the basics of artificial neural networks.

**OBJECTIVES:**

- To provide adequate knowledge about feed forward /feedback neural networks
- To apply the concept of fuzzy logic in various systems.
- To have the idea about genetic algorithms.
- To provide adequate knowledge about the applications of Soft Computing.

**UNIT I ARTIFICIAL NEURAL NETWORKS**

**9**

Basic concepts-single layer perceptron-Multi layer perceptron-Adaline-Madaline-Learning rules-Supervised learning-Back propagation networks-Training algorithm, Practical difficulties, Advanced Algorithms-Adaptive network- Radial basis network-modular network-Applications

**UNIT II UNSUPERVISED NETWORKS**

**9**

Introduction- unsupervised learning -Competitive learning networks-Kohonen self organising networks-Learning vector quantisation - Hebbian learning - Hopfield network-Content addressable nature, Binary Hopfield network, Continuous Hopfield network Traveling Salesperson problem - Adaptive resonance theory –Bidirectional Associative Memory-Principle component Analysis

**UNIT III FUZZY SYSTEMS**

**9**

Fuzzy sets-Fuzzy rules: Extension principle, Fuzzy relation- fuzzy reasoning – fuzzy inference systems:Mamdani model, Sugeno model. Tsukamoto model -Fuzzy decision making- Multi objective Decision Making,-Fuzzy classification-Fuzzy control methods -Application

**UNIT IV NEURO-FUZZY MODELLING**

**9**

Adaptive Neuro Fuzzy based inference systems – classification and regression trees: decision tress, Cart algorithm – Data clustering algorithms: K means clustering, Fuzzy C means clustering, Mountain clustering, Subtractive clustering – rule base structure identification – Neuro fuzzy control: Feedback Control Systems, Expert Control, Inverse Learning, Specialized Learning, Back propagation through Real –Time Recurrent Learning.

**UNIT V GENETIC ALGORITHM**

**9**

Fundamentals of genetic algorithm-Mathematical foundations-Genetic modeling-Survival of the fittest 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:45 Periods**



## **OUTCOMES:**

- Knowledge on concepts of soft computational techniques.
- Able to apply soft computational techniques to solve various problems.
- Motivate to solve research oriented problems.

## **BOOKS FOR REFERENCES :**

1. Jang J.S.R.,Sun C.T and Mizutani E – “Neuro Fuzzy and Soft computing”, Pearson education(Singapore) 2004
2. David E.Goldberg : “Genetic Algorithms in Search, Optimization, and Machine Learning”, PearsonEducation, Asia,1996
3. LaureneFauseett:”Fundamentals of Neural Networks”, Prentice Hall India, New Delhi,1994.
4. Timothy J.Ross:”Fuzzy Logic Engineering Applications”, McGrawHill, ewYork,1997.
5. S.Rajasekaran and G.A.VijayalakshmiPai “Neural networks,Fuzzylogics,and Genetic algorithms”,Prentice Hall of India,2003
6. George J.Klir and Bo Yuan,”Fuzzy Sets and Fuzzy Logic”,Prentice Hall Inc., New Jersey,1995.

**19271E25C**

**COMMUNICATION NETWORK SECURITY  
300 3**

**L T P C**

**AIM:**

The aim of this course is to understand the need and concept of security.

**OBJECTIVES :**

**The students should be made to:**

- Understand the need and concept of security
- Learn cryptosystems

**UNIT I SYMMETRIC CIPHERS**

**9**

Introduction – Services, Mechanisms and Attacks, OSI security Architecture, Model for network Security; Classical Encryption Techniques- Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Product ciphers , Data Encryption Standard- Block Cipher Principles, Strength of DES, Differential and Linear CryptAnalysis, Block Cipher Design Principles, Block Cipher Modes of operation, Steganography.

**UNIT II ADVANCED ENCRYPTION STANDARD AND STREAM CIPHERS**

**9**

Evaluation Criteria for AES, AES Cipher; Contemporary Symmetric Ciphers- Triple DES, Blowfish, RC5-Characteristics of Advanced Symmetric Block Ciphers, Stream ciphers based on LFSRs, RC4 Stream Cipher; Random Number Generation. Traffic Confidentiality, Key Distribution.

**UNIT III PUBLIC-KEY ENCRYPTION AND HASH FUNCTIONS**

**9**

Public Key Cryptography and Key Management- RSA Algorithm and other public key cryptosystems-, Diffie-Hellman Key Exchange, Elliptic Curve arithmetic, Elliptic Curve Cryptography; Message Authentication and Hash Functions- Authentication Requirements, - MD5 Message Digest Algorithm; Secure Hash Algorithm, RIPEMD 160, HMAC; Digital Signatures and Authentication Protocols- Digital Signature Standards.

**UNIT IV NETWORK SECURITY PRACTICE**

**9**

Authentication Applications- Kerberos, X.509 Authentication Service; Electronic Mail Security- Pretty Good Privacy, S/MIME; IP Security- overview and Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations; Web Security- Web Security Considerations, Secure Sockets Layer and Transport Layer Security, Secure Electronic Transaction.

**UNIT V SYSTEM SECURITY**

**9**

Intruders- Intruder Detection, Password Management; Malicious Software- Virus and Related Threats, Virus Countermeasures; Firewalls- Firewall Design Principles, Trusted Systems.

**Total:45 Periods**

**OUTCOMES:**

**At the end of this course, the students should be able to:**

- Explain digital signature standards
- Discuss authentication
- Explain security at different layers

**BOOKS FOR REFERENCES:**

1. William Stallings, “Cryptography and Network Security”, 3rd Edition. Prentice Hall of India, New Delhi,2004
2. William Stallings, “Network Security Essentials”, 2nd Edition. Prentice Hall of India, New Delhi, 2004
3. Charlie Kaufman , “Network Security: Private Communication in Public World”, 2nd Edition. PrenticeHall of India, New Delhi ,2004

**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.
- To design and develop RF components using microstrip technology

**LIST OF EXPERIMENTS:**

1. Simulation of Audio and speech compression algorithms
2. Simulation of EZW / SPIHT Image coding algorithm.
3. Simulation of Microstrip Antennas
4. S-parameter estimation of Microwave devices.
5. Study of Global Positioning System.
6. Performance evaluation of simulated CDMA System.
7. Design and testing of a Microstrip coupler.
8. Characteristics of  $\lambda/4$  and  $\lambda/2$  transmission lines.

**TOTAL: 45 PERIODS****OUTCOMES:****Upon Completion of the course, the students will be able to:**

- Apply knowledge to identify a suitable architecture and systematically design an RF system.
- Comprehensively record and report the measured data, and would be capable of analyzing, interpreting the experimentally measured data and producing meaningful conclusions.
- Design and develop microstrip filters.

**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, ScienceDirect 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

#### **OUTCOMES:**

**Upon Completion of the course, the students will be able to:**

- Understand the approaches towards and constraints in good research.
- Identify various statistical tools used in research methodology
- Train in basic computational and excel- skills for research in engineering.

#### **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.



**19271C31****WIRELESS SENSOR NETWORKS****L T P C****4 0 0 4****AIM:**

The aim of this course is to study about wireless IP architecture, Packet Data Protocol and LTE network architecture.

**OBJECTIVES:**

- To study about advanced wireless networks, LTE, 4G and Evolutions from LTE to LTE.
- To study about adaptive link layer, hybrid ARQ and graph routing protocol.
- To study about mobility management, cellular network, and micro cellular networks

**UNIT I OVERVIEW OF WIRELESS SENSOR NETWORKS 8**

Challenges for Wireless Sensor Networks, Enabling Technologies For Wireless Sensor Networks.

**UNIT II ARCHITECTURES 9**

Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes , Operating Systems and Execution Environments, Network Architecture -Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

**UNIT III NETWORKING SENSORS 10**

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wake Up Concepts - S-MAC , The Mediation Device Protocol, Wake Up Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing.

**UNIT IV INFRASTRUCTURE ESTABLISHMENT 9**

Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

**UNIT V SENSOR NETWORK ARCHITECTURE AND MAC PROTOCOLS 9**

Single node architecture – Hardware components, energy consumption of sensor nodes, Network architecture – Sensor network scenarios, types of sources and sinks, single hop versus multi-hop networks, multiple sinks and sources, design principles, Development of wireless sensor networks. , 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-adaptive medium access protocol (TRAMA), Link Layer protocols – fundamentals task and requirements, error control, framing, link management.

**TOTAL- 45 PERIODS**

## **OUTCOMES:**

- Familiar with the latest 4G networks and LTE
- Understand about the wireless IP architecture and LTE network architecture.
- Familiar with the adaptive link layer and network layer graphs and protocol.
- Understand about the mobility management and cellular network.
- Understand about the wireless sensor network architecture and its concept.

## **BOOKS FOR REFERENCES:**

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. KazemSohraby, Daniel Minoli, &TaiebZnati, "Wireless Sensor Networks- Technology, Protocols, And Applications", John Wiley, 2007.
4. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.

# LIST OF ELECTIVES

## ELECTIVE – IV (SEMESTER III)

### *ELECTIVE -IV* **SEMESTER III**

**19271E32A SOFTWARE DEFINED RADIO**

**L T P C**  
**3 0 0 3**

#### **AIM:**

The aim of this course is to understand the concepts of software defined radio.

#### **OBJECTIVES:**

**The students should be made to be**

- Understand the concepts of software defined radio
- Learn spectrum sensing and dynamic spectrum access

#### **UNIT I: Introduction to SDR**

**9**

The Need for Software Radios-Characteristics and Benefits of a Software Radio. Design Principles of a Software Radio.Radio frequency implementation issues-The Purpose of the RF Front-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 the Components -Transmitter Architectures and their Issues. Noise and Distortion in the RF Chain. ADC and DAC Distortion.

#### **UNIT II :Direct Digital Synthesis**

**9**

Introduction. Comparison of Direct Digital Synthesis with Analog Signal Synthesis. Approaches to Direct Digital Synthesis. Analysis of Spurious Signals. Spurious Components due to Periodic Jitter. Band pass Signal Generation. Performance of Direct Digital Synthesis Systems. Hybrid DDS-PLL Systems. Applications of direct Digital Synthesis. Generation of Random Sequences. ROM Compression Techniques.

#### **UNIT III Signal Processor and Multi Rate Processing Techniques**

**9**

Introduction. Sample Rate Conversion Principles. Polyphase Filters. Digital Filter Banks. Timing Recovery in Digital Receivers Using Multirate Digital Filters. DSP Processors; Field Programmable Gate Arrays; Trade-Offs in Using DSPs, FPGAs, and ASICs; Power Management Issues; Using a Combination of DSPs, FPGAs, and ASICs.

#### **UNIT IV: 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; Algorithms for Transmit STAP; Hardware Implementation of Smart Antennas; Array Calibration.

#### **UNIT V: Applications –Wireless Aspects of Tele-Health Care**

**9**

The application of advanced telecommunication , the special requirements especially related to reliability, privacy and trust, Regulatory and safety aspects of tele-health care, Cognitive radio and flexible spectrum usage for tele-healthcare, Cooperative Communications for Tele-health. Case studies: JTRS radio system ,Software defined base stations.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**At the end of this course, the student should be able to**

- Compare MAC and network layer design for software defined radio
- Discuss cognitive radio for Internet of Things and M2M technologies

**BOOKS FOR REFERENCES:**

1. Jeffrey H. Reed -Software Radio: A Modern Approach to Radio Engineering Publisher: Prentice Hall PTR; May 2002 ISBN: 0170811580.
2. Wireless Communications: Principles and Practice, 2nd ed, by Rappaport, Prentice-Hall 2002. ISBN 0-17-042232-0.
3. Wireless Application Development, by Skelton, Thomson, 2003, ISBN 0-619-15931-6

**19271E32B**

**SATELLITE COMMUNICATION**

**L T P C**

**30 0 3**

**AIM:**

To understand the basics of satellite orbits. To understand the satellite segment and earth segment.

**OBJECTIVES:**

**The students should be made to be**

- Learn M2M developments and satellite applications
- Understand Satellite Communication In Ipv6 Environment

**UNIT I ORBITAL MECHANICS**

**9**

Kepler's laws of motion, Orbits, Orbit Equations, Orbit Description, Locating the Satellite in the Orbit and with Respect to Earth, Orbital Elements-Look Angle Determination and Visibility - Orbital Perturbations, Orbit Determination, Launch Vehicles, Orbital Effects in Communication System - Performance Attitude control; Satellite launch vehicles. spectrum allocations for satellite systems.

**UNIT II SPACECRAFT SUBSYSTEMS AND EARTH STATION**

**9**

Spacecraft Subsystems, Altitude and Orbit Control, Telemetry and Tracking, Power Systems, Communication Subsystems, Transponders, Antennas, Equipment Reliability, Earth Stations, Example of payloads of operating and planned systems.

**UNIT III SPACE LINKS**

**9**

The Space Link, Satellite Link Design - Satellite uplink -down link power Budget, Basic Transmission Theory, System Noise Temp, G/T Ratio, Noise Figure, Downlink Design, Design of Satellite Links for Specified C/N - Microwave Propagation on Satellite-Earth Paths. Interference between satellite circuits, Energy Dispersion, propagation characteristics of fixed and mobile satellite links.

**UNIT IV MULTIPLE ACCESS TECHNIQUES AND NETWORK ASPECTS**

**9**

Single access vs. multiple access (MA). Classical MA techniques: FDMA, TDMA. Single channel per carrier (SCPC) access - Code division multiple access (CDMA). Demand assignment techniques. Examples of MA techniques for existing and planned systems (e.g. the satellite component of UMTS). Mobile satellite network design, ATM via satellite. TCP/IP via satellite - Call control, handover and call set up procedures.  
Hybrid satellite-terrestrial networks

**UNIT V SERVICES AND APPLICATIONS**

**9**

Fixed and mobile services - Multimedia satellite services - Advanced applications based on satellite platforms - INTELSAT series - INSAT, VSAT, Remote Sensing - Mobile satellite service: GSM. GPS, INMARSAT, Navigation System, Direct to Home service (DTH), Special services, E-mail, Videoconferencing and Internet connectivity

**OUTCOMES:**

**At the end of this course, the student should be able to:**

- Discuss satellite navigation and global positioning system
- Outline deep space networks and inter planetary missions

**BOOKS FOR REFERENCES:**

1. Dennis Roddy, "Satellite Communications", 3rd Edition, McGraw Hill International Editions, 2001
2. Bruce R.Elbert, "Introduction to Satellite Communication" ,Artech House Inc.,1999.
3. Timothy Pratt, Charles W. Bostian, Jeremy Allnutt, "Satellite Communications", 2nd Edition, Wiley, John& Sons, 2002
4. Wilbur L.Pritchard, HendriG.Suyderhood, Robert A.Nelson, "Satellite Communication SystemsEngineering", 2nd Edition, Prentice Hall, New Jersey, 1993
5. Tri T.Ha, "Digital satellite communication", 2nd Edition, McGraw Hill, New york.1990.

**19271E32C**

**CDMA SYSTEMS**

**L T P C  
3 0 0 3**

**AIM:**

The aim of this course is to define the basics of cellular communications and explain the Architecture OF GSM & its Radio Channels.

**OBJECTIVES:**

**The students should be made to be**

- understand cellular concept, widely popular 2G digital, TDMA based mobile system GSM and modern mobile wireless system CDMA.

**UNIT I BASIC CONCEPTS OF CDMA**

**9**

Spread spectrum communication techniques ( DS-CDMA, FH-CDMA ),Synchronization in CDMA system, Detection and False alarm probabilities, Early-Late gate measurement statistics, Information capacity of Spread Spectrum Systems.

**UNIT II IS-95 CDMA TECHNIQUES**

**9**

Spreading Codes , Power control, Handover techniques, Physical and logical channels and processing (Forward and reverse links)

**UNIT III WCDMA / CDMA 2000**

**9**

Introduction to IMT 2000, CDMA 2000 - Physical layer characteristics, modulation & demodulationprocess , Handoff and power control in 3G systems.

**UNIT IV MULTICARRIER CDMA SYSTEMS**

**9**

Multicarrier CDMA, System design , Performance parameters – BER lower bound,Multiusers detection, UTRA, FDD and TDD systems.

**UNIT V OPTICAL CDMA**

**9**

Prime Codes and it's properties, Generalized and Extended Prime Codes,Experimental demonstration of Optical CDMA, Synchronization of Optical CDMA networks, Multi wavelength Optical CDMA networks.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Analyze MIMO system.
- Discuss millimeter wave communication.
- Demonstrate software defined radio and cognitive radio.

**BOOKS FOR REFERENCES:**

1. John G.Proakis, "Digital Communications", McGraw Hill International Ltd,4th ed., Singapore, 2000.
2. Andrew J. Viterbi, " CDMA: Principles of Spread Spectrum Communication",Addison-Wesley, 1sted. , 1995.

3. KavethPahlavan,. K. PrashanthKrishnamuorthy, "Principles of Wireless Networks", Prentice Hall of India, 2006.
4. Vijay Kumar Garg, "IS -95 CDMA and CDMA 2000: Cellular/PCS Systems Implementation", Pearson Education , 2st ed. , 2003.
5. Richard Van Nee, Ramjee Prasad, " OFDM for Wireless Multimedia Communication" , Artech House , Boston ,London, 2000.
6. Andreas F. Molisch, "Wireless Communication", Wiley India, 2006.
7. Raymond Steele, Chin-Chun Lee, Peter Gould, "GSM CDMA One and 3GSystems", Wiley India, 2004.
8. Guu-Chang Yang, "Prime Codes with Application to Optical and Wireless Networks", Artech House, Inc., 2002.



# LIST OF ELECTIVES

## ELECTIVE – V (SEMESTER III)

*ELECTIVE - V*  
**SEMESTER III**

### **19271E33A                      WAVELETS AND MULTIREOLUTION PROCESSING**

**L T P C**  
**3 0 0 3**

#### **AIM:**

To introduce the fundamentals concepts of wavelet transforms.

#### **OBJECTIVE:**

- To study system design using Wavelets
- To learn the different wavelet families & their applications.

#### **UNIT I INTRODUCTION**

**9**

Vector Spaces - properties - dot product - basis - dimension, orthogonality and orthonormality - relationship between vectors and signals - Signal spaces - concept of Convergence – Generalised Fourier Expansion.

#### **UNIT II MULTI RESOLUTION ANALYSIS**

**9**

Definition of Multi Resolution Analysis (MRA) – Haar basis - Construction of general orthonormal MRA Wavelet basis– Continuous time MRA interpretation for the DTWT – Discrete time MRA- Basis functions for the DTWT – PR-QMF filter banks

#### **UNIT III CONTINUOUS WAVELET TRANSFORM**

**9**

Wavelet Transform - definition and properties - concept of scale and its relation with 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.

#### **UNIT IV DISCRETE WAVELET TRANSFORM**

**9**

Filter Bank and sub band coding principles - Wavelet Filters - Inverse DWT computation by Filterbanks -Basic Properties of Filter coefficients - Choice of wavelet function coefficients - Derivations of Daubechies Wavelets - Multi-band Wavelet transforms. Introduction to lifting Scheme

#### **UNIT V APPLICATIONS**

**9**

Signal Compression – Image Compression techniques: EZW-SPHIT Coding - Image denoising techniques: Noise estimation - Shrinkage rules -. Shrinkage Functions - Edge detection and object Isolation, Image Fusion, and Object Detection.

**TOTAL : 45 PERIODS**

#### **OUTCOME:**

- The students will be able to apprehend the detailed knowledge about the Wavelet transform & its applications.

## **BOOKS FOR REFERENCES:**

1. Rao .R.M and A.S.Bopardikar, "Wavelet Transforms: Introduction to theory and Applications", Pearson Education Asia Pte. Ltd., 2000.
2. Strang G, Nguyen T, "Wavelets and Filter Banks," Wellesley Cambridge Press, 1996
3. Vetterli M, Kovacevic J., "Wavelets and Sub-band Coding," Prentice Hall, 1995
4. Mallat S., "Wavelet tour of Signal Processing", Academic Press, 1996
5. David C.Lay., "Linear Algebra and its applications" Pearson education, 2007.(Unit I only)

**19271E33B**

**HIGH PERFORMANCE COMMUNICATION NETWORKS**

**L T P C  
3 0 0 3**

**AIM:**

To familiarize concepts and terminology associated with ATM, Frame Relay, MPLS, Bluetooth technology.

**OBJECTIVES:**

- To appreciate the need for interoperable network management as a typical distributed application
- To be aware of current trends in network technologies

**UNIT I PACKET SWITCHED NETWORKS**

**9**

OSI and IP models, Ethernet (IEEE 802.3), Token ring (IEEE 802.5), Wireless LAN (IEEE 802.11) FDDI,DQDB, SMDS: Internetworking with SMDS

**UNIT II ISDN AND BROADBAND ISDN**

**9**

ISDN - overview, interfaces and functions, Layers and services - Signaling System 7 (SS7)- Broadband ISDN architecture and Protocols.

**UNIT III ATM AND FRAME RELAY**

**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, Internet and ATM, Frame relay via ATM.

**UNIT IV ADVANCED NETWORK ARCHITECTURE**

**9**

IP forwarding architectures overlay model, Multi Protocol Label Switching (MPLS), integrated services in the Internet, Resource Reservation Protocol (RSVP), Differentiated services

**UNIT V BLUETOOTH TECHNOLOGY**

**9**

The Bluetooth module-Protocol stack Part I: Antennas, Radio interface, Base band, The Link controller, Audio, The Link Manager, The Host controller interface; The Bluetooth module-Protocol stack Part I:Logical link control and adaptation protocol, RFCOMM, Service discovery protocol, Wireless access protocol, Telephony control protocol.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**After the completion of this course, students will be able to**

- Diagnose problems and make minor repairs to computer networks using appropriate diagnostics software
- Demonstrate how to correctly maintain LAN computer systems
- Maintain the network by performing routine maintenance tasks
- Apply network management tools

## **BOOKS FOR REFERENCES:**

1. William Stallings, "ISDN and Broadband ISDN with Frame Relay and ATM", 4th edition, Pearson education Asia, 2002.
2. Leon Gracia, Widjaja, "Communication networks ", Tata McGraw-Hill, New Delhi, 2000.
3. Jennifer Bray and Charles F. Sturman, "BlueTooth" Pearson education Asia, 2001.
4. Sumit Kasera, Pankaj Sethi, "ATM Networks ", Tata McGraw-Hill, New Delhi, 2000.
5. Rainer Handel, Manfred N. Huber and Stefan Schroder, "ATM Networks", 3rd edition, Pearson education Asia, 2002.
6. Jean Walrand and Pravin Varaiya, "High Performance Communication networks", 2nd edition, Harcourt and Morgan Kaufman, London, 2000.
7. William Stallings, "High-speed Networks and Internets", 2nd edition, Pearson education Asia, 2003.

**19271E33C ADVANCED MICROPROCESSORS AND MICROCONTROLLERS**

**L T P C**  
**3 0 0 3**

**AIM:**

To introduce the advanced features in microprocessors and microcontrollers.

**OBJECTIVES:**

- To enable the students to understand various microcontroller architectures
- To expose the students to the fundamentals of microprocessor architecture.

**UNIT I MICROPROCESSOR ARCHITECTURE**

**9**

Instruction set – Data formats – Instruction formats – Addressing modes – Memory hierarchy – register file – Cache – Virtual memory and paging – Segmentation – Pipelining – The instruction pipeline – pipeline hazards – Instruction level parallelism – reduced instruction set – Computer principles – RISC versus CISC – RISC properties – RISC evaluation – On-chip register files versus cache evaluation

**UNIT II HIGH PERFORMANCE CISC ARCHITECTURE – PENTIUM**

**9**

The software model – functional description – CPU pin descriptions – RISC concepts – bus operations – Super scalar architecture – pipelining – Branch prediction – The instruction and caches – Floating point unit – protected mode operation – Segmentation – paging – Protection – multitasking – Exception and interrupts – Input /Output – Virtual 8086 model – Interrupt processing – Instruction types – Addressing modes – Processor flags – Instruction set – programming the Pentium processor.

**UNIT III HIGH PERFORMANCE RISC ARCHITECTURE :ARM**

**9**

The ARM architecture – ARM assembly language program – ARM organization and implementation – The ARM instruction set – The thumb instruction set – ARM CPU cores.

**UNIT IV MOTOROLA 68HC11 MICROCONTROLLERS**

**9**

Instructions and addressing modes – operating modes – Hardware reset – Interrupt system – Parallel I/O ports – Flags – Real time clock – Programmable timer – pulse accumulator – serial communication interface – A/D converter – hardware expansion – Assembly language Programming

**UNIT V PIC MICROCONTROLLER**

**9**

CPU architecture – Instruction set – Interrupts – Timers – I/O port expansion – I<sup>2</sup>C bus for peripheral chip access – A/D converter – UART

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- The student will be able to work with a suitable microprocessor / microcontroller for a specific real world application.

## **BOOKS FOR REFERENCES:**

1. Daniel Tabak , ‘ ‘ Advanced Microprocessors” McGraw Hill.Inc., 1995
  2. James L. Antonakos, “The Pentium Microprocessor “ Pearson Education, 1997.
  3. Steve Furber, ‘ ‘ ARM System –On –Chip architecture “Addison Wesley, 2000.
  4. Gene .H.Miller.” Micro Computer Engineering,” Pearson Education, 2003.
  5. John .B.Peatman, “Design with PIC Microcontroller, Prentice hall, 1997.
  6. James L.Antonakos, An Introduction to the Intel family of Microprocessors”, PearsonEducation 1999.
  7. Barry.B.Breg,” The Intel Microprocessors Architecture , Programming andInterfacing “ , PHI, 2002.
  8. Valvano "Embedded Microcomputer Systems" Thomson Asia PVT LTD first reprint 2001
- Readings : Web links: [www.ocw.nit.edu](http://www.ocw.nit.edu),[www.arm.com](http://www.arm.com),

# LIST OF ELECTIVES

## ELECTIVE – VI (SEMESTER III)

*ELECTIVE - VI*  
**SEMESTER III**

### **19271E34A SIMULATION OF COMMUNICATION NETWORKS**

**300 3**

**L T P C**

#### **AIM:**

The aim of this course is to learn modeling and simulation.

#### **OBJECTIVES:**

**The students should be made to be**

- Learn modeling and simulation
- Understand Monte Carlo simulation
- Study channel modeling and mobility modeling

#### **UNIT I MODELLING OF COMMUNICATION SYSTEM**

**9**

Model of speech and picture signals, Pseudo noise sequences, Non-linear sequences, Analog channel model, Noise and fading, Digital channel model-Gilbert model of bursty channels, HF, Troposcatter and satellite channels, Switched telephone channels, Analog and Digital communication system models, Light wave system models.

#### **UNIT II SIMULATION OF RANDOM VARIABLES AND RANDOM PROCESS**

**9**

Univariate and multivariate models, Transformation of random variables, Bounds and approximation, Random process models-Markov and ARMA Sequences, Sampling rate for simulation, Computer generation and testing of random numbers

#### **UNIT III ESTIMATION OF PERFORMANCE MEASURES**

**9**

Quality of an estimator, estimator for SNR, Probability density functions of analog communication system, BER of digital communication systems, Monte Carlo method and Importance of sampling method, estimation of power spectral density

#### **UNIT IV COMMUNICATION NETWORKS**

**9**

Queuing models, M/M/I and M/M/I/N queues, Little formula, Burke's theorem, M/G/I queue, Embedded Markov chain analysis of TDM systems, Polling, Random access systems

#### **UNIT V NETWORK OF QUEUES**

**9**

Queues in tandem, store and forward communication networks, capacity allocation, Congestion and flowchart, Routing model, Network layout and Reliability

**TOTAL : 45 PERIODS**

#### **OUTCOMES:**

**At the end of this course, the student should be able to**

- Apply Monte Carlo simulation
- Discuss Lower Layer and Link Layer Wireless Modeling
- Compare channel modeling and mobility modeling

## **BOOKS FOR REFERENCES:**

1. M.C.Jeruchim,PhilipBalaban and K.SamShanmugan, "Simulation of communication systems",Springer, 2nd Edition, 2002.
2. A.M.Law and W.David Kelton, "Simulation Modelling and analysis", 3rd Edition, McGraw Hill Inc.,1999.
3. J.F.Hayes, "Modeling and Analysis of Computer Communication networks (Applications ofCommunication Theory)", Plenum Press, 1984.
4. Jerry Banks and John S.Carson and Barry L. Nelson, "Discrete-Event System Simulation", 4th Edition,Prentice Hall Inc., 2004.



**19271E34B**

**MEDICAL IMAGING**

**L T P C  
3 0 0 3**

**AIM:**

To study the production of x-rays and its application to different medical Imaging techniques. To study the different types of Radio diagnostic techniques.

**OBJECTIVES:**

- To study the special imaging techniques used for visualizing the cross sections of the body.
- To study the imaging of soft tissues using ultrasound technique

**UNIT I PRINCIPLES OF RADIOGRAPHIC EQUIPMENTS**

**8**

X-Ray tubes, cooling systems, removal of scatters, construction of image Intensifier tubes, angiographic setup, digital radiology.

**UNIT II COMPUTER AIDED TOMOGRAPHY**

**10**

Need for sectional images, Principles of sectional scanning, Method of convolution and Back-Propagation, Methods of reconstruction, Artifacts, Principle of 3D imaging

**UNIT III RADIO ISOTOPIC IMAGING**

**9**

Radiation detectors, Radio isotopic imaging equipment, scanners, Principle of semiconductor detectors, Gamma ray camera, Positron Emission tomography. SPECT.

**UNIT IV ULTRASONIC SYSTEMS**

**9**

Wave propagation and interaction in Biological tissues, Acoustic radiation, continuous and pulsed excitation, Transducers and imaging systems, Scanning methods, Principle of image generation.

**UNIT V MAGNETIC RESONANCE IMAGING**

**9**

Principles of MRI, Relaxation processes and their measurements, Pulse sequencing and MR image acquisition.

**TOTAL:45 PERIODS**

**OUTCOMES:**

**At the end of this course, the students should be able to:**

- Explain computer aided tomography
- Discuss ultrasonic systems
- Outline magnetic resonance imaging

**BOOKS FOR REFERENCES:**

1. D.N.Chesney and M.O.Chesney Radiographic imaging, CBS Publications, New Delhi, 1987.
2. Peggy, W., Roger D.Ferimarch, MRI for Technologists, McGraw Hill, New York, 1995.
3. Steve Webb, The Physics of Medical Imaging, Taylor& Francis, New York.1988.



**19271E34C**

**MOBILE ADHOC NETWORKS**

**L T PC  
300 3**

**AIM:**

The aim of this course is to understand the basics of Ad-hoc & Sensor Networks.

**OBJECTIVES:**

- To learn various fundamental and emerging protocols of all layers.
- To study about the issues pertaining to major obstacles in establishment and efficient management of Ad-hoc and sensor networks.
- To understand the nature and applications of Ad-hoc and sensor networks.
- To understand various security practices and protocols of Ad-hoc and Sensor Networks.

**UNIT I INTRODUCTION**

**9**

Introduction to Ad Hoc networks – definition, characteristics features, applications. Characteristics of Wireless channel, Adhoc Mobility Models: - entity and group models.

**UNIT II MEDIUM ACCESS PROTOCOLS**

**9**

MAC Protocols: design issues, goals and classification. Contention based protocols, reservation based protocols, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.

**UNIT III NETWORK PROTOCOLS**

**9**

Addressing issues in ad hoc network, Routing Protocols: Design issues, goals and classification. Proactive Vs reactive routing, Unicast routing algorithms, Multicast routing algorithms, hybrid routing algorithm, Power/ Energy aware routing algorithm, Hierarchical Routing, QoS aware routing.

**UNIT IV END -TO - END DELIVERY AND SECURITY**

**9**

Transport layer: Issues in designing- Transport layer classification, adhoc transport protocols. Security issues in adhoc networks: issues and challenges, network security attacks, secure routing protocols.

**UNIT V CROSS LAYER DESIGN AND INTEGRATION OF ADHOC FOR 4G**

**9**

Cross layer Design: Need for cross layer design, cross layer optimization, parameter optimization techniques, Cross layer cautionary perspective, Co-operative networks:-Architecture, methods of cooperation, co-operative antennas, Integration of ad hoc networks with other wired and wireless networks.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**Upon Completion of the course, the students should be able to**

- Identify different issues in wireless ad hoc and sensor networks.
- To analyze protocols developed for ad hoc and sensor networks.

- To identify and address the security threats in ad hoc and sensor networks.
- Establish a Sensor network environment for different types of applications.

### **BOOKS FOR REFERENCES:**

1. C.Siva Ram Murthy and B.S.Manoj, “Ad Hoc Wireless Networks Architectures and protocols”, 2nd edition, Pearson Education, 2007.
2. Charles E. Perkins, “Adhoc Networking”, Addison – Wesley, 2000.
3. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, “Mobile Ad Hoc networking”, Wiley-IEEE press, 2004.
4. Mohammad Ilyas, “The handbook of adhoc wireless networks”, CRC press,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.



# **PRIST DEEMED TO BE UNIVERSITY**

**Vallam, Thanjavur**

## **SCHOOL OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF  
ELECTRONICS & COMMUNICATION ENGINEERING**

# **PROGRAM HANDBOOK**

**M.TECH - COMMUNICATION SYSTEMS  
[PART TIME]**

**[REGULATION 2019]**

**M.TECH (PART TIME) - COMMUNICATION SYSTEMS – R-2019**

**SEMESTER I – VI CURRICULUM**

**SEMESTER I**

S.N	SUB CODE	SUBJECT	L	T	P	C
<b>Theory</b>						
1	19248S11BP	Applied Mathematics for Electronics Engineering	3	1	0	4
2	19271C12P	Statistical Signal Processing	3	1	0	4
3	19271C13P	Modern Digital Communication Systems	3	1	0	4
<b>Practical</b>						
4	19271L14P	Communication Systems Lab - I	0	0	3	3
<b>Research Skill Development (RSD) Course</b>						
5	19271CRSP	Research Led Seminar	1	0	0	1
<b>Total</b>						<b>16</b>

**SEMESTER II**

S.N	SUB CODE	SUBJECT	L	T	P	C
<b>Theory</b>						
1	19271C21P	Mobile Communication Networks	4	0	0	4
2	19271C22P	Advanced Microwave Systems	4	0	0	4
3	<b>19271E23_P</b>	<b>Elective-I</b>	3	0	0	3
<b>Practical</b>						
4	19271L24P	Communication Systems Lab - II	0	0	3	3
5	192TECWRP	Technical Writing /Seminars	0	0	3	3
<b>Research Skill Development (RSD) Course</b>						
6	19271CRMP	Research Methodology	3	0	0	3
7	19271CBRP	Participation in Bounded Research	0	0	2	2
<b>Total</b>						<b>22</b>

**SEMESTER III**

S.N	SUB CODE	SUBJECT	L	T	P	C
<b>Theory</b>						
1	19271C31P	Communication Protocol Engineering	4	0	0	4
2	19271C32P	Advanced Radiation Systems	4	0	0	4
3	<b>19271E33_P</b>	<b>Elective – II</b>	3	0	0	3
<b>Research Skill Development (RSD) Course</b>						
4	19271CSRSP	Design / Socio - Technical Project	0	0	6	6
<b>Total</b>						<b>17</b>

### SEMESTER IV

S.N	SUB CODE	SUBJECT	L	T	P	C
<b>Theory</b>						
1	19271C41P	Wireless Sensor Networks	4	0	0	4
2	19271C42P	Fiber Optic Networking	4	0	0	4
3	<b>19271E43_P</b>	<b>Elective-III</b>	3	0	0	3
<b>Project</b>						
4	19271P44P	Project Work Phase – I	0	0	10	10
<b>Total</b>						<b>21</b>

### SEMESTER V

S.N	SUB CODE	SUBJECT	L	T	P	C
<b>Theory</b>						
1	<b>19271E51_P</b>	<b>Elective-IV</b>	3	0	0	3
2	<b>19271E52_P</b>	<b>Elective-V</b>	3	0	0	3
3	<b>19271E53_P</b>	<b>Elective-VI</b>	3	0	0	3
<b>Total</b>						<b>9</b>

### SEMESTER VI

S.N	SUB CODE	SUBJECT	L	T	P	C
1	19271P61P	Project Work Phase – II	0	0	15	15
<b>Total</b>						<b>15</b>
<b>TOTAL NO. OF CREDITS</b>						

## LIST OF ELECTIVES

### Elective-I (SEMESTER-II)

S.N	SUB CODE	SUBJECT	L	T	P	C
1.	19271E23AP	High Speed Switching Architecture	3	0	0	3
2.	19271E23BP	DSP Processor Architecture and Programming	3	0	0	3
3.	19271E23CP	Digital Speech Processing	3	0	0	3

### Elective-II (SEMESTER-III)

S.N	SUB CODE	SUBJECT	L	T	P	C
1.	19271E33AP	Internetworking and Multimedia	3	0	0	3
2.	19271E33BP	Digital Image Processing	3	0	0	3
3.	19271E33CP	LASER Communication	3	0	0	3

**Elective-III (SEMESTER-IV)**

<b>S.N</b>	<b>SUB CODE</b>	<b>SUBJECT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1.	19271E43AP	Digital Communication Receivers	3	0	0	3
2.	19271E43BP	Soft Computing	3	0	0	3
3.	19271E43CP	Communication Network Security	3	0	0	3

**Elective-IV (SEMESTER-V)**

<b>S.N</b>	<b>SUB CODE</b>	<b>SUBJECT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1.	19271E51AP	Software Defined Radio	3	0	0	3
2.	19271E51BP	Satellite Communication	3	0	0	3
3.	19271E51CP	CDMA Systems	3	0	0	3

**Elective-V (SEMESTER-V)**

<b>S.N</b>	<b>SUB CODE</b>	<b>SUBJECT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1.	19271E52AP	Wavelets and Multi Resolution Processing	3	0	0	3
2.	19271E52BP	High Performance Communication Networks	3	0	0	3
3.	19271E52CP	Advanced Microprocessors and Microcontrollers	3	0	0	3

**Elective-VI (SEMESTER-V)**

<b>S.N</b>	<b>SUB CODE</b>	<b>SUBJECT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1.	19271E53AP	Simulation of Communication Networks	3	0	0	3
2.	19271E53BP	Medical Imaging	3	0	0	3
3.	19271E53CP	Mobile ADHOC networks	3	0	0	3



## M.TECH (PART TIME) - COMMUNICATION SYSTEMS – R-2019

### Course Structure and 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	02	06	02	05	01	03	-	-	22
III	02	08	-	-	01	06	01	03	-	-	17
IV	02	08	01	10	-	-	01	03	-	-	21
V	-	-	-	-	-	-	03	09	-	-	09
VI	-	-	01	15	-	-	-	-	-	-	15
<b>Total Credits</b>											<b>100</b>

\*RSD-Research Skill Development Courses

**HOD**

**DEAN**

**DEAN -  
ACADEMIC AFFAIRS**

**19248S11PB APPLIED MATHEMATICS FOR ELECTRONICS ENGINEERING****L T P C****3 1 0 4****AIM:**

The primary aim of this course is to demonstrate various analytical skills in applied mathematics and extensive experience with the tactics of problem solving and logical thinking applicable in communication engineering.

**OBJECTIVES:**

The primary objective of this course will help the students to identify, formulate, abstract, and solve problems 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.

**UNIT I CALCULUS OF VARIATIONS****9**

Functional – Euler’s equation-Variational problems involving one unknown function-several unknown functions-functional dependent on higher order derivatives-several independent variables-isoperimetric problems.

**UNIT II INTEGRAL TRANSFORMS AND WAVE EQUATIONS****9**

Fourier transform pairs, 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.

**UNIT III LINEAR PROGRAMMING****9**

Simplex algorithm-two phase method-duality-transportation and assignment problems-inventory-scheduling.

**UNIT IV RANDOM PROCESS AND QUEUING THEORY****9**

Classification – auto correlation-cross correlation-ergodicity-power spectral density function-Poisson process. Single and multiple server Markovian queuing models- customer impatience-queuing applications.

**UNIT V TESTING OF HYPOTHESIS****9**

Sampling distributions-Testing of hypothesis of normal, t, chi square, F distributions for testing mean and variance- large sample test. Analysis of variance – one way classification.

**Tutorial :15****Total:60****OUTCOMES:**

**After completing this course, students should demonstrate competency in the following skills:**

- Concepts on vector spaces, linear transformation, inner product spaces, eigenvalues and generalized eigenvectors.

- Apply various methods in linear algebra to solve systems of linear equations.
- 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.
- Numerical solution of differential equations by single and multistep methods.
- Computation of probability, random variables and their associated distributions, correlations and regression.
- Conceptualize the principle of optimality and sub-optimization, formulation and computational procedure of dynamic programming.
- Exposing the basic characteristic features of a queuing system and acquiring skills in analyzing queuing models.
- Using discrete time Markov chains to model computer systems.

**BOOKS FOR REFERENCES :**

1. Grewal.B.S. “Higher Engineering Mathematics”, Khanna Publications, 2005.
2. Kapoor.J.N. &Saxena.H.C., Mathematical Statistics, S.Chand& Co., New Delhi.
3. Taha.H.A. “Operation Research – An Introduction”, 6<sup>th</sup> Edition, PHI, 1997.
4. M.K. Venkataraman, “Higher Mathematics for Engineering & Science”, National Publishing Company, 2000.
5. Kandasamy, “Engineering Mathematics Volume II, S.Chand& Co.
6. P.K. Guptha, D.S. Hira, Operations Research, S.Chand& Co., 1999
7. T.Veerarajan, Probability, Statistics and Random Processes, TMH, 2002

**19271C12P****STATISTICAL SIGNAL PROCESSING****L T P C****31 0 4****AIM:**

The student comprehends mathematical description and modelling of discrete time random signals.

**OBJECTIVES:**

- The student is conversant with important theorems and algorithms.
- The student learns relevant figures of merit such as power, energy, bias and consistency.
- The student is familiar with estimation, prediction and filtering concepts and techniques.

**UNIT I DISCRETE RANDOM SIGNAL PROCESSING****9**

Discrete Random Processes-, Autocorrelation and Autocovariance matrices. Parseval's Theorem, Wiener - Khintchine Relation- Power Spectral Density-Periodogram -, Parameter estimation: Bias and consistency.

**UNIT II SPECTRUM ESTIMATION****9**

Non-Parametric Methods-Correlation Method, Periodogram Estimator, Performance Analysis of Estimators –Unbiased Consistent Estimators-; Bartlett, Blackman –Tukey method. Parametric Methods - AR, MA, and ARMA model based spectral estimation.

**UNIT III SIGNAL MODELING AND OPTIMUM FILTERS****9**

Introduction- Least square method – Pade approximation – Prony's method – Levinson Recursion – Lattice filter - FIR Wiener filter – Filtering – Linear Prediction – Non Causal and Causal IIR Wiener Filter -- Mean square error – Discrete Kalman filter

**UNIT IV ADAPTIVE FILTERS****9**

FIR adaptive filters -adaptive filter based on steepest descent method-Widrow-Hoff LMS adaptive algorithm Adaptive recursive filters (IIR). RLS adaptive filters-Exponentially weighted RLS-sliding window RLS.

**UNIT V MULTIRATE DIGITAL SIGNAL PROCESSING****9**

Mathematical description of change of sampling rate - Interpolation and Decimation, Decimation by an integer factor - Interpolation by an integer factor, Filter implementation for sampling rate conversion- Application to sub band coding and Filter bank implementation of wavelet expansion of signals.

**Total: 45 Periods****OUTCOMES:**

- Formulate time domain and frequency domain description of Wide Sense Stationary process in terms of matrix algebra and relate to linear algebra concepts.
- State Parseval's theorem, W-K theorem, principle of orthogonality, spectral factorization theorem,

Widrow-Hoff LMS algorithm and Shannon's sampling theorem, and define linear 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 versus 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's theorem, W-K theorem and normal equations.
- Design AR, MA, ARMA models, Wiener filter, anti aliasing and anti imaging filters, and develop FIR adaptive filter and polyphase filter structures.
- Simulate spectral estimation algorithms and basic models on computing platforms.

#### **BOOKS FOR REFERENCES :**

1. Monson H.Hayes, Statistical Digital Signal Processing and Modeling, John Wiley and Sons, Inc., Singapore, 2002.
2. John G. Proakis, Dimitris G.Manolakis, Digital Signal Processing Pearson Education, 2002.
3. John G. Proakis et.al., 'Algorithms for Statistical Signal Processing', Pearson Education, 2002.
4. Dimitris G.Manolakis et.al., 'Statistical and adaptive signal Processing', McGraw Hill, New York, 2000.

**19271C13P MODERN DIGITAL COMMUNICATION SYSTEMS L T P C**  
**31 0 4**

**AIM:**

To understand the basics of signal-space analysis and digital transmission.

**OBJECTIVES:**

- To understand the coherent and noncoherent receivers and its impact on different channel characteristics.
- To understand the different Equalizers
- To understand the different block coded and convolutional coded digital communication systems.
- To understand the basics of Multicarrier and Multiuser Communications.

**UNIT I COHERENT AND NON-COHERENT COMMUNICATION: 9**

Coherent receivers – Optimum receivers in WGN – IQ modulation & demodulation – Non coherent receivers in random phase channels; M-FSK receivers – Rayleigh and Rician channels – Partially coherent receives – DPSK; M-PSK; M-DPSK,-BER Performance Analysis.

**UNIT II BANDLIMITED CHANNELS AND DIGITAL MODULATIONS: 9**

Eye pattern; demodulation in the presence of ISI and AWGN; Equalization techniques – IQ modulations; QPSK; QAM; QBOM; -BER Performance Analysis. – Continuous phase modulation; CPM; CPFSK;MSK,OFDM. OFDM signal processing; Peak Power Problem: PAP reduction schemes-Clipping, Filtering, Coding and Scrambling.

**UNIT III BLOCK CODED DIGITAL COMMUNICATION: 9**

Architecture and performance – Binary block codes; Orthogonal; Biorthogonal; Transorthogonal –Shannon’s channel coding theorem; Channel capacity; Matched filter; Concepts of Spread spectrum communication – Coded BPSK and DPSK demodulators – Linear block codes; Hamming; Golay;Cyclic; BCH ; Reed – Solomon codes.

**UNIT IV CONVOLUTIONAL CODED DIGITAL COMMUNICATION: 9**

Representation of codes using Polynomial, State diagram, Tree diagram, and Trellis diagram – Decoding techniques using Maximum likelihood, Viterbi algorithm, Sequential and Threshold methods – Error probability performance for BPSK and Viterbi algorithm, Turbo Coding. Model of spread Spectrum Digital Communication System-Direct Sequence Spread Spectrum Signals, Error rate performance of the coder, Generation of PN Sequences- Frequency-Hopped Spread Spectrum Signals, Performance of FH Spread Spectrum Signals in an AWGN Channel-Synchronization of Spread Spectrum Systems.

**UNIT V MULTICARRIER AND MULTIUSER COMMUNICATIONS 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.

**OUTCOMES:**

**Upon Completion of the course, the students will be able to:**

- Develop the ability to understand the concepts of signal space analysis for coherent and non- coherent receivers.
- Conceptually appreciate different Equalization techniques
- Possess knowledge on different block codes and convolutional codes.
- Comprehend the generation of OFDM signals and the techniques of multiuser detection.

**BOOKS FOR REFERENCES :**

1. M.K.Simon, S.M.Hinedi and W.C.Lindsey, Digital communication techniques; Signalling and detection, Prentice HallIndia, New Delhi. 1995.
2. Simon Haykin, Digital communications, John Wiley and sons, 1998
3. Wayne Tomasi, Advanced electronic communication systems, 4th Edition Pearson Education Asia, 1998
4. B.P.Lathi Modern digital and analog communication systems, 3rd Edition, Oxford University press 1998.
5. John G. Proakis, Digital Communications, 4th Edition, McGraw-Hill, New york , 2001

**OBJECTIVES:**

- To acquire knowledge on Transmission line and S- parameter estimation of microwave devices.
- To study & measure the performance of digital communication systems.
- To provide a comprehensive knowledge of Wireless Communication.
- To learn about the design of digital filters and its adaptive filtering algorithms.

**LIST OF EXPERIMENTS:**

1. Antenna Radiation Pattern measurement.
2. Simulation of Modulation and Coding in a AWGN Communication Channel using Simulation Packages.
3. Implementation of Adaptive Filters, periodogram and multistage multirate system in DSP Processor
4. Performance evaluation of Digital Data Transmission through Fiber Optic Link.
5. Study of Spread Spectrum Techniques.
6. Simulation of QMF using Simulation Packages.
7. Implementation of Video Link using Optical Fiber.
8. Implementation of Linear and Cyclic Codes.

**TOTAL:45 PERIODS****OUTCOMES:****Upon the completion of course, students are able to**

- Measure and analyze various transmission line parameters.
- Implement the adaptive filtering algorithms
- To generate and detect digital communication signals of various modulation techniques using MATLAB.



**AIM:**

The aim of this course is to provide the basic cellular system concepts.

**OBJECTIVES:**

- To understand the basic cellular system concepts.
- To have an insight into the various propagation models and the speech coders used in mobile communication.
- To understand the multiple access techniques and interference reduction techniques in mobile communication

**UNIT I WIRELESS CHANNEL PROPAGATION AND MODEL****9**

Propagation of EM signals in wireless channel–Reflection, diffraction and Scattering–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

**UNIT II OPERATION AND PROPAGATION MODELS AND AIR PROTOCOLS****9**

Operation of first, second, and third generation wireless networks: cellular systems, medium access techniques, Mobile networks Elementary Principles of cellular Telephony Channel Division Techniques(TDMA, FDMA, CDMA) Cellular Coverage Methods Network Planning and Resource Allocation,Network Dimensioning ,Mobility Management Procedures

**UNIT III MOBILE NETWORK ARCHITECTURE****9**

General Architecture definition, Mobile Terminals (MT, SIM)  
Radio Section (BTS, BSC) Core Network (MSC, G-MSC, VLR, HLR, AuC)  
User and Control Plane Protocol Stack, MAP & SS#7, The Key Role of Signaling Interfaces and NetworkEntities Relation The Physical Channel, The Logical Channels Terminal, Call and Network ManagementProcedures, Network Planning.

**UNIT IV WIRELESS LOCAL AREA NETWORKS****9**

Wireless Local Area Networks , General Characteristics of the Hiperlan System, 802.11 Standard, BasicDCF access schemeDCF Access Scheme with Handshaking, PCF Access Scheme, The 802.11a Standard, Mobile Ad HocNetworks, Wireless Sensor Networks, Routing Energy Efficiency, Localization, Clustering.

**UNIT V SECURITY ISSUES IN WIRELESS NETWORKS****9**

Security in Wireless Networks, Secure routing, Key Pre-distribution and Management, Encryption andAuthentication, Security in Group Communication, Trust Establishment and Management, Denial ofService Attacks, Energy-aware security mechanisms, Location verification, Security on Data fusion.

**Total:45 Periods**

**Outcomes :**

- Discuss cellular radio concepts.
- Identify various propagation effects.
- To have knowledge of the mobile system specifications.
- Classify multiple access techniques in mobile communication.
- Outline cellular mobile communication standards.
- Analyze various methodologies to improve the cellular capacity

**BOOKS FOR REFERENCES :**

1. W. Stallings, "Wireless Communications and Networks", Second Edition Prentice Hall, 2007.
2. V.K. Garg, "IS-95 CDMA and CDMA 2000", Prentice Hall PTR, 2000.
3. T.S. Rappaport, "Wireless Communications: Principles & Practice", Second Edition, Prentice Hall, 2002.
4. Leon-Garcia and I. Widjaja, "Communication Networks, Fundamental Concepts and Key Architectures", McGraw-Hill, 2000.
5. J. Schiller, "Mobile Communications", Addison Wesley, 2000.
6. Fred Halsall, "Multimedia Communications, Applications, Networks, Protocols and Standards", Addison Wesley, 2001.
7. UylesBlack, "Mobile and Wireless Networks", Prentice Hall PTR, 1996.

**AIM:**

The aim of this course is to explain fundamentals of microwave integrated circuits.

**OBJECTIVES:**

- To understand the fundamentals of Microwave integrated circuits.
- To understand the various components for Wireless Communications.
- To know the basic techniques needed for analysis of Microwave systems.

**UNIT I INTRODUCTION TO MONOLITHIC MICROWAVE INTEGRATED CIRCUITS 9**

Introduction to Monolithic Microwave Integrated Circuits (MMICs), their advantages over discrete circuits, materials, MMIC fabrication techniques, MOSFET fabrication. Thin film formation.

**UNIT II MICROSTRIP ANALYSIS 9**

Planar transmission lines for MICs. Method of conformal transformation for microstrip analysis, concept of effective dielectric constant, Effective dielectric constant for microstrip, Losses in Microstrip

**UNIT III SLOT LINE ANALYSIS 9**

Slot Line Approximate analysis and field distribution, Transverse resonance method and evaluation of slot line impedance, comparison with micro strip line.

**UNIT IV LUMPED ELEMENTS FOR MICs 9**

Lumped Elements for MICs: Use of Lumped Elements, Capacitive elements, Inductive elements and Resistive elements.

**UNIT V MICROWAVE SEMICONDUCTOR DEVICES & MICROWAVE PASSIVE COMPONENTS 9**

Microwave semiconductor Devices & Microwave passive components Parametric amplifiers, tunnel diode, varactor diode, PIN diode, Gunn diode, their principle of operation, performance characteristics & applications, scattering parameter calculations of E plane-Tee, Magic Tee, Directional Coupler.

**Total:45 Periods**

**OUTCOMES:**

- Capability to design Microwave circuits.
- To be able to analyze microwave integrated circuits.

**REFERENCES:**

1. Gupta,K.C, and Amarjitsingh “Microwave Integrated Circuits” John Wiley and sons – Wiley Eastern Reprint, 1978.

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2. Hoffmann, R.K “Handbook of Microwave Integrated Circuits” Artech House, 1987.

**19271L24P****COMMUNICATION SYSTEMS LAB-II  
0 0 3 3****L T P C****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.
- To design and develop RF components using microstrip technology

**LIST OF EXPERIMENTS:**

1. Simulation of Audio and speech compression algorithms
2. Simulation of EZW / SPIHT Image coding algorithm.
3. Simulation of Microstrip Antennas
4. S-parameter estimation of Microwave devices.
5. Study of Global Positioning System.
6. Performance evaluation of simulated CDMA System.
7. Design and testing of a Microstrip coupler.
8. Characteristics of  $\lambda/4$  and  $\lambda/2$  transmission lines.

**TOTAL: 45 PERIODS****OUTCOMES:****Upon Completion of the course, the students will be able to:**

- Apply knowledge to identify a suitable architecture and systematically design an RF system.
- Comprehensively record and report the measured data, and would be capable of analyzing, interpreting the experimentally measured data and producing meaningful conclusions.
- Design and develop microstrip filters.

# LIST OF ELECTIVES

## ELECTIVE – I (SEMESTER II)

*ELECTIVE -I*  
**SEMESTER II**

**19271E23AP                      HIGH SPEED SWITCHING ARCHITECTURE                      L T P C**  
**4 0 0 4**

### AIM:

To expose the student to the advances in packet switching architectures and IP addressing and switching solutions and approaches to exploit and integrate the best features of different architectures for high speed switching.

### OBJECTIVES:

- To enable the student to understand the basics of switching technologies and their 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.

### UNIT I HIGH SPEED NETWORK 9

LAN and WAN network evolution through ISDN to BISDN - Transfer mode and control of BISDN -SDH multiplexing structure - ATM standard; ATM adaptation layers.

### UNIT II LAN SWITCHING TECHNOLOGY 9

Switching concepts; Switch forwarding techniques; switch path control - LAN switching; cut through forwarding; store and forward - virtual LANs.

### UNIT III ATM SWITCHING ARCHITECTURE 9

Switch models - Blocking networks – basic and enhanced banyan networks - sorting networks – merge sorting – rearrangeable networks - full and partial connection networks – non-blocking networks –recursive network – construction and comparison of non-blocking network - switches with deflection routing – shuffle switch - tandem banyan.

### UNIT IV MULTIMEDIA COMMUNICATION STANDARDS 9

Objective of MPEG- 7 standard, Functionalities and systems of MPEG-7, MPEG-21 Multimedia Framework Architecture, - Content representation, Content Management and usage, Intellectual property management, Audio visual system- H322: Guaranteed QOS LAN systems; MPEG\_4 video Transport across internet.

### UNIT V IP SWITCHING 9

Addressing mode - IP switching types-flow driven and topology driven solutions - IP Over ATM address and next hop resolution – multicasting - IPv6 over ATM.

**Total:45 Periods**

### OUTCOMES:

- The student would be able to identify suitable switch architectures for a specified networking scenario and demonstrate its blocking performance.

- 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

#### **BOOKS FOR REFERENCES :**

1. Achille Patavina, Switching Theory: Architectures and performance in Broadband ATM Networks. John Wiley & Sons Ltd., New York. 1998.
2. Christopher Y Metz, Switching protocols & Architectures. McGraw Hill, New York. 1998.
3. Ranier Handel, Manfred N Huber, Stefan Schroder. ATM Networks-concepts, protocols, applications, 3rd Edition, Addison Wesley, New York, 1999.
4. John A. Chiong: Internetworking ATM for the internet and enterprise networks. McGraw Hill, New York, 1998.

**19271E23BP DSP PROCESSOR ARCHITECTURE AND PROGRAMMING**

**L T P C**  
**3 0 0 3**

**AIM:**

The aim of this course is to provide in-depth knowledge on digital signal processor basics.

**OBJECTIVES:**

The objective of this course is to provide in-depth knowledge on

- Digital Signal Processor basics
- Third generation DSP Architecture and programming skills
- Advanced DSP architectures and some applications.

**UNIT I FUNDAMENTALS OF PROGRAMMABLE DSPs 9**

Multiplier and Multiplier accumulator (MAC) – Modified Bus Structures and Memory access in Programmable DSPs – Multiple access memory – Multi-port memory – VLIW architecture- Pipelining –Special Addressing modes in P-DSPs – On chip Peripherals.

**UNIT II TMS320C3X PROCESSOR 9**

Architecture – Data formats - Addressing modes – Groups of addressing modes- Instruction sets -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

**UNIT III ADSP PROCESSORS I 9**

Architecture of ADSP-21XX and ADSP-210XX series of DSP processors- Addressing modes and assembly language instructions – Application programs –Filter design, FFT calculation.

**UNIT IV ADVANCED PROCESSORS 9**

Architecture of TMS320C54X: Pipeline operation, Addressing modes and assembly language instructions Introduction to Code Composer studio

**UNIT V ADVANCED PROCESSORS II 9**

Architecture of TMS320C6X - Architecture of Motorola DSP563XX – Comparison of the features of DSP family processors.

**Total:45Periods**

**OUTCOMES:**

**Students should be able to:**

- Become Digital Signal Processor specialized engineer
- DSP based System Developer

**BOOKS FOR REFERENCES :**

1. B.Venkataramani and M.Bhaskar, “Digital Signal Processors – Architecture, Programming and Applications” – Tata McGraw – Hill Publishing Company Limited. New Delhi, 2003.



2. User guides Texas Instrumentation, Analog Devices, Motorola.

**19271E23CP**

**DIGITAL SPEECH PROCESSING**

**L T P C**  
**3 0 0 3**

**AIM:**

To illustrate the concepts of speech signal representations and coding.

**OBJECTIVES:**

- To introduce speech production and related parameters of speech.
- To understand different speech modeling procedures such as Markov and their implementation issues.
- To gain knowledge about text analysis and speech synthesis.

**UNIT I MECHANICS OF SPEECH**

**9**

Speech production mechanism – Nature of Speech signal – Discrete time modelling of Speech production – 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 perception of sound – Peripheral auditory system – Psycho acoustics

**UNIT II TIME DOMAIN METHODS FOR SPEECH PROCESSING**

**9**

Time domain parameters of Speech signal – Methods for extracting the parameters Energy, Average Magnitude – Zero crossing Rate – Silence Discrimination using ZCR and energy – Short Time Auto Correlation Function – Pitch period estimation using Auto Correlation Function

**UNIT III FREQUENCY DOMAIN METHOD FOR SPEECH PROCESSING**

**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

**UNIT IV LINEAR PREDICTIVE ANALYSIS OF SPEECH**

**9**

Formulation of Linear Prediction problem in Time Domain – Basic Principle – Auto correlation method– Solution of LPC equations — Durbin’s Recursive algorithm – lattice formation and solutions – Comparison of different methods — Formant analysis – VELP – CELP.

**UNIT V APPLICATION OF SPEECH & AUDIO SIGNAL PROCESSING**

**9**

Algorithms: Spectral Estimation, dynamic time warping, hidden Markov model – Music analysis – Pitch Detection – Feature analysis for recognition – Music synthesis – Automatic Speech Recognition – Feature Extraction for ASR — ASR systems– Voice response system – Speech Synthesis: Text to speech, voice over IP.

**Total:45 Periods**

**OUTCOMES:**

**Students will be able to:**

- Model speech production system and describe the fundamentals of speech.
- Extract and compare different speech parameters.

- Choose an appropriate statistical speech model for a given application.
- Design a speech recognition system.
- Use different text analysis and speech synthesis techniques.

**BOOKS FOR REFERENCES :**

1. Ben Gold and Nelson Morgan, Speech and Audio Signal Processing, John Wiley and Sons Inc. , Singapore, 2004
2. L.R.Rabiner and R.W.Schaffer – Digital Processing of Speech signals – Prentice Hall - 1978
3. Quatieri – Discrete-time Speech Signal Processing – Prentice Hall – 2001.
4. J.L.Flanagan – Speech analysis: Synthesis and Perception – 2<sup>nd</sup> edition – Berlin – 1972
5. I.H.Witten – Principles of Computer Speech – Academic Press – 1982

**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, ScienceDirect 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

#### **OUTCOMES:**

**Upon Completion of the course, the students will be able to:**

- Understand the approaches towards and constraints in good research.
- Identify various statistical tools used in research methodology
- Train in basic computational and excel- skills for research in engineering.

#### **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**

**19271C31P**

**COMMUNICATION PROTOCOL ENGINEERING**

**L T P C**

**4 0 04**

**AIM:**

To expose the students to the layered architecture for communication networks and the specific functionality of the network layer.

**OBJECTIVES:**

- To enable the student to understand the basic principles of routing 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.

**UNIT I NETWORK INTRODUCTION**

**9**

Introduction: Communication model, Communication Software, Communication Subsystems, Communication Protocol Definition/Representation Formal and Informal Protocol Development Methods, Protocol Engineering Phases Error Control, Flow Control Type of Transmission Errors, Linear Block Code, Cyclic Redundancy Checks, Introduction to Flow Control, Window Protocols

**UNIT II NETWORK REFERENCE MODEL**

**9**

Sequence Numbers, Negative Acknowledgments, Congestion Avoidance Network Reference Model: Layered Architecture, Network Services and Interfaces, Protocol Functions Encapsulation, Segmentation, Reassembly, Multiplexing, Addressing, OSI Model Layer Functions, TCP/IP Protocol Suite, Application Protocols

**UNIT III PROTOCOL SPECIFICATIONS**

**9**

Components of protocol, Specifications of Communication service, Protocol entity, Interface, Interactions, Multimedia protocol, Internet protocol, SDL, SDL based protocol- other protocol specification languages

**UNIT IV PROTOCOL CONFORMANCE/PERFORMANCE TESTING**

**9**

Conformance testing methodology and framework, Conformance test architectures, Test sequence generation methods, Distributed architecture by local methods, Conformance testing with TTCN, systems with semi controllable interfaces - RIP,SDL based tools for conformance testing, SDL based conformance testing of MPLS Performance testing, SDL based performance testing of TCP and OSPF, Interoperability testing, SDL based

interoperability testing of CSMA/CD and CSMA/CA protocol using Bridge, Scalability testing

## **UNIT V PROTOCOL SYNTHESIS AND IMPLEMENTATION**

**9**

Protocol synthesis, Interactive synthesis algorithm, Automatic synthesis algorithm, Automatic synthesis of SDL from MSC, Protocol Re-synthesis; Requirements of protocol implementation, Object based approach to protocol implementation, Protocol compilers, Tool for protocol engineering

**Total:45 Periods**

### **COURSE OUTCOMES:**

- 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.

### **BOOKS FOR REFERENCES :**

1. PallapaVenkataram and SunilkumarS.Manvi, “Communication protocol Engineering”, EasternEconomy edition, 2004
2. Richard Lai and Jirachiefpattana, “Communication Protocol Specification and Verification”, KluwerPublishers, Boston, 1998.
3. Tarnay, K., “Protocol Specification and Testing”, Plenum, New York, 1991.
4. Mohamed G. Gouda, “Elements of Network Protocol Design”, John Wiley & Sons, Inc. New York,USA, 1998
5. V.Ahuja, “Design and Analysis of Computer Communication networks”, McGraw-Hill, London,1982.
6. G.J.Holtzmann, “Design and validation of Computer protocols”, Prentice Hall, New York, 1991.

## SEMESTER III

19271C32P

### ADVANCED RADIATION SYSTEMS

L T P C

4 0 0 4

#### AIM:

To enhance the student's knowledge in the area of various antenna design.

#### OBJECTIVES:

- To understand antenna radiation and its parameters.
- To enhance the student's knowledge in the area of various antenna design.
- To design monopole, dipole and patch antenna and to impart the knowledge about modern antennas.

#### UNIT I ANTENNA FUNDAMENTALS

9

Antenna fundamental parameters, Radiation integrals ,Radiation from surface and line current distributions – dipole, monopole, loop antenna; Mobile phone antenna- base station, handset antenna; Image; Induction ,reciprocity theorem, Broadband antennas and matching techniques, Balance to unbalance transformer, Introduction to numerical techniques.

#### UNIT II RADIATION FROM APERTURES

9

Field equivalence principle, Radiation from Rectangular and Circular apertures, Uniform aperture distribution on an infinite ground plane; Slot antenna; Horn antenna; Reflector antenna, aperture blockage, and design consideration.

#### UNIT III ANTENNA SYNTHESIS

9

Synthesis problem-Line source based beam synthesis methods (Fourier transform and Woodward-Lawson sampling method – Linear array shaped beam synthesis method – Low side lobe, narrow main beam synthesis methods - discretization of continuous sources. Schelkunoff polynomial method

#### UNIT IV APERTURE ANTENNAS

9

Radiation from apertures - Huygens Principle. Rectangular apertures- techniques for evaluating gain, Circular apertures and their design considerations- Babinet's principle Fraunhofer and Fresnel diffraction. Complimentary screens and slot antennas. Slot and dipoles as dual antennas. Fourier transform of aperture antenna theory.

#### UNIT V HORN, MICROSTRIP, REFLECTOR ANTENNAS.

9

E and H plane sectoral Horns. Pyramidal horns. Conical and corrugated Horns. Multimode horns. Phasecenter. Microstrip antennas – feeding methods. Rectangular patch- Transmission line model – Circular patch Parabolic Reflector antennas – Prime focus and Cassegrain reflectors. Equivalent focal length of Cassegrain antennas. Spillover and taper efficiencies. Optimum illumination.

**Total:45 Periods**

#### OUTCOMES:

- Ability to understand antenna concepts
- Ability to design antenna for various applications
- Knowledge of modern antenna design



## **BOOKS FOR REFERENCES :**

1. Balanis, C.A., "Antenna Theory" Wiley,2003
2. Warren L. Stutzman and Gary A. Thiele," Antenna theory and design"John Wiley and sons 1998
3. Jordan, E.C., " Electromagnetic waves and Radiating systems". PHI 2003
4. Krauss, J.D., " Radio Astronomy" McGraw-Hill 1966, for the last unit (reprints available)
5. Krauss, J.D.,Fleisch,D.A., "Electromagnetics" McGraw-Hill,1999



Streaming video across Internet, Multimedia transport across ATM networks and IP network, Multimedia across wireless networks.

**Total: 45 Periods**

### **Outcomes**

Upon completion of the subject, students will be able to:

- Understand the state-of-art developments in Internet technologies and applications
- Understand the development of next generation Internet
- Appreciate the principles used in designing Internet protocols for multimedia applications, and so understand why standard protocols are designed the way that they are
- Be able to solve problems for the design of multimedia applications on Internet.

### **BOOKS FOR REFERENCES :**

1. Jon Crowcroft, Mark Handley, Ian Wakeman, Internetworking Multimedia, Harcourt Asia Pvt. Ltd.Singapore, 1998.
2. B.O. Szuprowicz, Multimedia Networking, McGraw Hill, Newyork. 1995.
3. Tay Vaughan, Multimedia - Making it to work, 4ed, Tata McGraw Hill ,NewDelhi, 2000.
4. K.R.Rao, Zoran S. Bojkovic and Dragorad A. Milovanovic, Multimedia Communication systems, PHI ,

**19271E33BP**

**DIGITAL IMAGE PROCESSING**

**L T P C**  
**3 0 0 3**

**AIM:**

The aim of this course is to explain the fundamentals of digital image processing.

**OBJECTIVES:**

- To understand the image fundamentals.
- To understand the various image segmentation techniques.
- To extract features for image analysis.
- To introduce the concepts of image registration and image fusion.

**UNIT I DIGITAL IMAGE FUNDAMENTALS**

**9**

Elements of digital image processing systems - Elements of visual perception - Psycho visual model- Brightness - Contrast - Hue - Saturation - Mach band effect - Color image fundamentals – RGBHSI models - Image sampling - Quantization - Dither - Two-dimensional mathematical preliminaries.

**UNIT II IMAGE TRANSFORMS**

**9**

1D DFT - 2D transforms - DFT - DCT - Discrete Sine - Walsh - Hadamard - Slant - Haar - KLT SVD - Wavelet Transform.

**UNIT III ENHANCEMENT AND RESTORATION**

**9**

Histogram modification and specification techniques - Noise distributions - Spatial averaging -Directional Smoothing – Median - Geometric mean - Harmonic mean – Contra harmonic and Yp mean filters - Homomorphic filtering - Color image enhancement - Image Restoration – Degradation model - Unconstrained and Constrained restoration - Inverse filtering - Removal of blur caused by uniform linear motion - Wiener filtering - Geometric transformations - Spatial transformations -Gray Level interpolation.

**UNIT IV IMAGE SEGMENTATION AND RECOGNITION**

**9**

Edge detection - Image segmentation by region growing - Region splitting and merging – Edge linking - Image Recognition - Patterns and pattern classes - Matching by minimum distance classifier - Matching by correlation - Back Propagation Neural Network - Neural Network applications in Image Processing.

**UNIT V IMAGE COMPRESSION**

**9**

Need for data compression - Huffman - Run Length Encoding - Shift codes - Arithmetic coding -Vector Quantization - Block Truncation Coding - Transform Coding - DCT and Wavelet - JPEG -MPEG – Standards - Concepts of Context based Compression.

**Total:45 Periods**

**OUTCOMES:**

**Upon Completion of the course, the students will be able to**

- Explain the fundamentals of digital image processing.

- Describe image various segmentation and feature extraction techniques for image analysis.
- Discuss the concepts of image registration and fusion.

### **BOOKS FOR REFERENCES :**

1. Rafael C. Gonzalez, Richard E. Woods, 'Digital Image Processing', Second Edition, Pearson Education Inc., 2004.
2. Anil K. Jain, 'Fundamentals of Digital Image Processing', Prentice Hall of India, 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. William K. Pratt, "Digital Image Processing", John Wiley, NewYork, 2002.
6. MilmanSonka, Vaclav Hlavac, Roger Boyle, "Image Processing Analysis and Machine Vision", 2nd edition, Brooks/Cole, Vikas Publishing House, 1999.



**19271E33CP**

**LASER COMMUNICATION**  
**3 0 0 3**

**L T P C**

**AIM:**

The aim of this course is to gain knowledge about light and its propagation

**OBJECTIVES:**

- To study the nonlinear optic devices.
- To learn about holography.
- To study the different types of laser and its effects.

**UNIT I LASER COMMUNICATIONS 9**

Atmospheric low loss windows, optical sources and detectors for these windows, Characteristics of source and detectors. Optical transmitting and receiving antennas.

**UNIT II SYSTEM DESIGN 9**

Link equation, Transmitter terminal, Antenna design, Antenna gain, Beam width, C/N, Optical detectors, Optical modulation formats, Deriving error statistics, Signal requirements for acquisition and tracking, Fundamentals of system design.

**UNIT III SEMICONDUCTOR AND METAL LASER SOURCES FOR SATELLITE COMMUNICATIONS 9**

Performance and Geometries, output wavelength control, Semiconductor laser lifetime, Direct and indirect modulation techniques and radiation effects.

**UNIT IV OPTICAL RECEIVERS AND SYSTEM DESIGN 9**

Direct detection, coherent detection and demodulation. Gimbals in transceiver design, Receiver options and optics; Lasers; antennas / Telescope, Internal optical systems, Transmitter analysis.

**UNIT V LASER BEAM POINTING CONTROL 9**

Acquisition and Tracking systems, System description, Acquisition methodology, racking and pointing control system, RF cross link system design, link equation.

**Total:45 Periods**

**Outcomes:**

Students are able to

- Recognize and classify the structures of Optical fiber and types.
- Discuss the channel impairments like losses and dispersion.
- Analyze various coupling losses.
- Classify the Optical sources and detectors and to discuss their principle.
- Familiar with Design considerations of fiber optic systems.
- To perform characteristics of optical fiber, sources and detectors, design as well as conduct experiments in software and hardware, analyze the results to provide valid conclusions.

**BOOKS FOR REFERENCES :**

1. Morris Katzman, "Laser Satellite Communications", Prentice Hall Inc, New York, 1991.
2. J. Franz and V.K.Jain, "Optical Communication Systems", Narosa Publication, New Delhi, 1994.

**19271C41P**

**WIRELESS SENSOR NETWORKS**

**L T P C**

**4 0 0 4**

**AIM:**

The aim of this course is to study about wireless IP architecture, Packet Data Protocol and LTE network architecture.

**OBJECTIVES:**

- To study about advanced wireless networks, LTE, 4G and Evolutions from LTE to LTE.
- To study about adaptive link layer, hybrid ARQ and graph routing protocol.
- To study about mobility management, cellular network, and micro cellular networks

**UNIT I OVERVIEW OF WIRELESS SENSOR NETWORKS 8**

Challenges for Wireless Sensor Networks, Enabling Technologies For Wireless Sensor Networks.

**UNIT II ARCHITECTURES 9**

Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes , Operating Systems and Execution Environments, Network Architecture -Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

**UNIT III NETWORKING SENSORS 10**

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wake Up Concepts - S-MAC , The Mediation Device Protocol, Wake Up Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing.

**UNIT IV INFRASTRUCTURE ESTABLISHMENT 9**

Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

**UNIT V SENSOR NETWORK ARCHITECTURE AND MAC PROTOCOLS 9**

Single node architecture – Hardware components, energy consumption of sensor nodes, Network architecture – Sensor network scenarios, types of sources and sinks, single hop versus multi-hop networks, multiple sinks and sources, design principles, Development of wireless sensor networks. , 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, B-MAC, Traffic-adaptive medium access protocol (TRAMA), Link Layer protocols – fundamentals task and requirements, error control, framing, link management.

**TOTAL- 45 PERIODS**



**OUTCOMES:**

- Familiar with the latest 4G networks and LTE
- Understand about the wireless IP architecture and LTE network architecture.
- Familiar with the adaptive link layer and network layer graphs and protocol.
- Understand about the mobility management and cellular network.
- Understand about the wireless sensor network architecture and its concept.

**BOOKS FOR REFERENCES:**

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. KazemSohraby, Daniel Minoli, &TaiebZnati, "Wireless Sensor Networks- Technology, Protocols, And Applications", John Wiley, 2007.
4. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.



## **UNIT V WDM CONCEPTS AND COMPONENTS**

**9**

WDM concepts, overview of WDM operation principles, WDM standards, Mach-Zehnder interferometer, multiplexer, Isolators and circulators, direct thin film filters, active optical components, MEMS technology, variable optical attenuators, tunable optical fibers, dynamic gain equalizers, optical drop multiplexers, polarization controllers, chromatic dispersion compensators, tunable light sources.

**Total:45 Periods**

### **OUTCOMES:**

**At the end of the course, the student should be able to:**

- Design and Analyze Network Components
- Assess and Evaluate optical networks

### **BOOKS FOR REFERENCES :**

1. Rajiv Ramaswami and Kumar Sivarajan, Optical Networks: A practical perspective, MorganKaufmann, 2nd edition, 2001.
2. VivekAlwayn, Optical Network Design and Implementation, Pearson Education, 2004.
3. Hussein T.Mouftab and Pin-Han Ho, Optical Networks: Architecture and Survivability, Kluwer Academic Publishers, 2002.
4. Biswanath Mukherjee, Optical Communication Networks, McGraw Hill, 1997



- Describe various synchronization techniques.
- Design adaptive equalization algorithms to satisfy the evolving demands in digital communication.

**BOOKS FOR REFERENCES :**

1. Heinrich Meyer, Mare Moeneclacy and Stefan.A. Fechtel, “Digital Communication Receivers”, VolII&II, John Wiley, New York, 1997
2. John. G. Proakis, “Digital Communication”, 4th ed., McGraw Hill, New York, 2001
3. E.A. Lee and D.G. Messerschmitt, “Digital Communication”, 2nd edition, Allied Publishers, NewDelhi, 1994
4. Simon Marvin, “Digital Communication Over Fading channel; An unified approach to performanceAnalysis”, John Wiley, New York, 2000
5. Bernard Sklar, “Digital Communication Fundamentals and Applications, Prentice Hall, 1998

**19271E43BP**

**SOFT COMPUTING**

**L T P C**  
**3 0 0 3**

**AIM:**

The aim of this course is to know the basics of artificial neural networks.

**OBJECTIVES:**

- To provide adequate knowledge about feed forward /feedback neural networks
- To apply the concept of fuzzy logic in various systems.
- To have the idea about genetic algorithms.
- To provide adequate knowledge about the applications of Soft Computing.

**UNIT I ARTIFICIAL NEURAL NETWORKS**

**9**

Basic concepts-single layer perceptron-Multi layer perceptron-Adaline-Madaline-Learning rules-Supervised learning-Back propagation networks-Training algorithm, Practical difficulties, Advanced Algorithms-Adaptive network- Radial basis network-modular network-Applications

**UNIT II UNSUPERVISED NETWORKS**

**9**

Introduction- unsupervised learning -Competitive learning networks-Kohonen self organising networks-Learning vector quantisation - Hebbian learning - Hopfield network-Content addressable nature, Binary Hopfield network, Continuous Hopfield network Traveling Salesperson problem - Adaptive resonance theory –Bidirectional Associative Memory-Principle component Analysis

**UNIT III FUZZY SYSTEMS**

**9**

Fuzzy sets-Fuzzy rules: Extension principle, Fuzzy relation- fuzzy reasoning – fuzzy inference systems:Mamdani model, Sugeno model. Tsukamoto model -Fuzzy decision making- Multi objective Decision Making,-Fuzzy classification-Fuzzy control methods -Application

**UNIT IV NEURO-FUZZY MODELLING**

**9**

Adaptive Neuro Fuzzy based inference systems – classification and regression trees: decision trees, Cart algorithm – Data clustering algorithms: K means clustering, Fuzzy C means clustering, Mountain clustering, Subtractive clustering – rule base structure identification – Neuro fuzzy control: Feedback Control Systems, Expert Control, Inverse Learning, Specialized Learning, Back propagation through Real –Time Recurrent Learning.

**UNIT V GENETIC ALGORITHM**

**9**

Fundamentals of genetic algorithm-Mathematical foundations-Genetic modeling-Survival of the fittest 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:45 Periods**

**OUTCOMES:**

- Knowledge on concepts of soft computational techniques.
- Able to apply soft computational techniques to solve various problems.
- Motivate to solve research oriented problems.

**BOOKS FOR REFERENCES :**

1. Jang J.S.R.,Sun C.T and Mizutani E – “Neuro Fuzzy and Soft computing”, Pearson education(Singapore) 2004
2. David E.Goldberg : “Genetic Algorithms in Search, Optimization, and Machine Learning”, PearsonEducation, Asia,1996
3. LaureneFauseett:”Fundamentals of Neural Networks”, Prentice Hall India, New Delhi,1994.
4. Timothy J.Ross:”Fuzzy Logic Engineering Applications”, McGrawHill, ewYork,1997.
5. S.Rajasekaran and G.A.VijayalakshmiPai “Neural networks,Fuzzylogics,and Genetic algorithms”,Prentice Hall of India,2003
6. George J.Klir and Bo Yuan,”Fuzzy Sets and Fuzzy Logic”,Prentice Hall Inc., New Jersey,1995.

**19271E43CP**

**COMMUNICATION NETWORK SECURITY**  
**3 00 3**

**L T P C**

**AIM:**

The aim of this course is to understand the need and concept of security.

**OBJECTIVES :**

**The students should be made to:**

- Understand the need and concept of security
- Learn cryptosystems

**UNIT I SYMMETRIC CIPHERS**

**9**

Introduction – Services, Mechanisms and Attacks, OSI security Architecture, Model for network Security; Classical Encryption Techniques- Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Product ciphers , Data Encryption Standard- Block Cipher Principles, Strength of DES,Differential and Linear CryptAnalysis, Block Cipher Design Principles, Block Cipher Modes of operation, Steganography.

**UNIT II ADVANCED ENCRYPTION STANDARD AND STREAM CIPHERS**

**9**

Evaluation Criteria for AES, AES Cipher; Contemporary Symmetric Ciphers- Triple DES, Blowfish, RC5-Characteristics of Advanced Symmetric Block Ciphers, Stream ciphers based on LFSRs,RC4 Stream Cipher; Random Number Generation. Traffic Confidentiality, Key Distribution.

**UNIT III PUBLIC-KEY ENCRYPTION AND HASH FUNCTIONS**

**9**

Public Key Cryptography and Key Management- RSA Algorithm and other public key cryptosystems-,Diffie-Hellman Key Exchange, Elliptic Curve arithmetic, Elliptic Curve Cryptography; Message Authentication and Hash Functions- Authentication Requirements, - MD5 Message Digest Algorithm; Secure Hash Algorithm, RIPEMD 160, HMAC; Digital Signatures and Authentication Protocols- Digital Signature Standards.

**UNIT IV NETWORK SECURITY PRACTICE**

**9**

Authentication Applications- Kerberos, X.509 Authentication Service; Electronic Mail Security- Pretty Good Privacy, S/MIME; IP Security- overview and Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations; Web Security- Web Security Considerations, Secure Sockets Layer and Transport Layer Security, Secure Electronic Transaction.

**UNIT V SYSTEM SECURITY**

**9**

Intruders- Intruder Detection, Password Management; Malicious Software- Virus and Related Threats, Virus Countermeasures; Firewalls- Firewall Design Principles, Trusted Systems.

**Total:45 Periods**



**OUTCOMES:**

**At the end of this course, the students should be able to:**

- Explain digital signature standards
- Discuss authentication
- Explain security at different layers

**BOOKS FOR REFERENCES:**

1. William Stallings, “Cryptography and Network Security”, 3rd Edition. Prentice Hall of India, New Delhi, 2004
2. William Stallings, “Network Security Essentials”, 2nd Edition. Prentice Hall of India, New Delhi, 2004
3. Charlie Kaufman , “Network Security: Private Communication in Public World”, 2nd Edition. PrenticeHall of India, New Delhi ,2004

## LIST OF ELECTIVES

### ELECTIVE – IV (SEMESTER V)

#### *ELECTIVE -IV* **SEMESTER V**

**19271E51AP**

**SOFTWARE DEFINED RADIO**

**L T P C**  
**3 0 0 3**

#### **AIM:**

The aim of this course is to understand the concepts of software defined radio.

#### **OBJECTIVES:**

**The students should be made to be**

- Understand the concepts of software defined radio
- Learn spectrum sensing and dynamic spectrum access

#### **UNIT I: Introduction to SDR**

**9**

The Need for Software Radios-Characteristics and Benefits of a Software Radio. Design Principles of a Software Radio.Radio frequency implementation issues-The Purpose of the RF Front-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 the Components -Transmitter Architectures and their Issues. Noise and Distortion in the RF Chain. ADC and DAC Distortion.

#### **UNIT II :Direct Digital Synthesis**

**9**

Introduction. Comparison of Direct Digital Synthesis with Analog Signal Synthesis. Approaches to Direct Digital Synthesis. Analysis of Spurious Signals. Spurious Components due to Periodic Jitter. Band pass Signal Generation. Performance of Direct Digital Synthesis Systems. Hybrid DDS-PLL Systems. Applications of direct Digital Synthesis. Generation of Random Sequences. ROM Compression Techniques.

#### **UNIT III Signal Processor and Multi Rate Processing Techniques**

**9**

Introduction. Sample Rate Conversion Principles. Polyphase Filters. Digital Filter Banks. Timing Recovery in Digital Receivers Using Multirate Digital Filters. DSP Processors; Field Programmable Gate Arrays; Trade-Offs in Using DSPs, FPGAs, and ASICs; Power Management Issues; Using a Combination of DSPs, FPGAs, and ASICs.

#### **UNIT IV: 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; Algorithms for Transmit STAP; Hardware Implementation of Smart Antennas; Array Calibration.

#### **UNIT V: Applications –Wireless Aspects of Tele-Health Care**

**9**

The application of advanced telecommunication , the special requirements especially related to reliability, privacy and trust, Regulatory and safety aspects of tele-health care, Cognitive radio and flexible spectrum usage for tele-healthcare, Cooperative Communications for Tele-health. Case studies: JTRS radio system ,Software defined base stations.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**At the end of this course, the student should be able to**

- Compare MAC and network layer design for software defined radio
- Discuss cognitive radio for Internet of Things and M2M technologies

**BOOKS FOR REFERENCES:**

1. Jeffrey H. Reed -Software Radio: A Modern Approach to Radio Engineering Publisher: Prentice Hall PTR; May 2002 ISBN: 0170811580.
2. Wireless Communications: Principles and Practice, 2nd ed, by Rappaport, Prentice-Hall 2002. ISBN 0-17-042232-0.
3. Wireless Application Development, by Skelton, Thomson, 2003, ISBN 0-619-15931-6

**19271E51BP            SATELLITE COMMUNICATION  
3 0 0 3**

**L T P C**

**AIM:**

To understand the basics of satellite orbits.To understand the satellite segment and earth segment.

**OBJECTIVES:**

**The students should be made to be**

- Learn M2M developments and satellite applications
- Understand Satellite Communication In Ipv6 Environment

**UNIT I ORBITAL MECHANICS**

**9**

Kepler's laws of motion, Orbits, Orbit Equations, Orbit Description, Locating the Satellite in the Orbit and with Respect to Earth, Orbital Elements-Look Angle Determination and Visibility - Orbital Perturbations,Orbit Determination, Launch Vehicles, Orbital Effects in Communication System - Performance Attitude control; Satellite launch vehicles. spectrum allocations for satellite systems.

**UNIT II SPACECRAFT SUBSYSTEMS AND EARTH STATION**

**9**

Spacecraft Subsystems, Altitude and Orbit Control, Telemetry and Tracking, Power Systems,Communication Subsystems, Transponders, Antennas, Equipment Reliability, Earth Stations, Example of payloads of operating and planned systems.

**UNIT III SPACE LINKS**

**9**

The Space Link, Satellite Link Design - Satellite uplink -down link power Budget, Basic Transmission Theory, System Noise Temp, G/T Ratio, Noise Figure, Downlink Design, Design of Satellite Links for Specified C/N - Microwave Propagation on Satellite-Earth Paths. Interference between satellite circuits, Energy Dispersion, propagation characteristics of fixed and mobile satellite links.

**UNIT IV MULTIPLE ACCESS TECHNIQUES AND NETWORK ASPECTS**

**9**

Single access vs. multiple access (MA). Classical MA techniques: FDMA, TDMA. Single channel per carrier (SCPC) access - Code division multiple access (CDMA). Demand assignment techniques. Examples of MA techniques for existing and planned systems (e.g. the satellite component of UMTS).Mobile satellite network design, ATM via satellite. TCP/IP via satellite - Call control, handover and call set up procedures.  
Hybrid satellite-terrestrial networks

**UNIT V SERVICES AND APPLICATIONS**

**9**

Fixed and mobile services - Multimedia satellite services - Advanced applications based on satellite platforms - INTELSAT series - INSAT, VSAT, Remote Sensing - Mobile satellite service: GSM. GPS,INMARSAT, Navigation System, Direct to Home service (DTH), Special services, E-mail, Videoconferencing and Internet connectivity

**OUTCOMES:**

**At the end of this course, the student should be able to:**

- Discuss satellite navigation and global positioning system
- Outline deep space networks and inter planetary missions

**BOOKS FOR REFERENCES:**

1. Dennis Roddy, "Satellite Communications", 3rd Edition, McGraw Hill International Editions, 2001
2. Bruce R.Elbert, "Introduction to Satellite Communication" ,Artech House Inc.,1999.
3. Timothy Pratt, Charles W. Bostian, Jeremy Allnutt, "Satellite Communications", 2nd Edition, Wiley, John& Sons, 2002
4. Wilbur L.Pritchard, HendriG.Snyderhood, Robert A.Nelson, "Satellite Communication SystemsEngineering", 2nd Edition, Prentice Hall, New Jersey, 1993
5. Tri T.Ha, "Digital satellite communication", 2nd Edition, McGraw Hill, New york.1990.

**19271E51CP**

**CDMA SYSTEMS**

**L T P C  
3 0 0 3**

**AIM:**

The aim of this course is to define the basics of cellular communications and explain the Architecture OF GSM & its Radio Channels.

**OBJECTIVES:**

**The students should be made to be**

- understand cellular concept, widely popular 2G digital, TDMA based mobile system GSM and modern mobile wireless system CDMA.

**UNIT I BASIC CONCEPTS OF CDMA**

**9**

Spread spectrum communication techniques ( DS-CDMA, FH-CDMA ), Synchronization in CDMA system, Detection and False alarm probabilities, Early-Late gate measurement statistics, Information capacity of Spread Spectrum Systems.

**UNIT II IS-95 CDMA TECHNIQUES**

**9**

Spreading Codes , Power control, Handover techniques, Physical and logical channels and processing (Forward and reverse links)

**UNIT III WCDMA / CDMA 2000**

**9**

Introduction to IMT 2000, CDMA 2000 - Physical layer characteristics, modulation & demodulation process , Handoff and power control in 3G systems.

**UNIT IV MULTICARRIER CDMA SYSTEMS**

**9**

Multicarrier CDMA, System design , Performance parameters – BER lower bound, Multiuser detection, UTRA, FDD and TDD systems.

**UNIT V OPTICAL CDMA**

**9**

Prime Codes and it's properties, Generalized and Extended Prime Codes, Experimental demonstration of Optical CDMA, Synchronization of Optical CDMA networks, Multi wavelength Optical CDMA networks.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Analyze MIMO system.
- Discuss millimeter wave communication.
- Demonstrate software defined radio and cognitive radio.

**BOOKS FOR REFERENCES:**

1. John G.Proakis, "Digital Communications", McGraw Hill International Ltd, 4th ed., Singapore, 2000.
2. Andrew J. Viterbi, " CDMA: Principles of Spread Spectrum Communication", Addison- Wesley, 1st ed. , 1995.

3. KavethPahlavan,. K. PrashanthKrishnamuorthy, "Principles of Wireless Networks", Prentice Hall of India, 2006.
4. Vijay Kumar Garg, "IS -95 CDMA and CDMA 2000: Cellular/PCS Systems Implementation", Pearson Education , 2st ed. , 2003.
5. Richard Van Nee, Ramjee Prasad, " OFDM for Wireless Multimedia Communication" , Artech House , Boston ,London, 2000.
6. Andreas F. Molisch, "Wireless Communication", Wiley India, 2006.
7. Raymond Steele, Chin-Chun Lee, Peter Gould, "GSM CDMA One and 3GSystems", Wiley India, 2004.
8. Guu-Chang Yang, "Prime Codes with Application to Optical and Wireless Networks", Artech House, Inc., 2002.

# LIST OF ELECTIVES

## ELECTIVE – V (SEMESTER V)

*ELECTIVE - V*  
**SEMESTER V**

**19271E52AP                      WAVELETS AND MULTIREOLUTION PROCESSING**

**L T P C**  
**3 0 0 3**

### **AIM:**

To introduce the fundamentals concepts of wavelet transforms.

### **OBJECTIVE:**

- To study system design using Wavelets
- To learn the different wavelet families & their applications.

### **UNIT I INTRODUCTION**

**9**

Vector Spaces - properties - dot product - basis - dimension, orthogonality and orthonormality - relationship between vectors and signals - Signal spaces - concept of Convergence – Generalised Fourier Expansion.

### **UNIT II MULTI RESOLUTION ANALYSIS**

**9**

Definition of Multi Resolution Analysis (MRA) – Haar basis - Construction of general orthonormal MRA Wavelet basis– Continuous time MRA interpretation for the DTWT – Discrete time MRA- Basis functions for the DTWT – PR-QMF filter banks

### **UNIT III CONTINUOUS WAVELET TRANSFORM**

**9**

Wavelet Transform - definition and properties - concept of scale and its relation with 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.

### **UNIT IV DISCRETE WAVELET TRANSFORM**

**9**

Filter Bank and sub band coding principles - Wavelet Filters - Inverse DWT computation by Filterbanks -Basic Properties of Filter coefficients - Choice of wavelet function coefficients - Derivations of Daubechies Wavelets - Multi-band Wavelet transforms. Introduction to lifting Scheme

### **UNIT V APPLICATIONS**

**9**

Signal Compression – Image Compression techniques: EZW-SPHIT Coding - Image denoising techniques: Noise estimation - Shrinkage rules -. Shrinkage Functions - Edge detection and object Isolation, Image Fusion, and Object Detection.

**TOTAL : 45 PERIODS**

### **OUTCOME:**

- The students will be able to apprehend the detailed knowledge about the Wavelet transform & its applications.



**BOOKS FOR REFERENCES:**

1. Rao .R.M and A.S.Bopardikar, "Wavelet Transforms: Introduction to theory and Applications", Pearson Education Asia Pte. Ltd., 2000.
2. Strang G, Nguyen T, "Wavelets and Filter Banks," Wellesley Cambridge Press, 1996
3. Vetterli M, Kovacevic J., "Wavelets and Sub-band Coding," Prentice Hall, 1995
4. Mallat S., "Wavelet tour of Signal Processing", Academic Press, 1996
5. David C.Lay., "Linear Algebra and its applications" Pearson education, 2007.(Unit I only)

**19271E52BP**

**HIGH PERFORMANCE COMMUNICATION NETWORKS**

**L T P C  
3 0 0 3**

**AIM:**

To familiarize concepts and terminology associated with ATM, Frame Relay, MPLS, Bluetooth technology.

**OBJECTIVES:**

- To appreciate the need for interoperable network management as a typical distributed application
- To be aware of current trends in network technologies

**UNIT I PACKET SWITCHED NETWORKS**

**9**

OSI and IP models, Ethernet (IEEE 802.3), Token ring (IEEE 802.5), Wireless LAN (IEEE 802.11) FDDI,DQDB, SMDS: Internetworking with SMDS

**UNIT II ISDN AND BROADBAND ISDN**

**9**

ISDN - overview, interfaces and functions, Layers and services - Signaling System 7 (SS7)- Broadband ISDN architecture and Protocols.

**UNIT III ATM AND FRAME RELAY**

**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, Internet and ATM, Frame relay via ATM.

**UNIT IV ADVANCED NETWORK ARCHITECTURE**

**9**

IP forwarding architectures overlay model, Multi Protocol Label Switching (MPLS), integrated services in the Internet, Resource Reservation Protocol (RSVP), Differentiated services

**UNIT V BLUETOOTH TECHNOLOGY**

**9**

The Bluetooth module-Protocol stack Part I: Antennas, Radio interface, Base band, The Link controller, Audio, The Link Manager, The Host controller interface; The Bluetooth module-Protocol stack Part I:Logical link control and adaptation protocol, RFCOMM, Service discovery protocol, Wireless access protocol, Telephony control protocol.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**After the completion of this course, students will be able to**

- Diagnose problems and make minor repairs to computer networks using appropriate diagnostics software
- Demonstrate how to correctly maintain LAN computer systems
- Maintain the network by performing routine maintenance tasks
- Apply network management tools

## **BOOKS FOR REFERENCES:**

1. William Stallings, "ISDN and Broadband ISDN with Frame Relay and ATM", 4th edition, Pearson education Asia, 2002.
2. Leon Gracia, Widjaja, "Communication networks ", Tata McGraw-Hill, New Delhi, 2000.
3. Jennifer Bray and Charles F. Sturman, "BlueTooth" Pearson education Asia, 2001.
4. Sumit Kasera, Pankaj Sethi, "ATM Networks ", Tata McGraw-Hill, New Delhi, 2000.
5. Rainer Handel, Manfred N. Huber and Stefan Schroder, "ATM Networks", 3rd edition, Pearson education asia, 2002.
6. Jean Walrand and Pravin Varaiya, "High Performance Communication networks", 2nd edition, Harcourt and Morgan Kauffman, London, 2000.
7. William Stallings, "High-speed Networks and Internets", 2nd edition, Pearson education Asia, 2003.

**19271E52CP ADVANCED MICROPROCESSORS AND MICROCONTROLLERS**

**L T P C**  
**3 0 0 3**

**AIM:**

To introduce the advanced features in microprocessors and microcontrollers.

**OBJECTIVES:**

- To enable the students to understand various microcontroller architectures
- To expose the students to the fundamentals of microprocessor architecture.

**UNIT I MICROPROCESSOR ARCHITECTURE**

**9**

Instruction set – Data formats – Instruction formats – Addressing modes – Memory hierarchy – register file – Cache – Virtual memory and paging – Segmentation – Pipelining – The instruction pipeline – pipeline hazards – Instruction level parallelism – reduced instruction set – Computer principles – RISC versus CISC – RISC properties – RISC evaluation – On-chip register files versus cache evaluation

**UNIT II HIGH PERFORMANCE CISC ARCHITECTURE – PENTIUM**

**9**

The software model – functional description – CPU pin descriptions – RISC concepts – bus operations – Super scalar architecture – pipelining – Branch prediction – The instruction and caches – Floating point unit – protected mode operation – Segmentation – paging – Protection – multitasking – Exception and interrupts – Input /Output – Virtual 8086 model – Interrupt processing – Instruction types – Addressing modes – Processor flags – Instruction set – programming the Pentium processor.

**UNIT III HIGH PERFORMANCE RISC ARCHITECTURE :ARM**

**9**

The ARM architecture – ARM assembly language program – ARM organization and implementation – The ARM instruction set - The thumb instruction set – ARM CPU cores.

**UNIT IV MOTOROLA 68HC11 MICROCONTROLLERS**

**9**

Instructions and addressing modes – operating modes – Hardware reset – Interrupt system – Parallel/O ports – Flags – Real time clock – Programmable timer – pulse accumulator – serial communication interface – A/D converter – hardware expansion – Assembly language Programming

**UNIT V PIC MICROCONTROLLER**

**9**

CPU architecture – Instruction set - Interrupts – Timers – I/O port expansion – I<sup>2</sup>C bus for peripheral chip access – A/D converter – UART

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- The student will be able to work with a suitable microprocessor / microcontroller for a specific real world application.

## **BOOKS FOR REFERENCES:**

1. Daniel Tabak , ‘ ‘ Advanced Microprocessors” McGraw Hill.Inc., 1995
  2. James L. Antonakos, “The Pentium Microprocessor “ Pearson Education, 1997.
  3. Steve Furber, ‘ ‘ ARM System –On –Chip architecture “Addison Wesley, 2000.
  4. Gene .H.Miller.” Micro Computer Engineering,” Pearson Education, 2003.
  5. John .B.Peatman, “Design with PIC Microcontroller, Prentice hall, 1997.
  6. James L.Antonakos, An Introduction to the Intel family of Microprocessors”, PearsonEducation 1999.
  7. Barry.B.Breg,” The Intel Microprocessors Architecture , Programming andInterfacing “, PHI, 2002.
  8. Valvano "Embedded Microcomputer Systems" Thomson Asia PVT LTD first reprint 2001
- Readings : Web links: [www.ocw.nit.edu](http://www.ocw.nit.edu),[www.arm.com](http://www.arm.com),

# LIST OF ELECTIVES

## ELECTIVE – VI (SEMESTER V)

*ELECTIVE - VI*  
**SEMESTER V**

**19271E53AP                      SIMULATION OF COMMUNICATION NETWORKS**

**L T P C**

**300 3**

### **AIM:**

The aim of this course is to learn modeling and simulation.

### **OBJECTIVES:**

**The students should be made to be**

- Learn modeling and simulation
- Understand Monte Carlo simulation
- Study channel modeling and mobility modeling

### **UNIT I MODELLING OF COMMUNICATION SYSTEM**

**9**

Model of speech and picture signals, Pseudo noise sequences, Non-linear sequences, Analog channel model, Noise and fading, Digital channel model-Gilbert model of bursty channels, HF, Troposcatter and satellite channels, Switched telephone channels, Analog and Digital communication system models, Light wave system models.

### **UNIT II SIMULATION OF RANDOM VARIABLES AND RANDOM PROCESS**

**9**

Univariate and multivariate models, Transformation of random variables, Bounds and approximation, Random process models-Markov and ARMA Sequences, Sampling rate for simulation, Computer generation and testing of random numbers

### **UNIT III ESTIMATION OF PERFORMANCE MEASURES**

**9**

Quality of an estimator, estimator for SNR, Probability density functions of analog communication system, BER of digital communication systems, Monte Carlo method and Importance of sampling method, estimation of power spectral density

### **UNIT IV COMMUNICATION NETWORKS**

**9**

Queuing models, M/M/I and M/M/I/N queues, Little formula, Burke's theorem, M/G/I queue, Embedded Markov chain analysis of TDM systems, Polling, Random access systems

### **UNIT V NETWORK OF QUEUES**

**9**

Queues in tandem, store and forward communication networks, capacity allocation, Congestion and flowchart, Routing model, Network layout and Reliability

**TOTAL : 45 PERIODS**

### **OUTCOMES:**

**At the end of this course, the student should be able to**

- Apply Monte Carlo simulation
- Discuss Lower Layer and Link Layer Wireless Modeling
- Compare channel modeling and mobility modeling

## **BOOKS FOR REFERENCES:**

1. M.C.Jeruchim,PhilipBalaban and K.SamShanmugan, "Simulation of communication systems",Springer, 2nd Edition, 2002.
2. A.M.Law and W.David Kelton, "Simulation Modelling and analysis", 3rd Edition, McGraw Hill Inc.,1999.
3. J.F.Hayes, "Modeling and Analysis of Computer Communication networks (Applications ofCommunication Theory)", Plenum Press, 1984.
4. Jerry Banks and John S.Carson and Barry L. Nelson, "Discrete-Event System Simulation", 4th Edition,Prentice Hall Inc., 2004.

**19271E53BP**

**MEDICAL IMAGING**

**L T P C  
3 0 0 3**

**AIM:**

To study the production of x-rays and its application to different medical Imaging techniques. To study the different types of Radio diagnostic techniques.

**OBJECTIVES:**

- To study the special imaging techniques used for visualizing the cross sections of the body.
- To study the imaging of soft tissues using ultrasound technique

**UNIT I PRINCIPLES OF RADIOGRAPHIC EQUIPMENTS 8**

X-Ray tubes, cooling systems, removal of scatters, construction of image Intensifier tubes, angiographic setup, digital radiology.

**UNIT II COMPUTER AIDED TOMOGRAPHY 10**

Need for sectional images, Principles of sectional scanning, Method of convolution and Back-Propagation, Methods of reconstruction, Artifacts, Principle of 3D imaging

**UNIT III RADIO ISOTOPIC IMAGING 9**

Radiation detectors, Radio isotopic imaging equipment, scanners, Principle of semiconductor detectors, Gamma ray camera, Positron Emission tomography. SPECT.

**UNIT IV ULTRASONIC SYSTEMS 9**

Wave propagation and interaction in Biological tissues, Acoustic radiation, continuous and pulsed excitation, Transducers and imaging systems, Scanning methods, Principle of image generation.

**UNIT V MAGNETIC RESONANCE IMAGING 9**

Principles of MRI, Relaxation processes and their measurements, Pulse sequencing and MR image acquisition.

**TOTAL:45 PERIODS**

**OUTCOMES:**

**At the end of this course, the students should be able to:**

- Explain computer aided tomography
- Discuss ultrasonic systems
- Outline magnetic resonance imaging

**BOOKS FOR REFERENCES:**

1. D.N.Chesney and M.O.Chesney Radiographic imaging, CBS Publications, New Delhi, 1987.
2. Peggy, W., Roger D.Ferimarch, MRI for Technologists, McGraw Hill, New York, 1995.
3. Steve Webb, The Physics of Medical Imaging, Taylor& Francis, New York.1988.



**19271E53CP**

**MOBILE AD HOC NETWORKS**

**L T P C  
300 3**

**AIM:**

The aim of this course is to understand the basics of Ad-hoc & Sensor Networks.

**OBJECTIVES:**

- To learn various fundamental and emerging protocols of all layers.
- To study about the issues pertaining to major obstacles in establishment and efficient management of Ad-hoc and sensor networks.
- To understand the nature and applications of Ad-hoc and sensor networks.
- To understand various security practices and protocols of Ad-hoc and Sensor Networks.

**UNIT I INTRODUCTION**

**9**

Introduction to Ad Hoc networks – definition, characteristics features, applications. Characteristics of Wireless channel, Adhoc Mobility Models: - entity and group models.

**UNIT II MEDIUM ACCESS PROTOCOLS**

**9**

MAC Protocols: design issues, goals and classification. Contention based protocols, reservation based protocols, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.

**UNIT III NETWORK PROTOCOLS**

**9**

Addressing issues in ad hoc network, Routing Protocols: Design issues, goals and classification. Proactive Vs reactive routing, Unicast routing algorithms, Multicast routing algorithms, hybrid routing algorithm, Power/ Energy aware routing algorithm, Hierarchical Routing, QoS aware routing.

**UNITIV END -TO - END DELIVERY AND SECURITY**

**9**

Transport layer: Issues in designing- Transport layer classification, adhoc transport protocols. Security issues in adhoc networks: issues and challenges, network security attacks, secure routing protocols.

**UNITV CROSS LAYER DESIGN AND INTEGRATION OF ADHOC FOR 4G**

**9**

Cross layer Design: Need for cross layer design, cross layer optimization, parameter optimization techniques, Cross layer cautionary perspective, Co-operative networks:- Architecture, methods of cooperation, co-operative antennas, Integration of ad hoc networks with other wired and wireless networks.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**Upon Completion of the course, the students should be able to**

- Identify different issues in wireless ad hoc and sensor networks.
- To analyze protocols developed for ad hoc and sensor networks.

- To identify and address the security threats in ad hoc and sensor networks.
- Establish a Sensor network environment for different types of applications.

### **BOOKS FOR REFERENCES:**

1. C.Siva Ram Murthy and B.S.Manoj, “Ad Hoc Wireless Networks Architectures and protocols”, 2nd edition, Pearson Education, 2007.
2. Charles E. Perkins, “Adhoc Networking”, Addison – Wesley, 2000.
3. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, “Mobile Ad Hoc networking”, Wiley-IEEE press, 2004.
4. Mohammad Ilyas, “The handbook of adhoc wireless networks”, CRC press,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.



**PRIST**  
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THANJAVUR – 613 403 - TAMIL NADU

**SCHOOL OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

**PROGRAM HANDBOOK**

**B.TECH – FULL TIME**

[REGULATION 2019]

# **COURSE STRUCTURE**

## I - VIII SEMESTERS CURRICULUM AND SYLLABI

### B.TECH (FT) CSE [REGULATION 2019]

#### SEMESTER I

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
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
<b>PRACTICAL</b>						
7.	19150L17	Problem Solving and Python Programming Lab	0	0	4	2
8.	19149L18	Physics and Chemistry Laboratory	0	0	4	2
9.	191VEA19	Value Education				1
<b>TOTAL</b>			<b>19</b>	<b>0</b>	<b>12</b>	<b>25</b>

#### SEMESTER II

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1	19147S21	Technical English	4	0	0	4
2	19148S22	Engineering Mathematics – II	4	0	0	4
3	19149S23A	Physics for Information Science	3	0	0	3
4	19149S24A	Environmental Science And Engineering	3	0	0	3
5	19153S25A	Basic Electrical, Electronics And measurement Engineering	3	0	0	3
6	19150S26A	Programming in C	3	2	0	4
<b>PRACTICAL</b>						
7	19154L27	Engineering Practices Lab	0	0	4	2
8	19150L28A	C Programming Lab	0	0	4	2
9	191ICA29	Fundamentals of Indian constitution and Economy				1
<b>TOTAL</b>			<b>20</b>	<b>2</b>	<b>8</b>	<b>25</b>

**SEMESTER III**

SI. No	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	19148S31A	Discrete Mathematics	4	0	0	4
2.	19150S32	Digital Principles and System Design	4	0	0	4
3.	19150C33	Data Structures	3	0	0	3
4.	19150C34	Object Oriented Programming	3	0	0	3
5.	19150S35	Communication Engineering	3	0	0	3
<b>PRACTICAL</b>						
6.	19150L36	Data Structures Laboratory	0	0	4	2
7.	19150L37	Object Oriented Programming Laboratory	0	0	4	2
8.	19150L38	Digital Systems Laboratory	0	0	4	2
9.	19150L39	Interpersonal Skills/Listening & Speaking	0	0	2	1
<b>TOTAL</b>			<b>17</b>	<b>0</b>	<b>14</b>	<b>24</b>

**SEMESTER IV**

SI. No	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1	19148S41A	Probability and Queuing Theory	4	0	0	4
2	19150C42	Computer Architecture	3	0	0	3
3	19150C43	Database Management Systems	3	0	0	3
4	19150C44	Design and Analysis of Algorithms	3	0	0	3
5	19150C45	Operating Systems	3	0	0	3
6	19150C46	Software Engineering	3	0	0	3
<b>PRACTICAL</b>						
7	19150L47	Database Management Systems Laboratory	0	0	4	2
8	19150L48	Operating Systems Laboratory	0	0	4	2
9	19150L49	Advanced Reading and Writing	0	0	2	1
<b>Research Skill Based (RSB) Course</b>						
10	19150CRS	Research Led Seminar				1
<b>TOTAL</b>			<b>19</b>	<b>0</b>	<b>10</b>	<b>25</b>

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1	19148S51A	Algebra and Number Theory	4	0	0	4
2	19150C52	Computer Networks	3	0	0	3
3	19150C53	Microprocessors and Microcontrollers	3	0	0	3
4	191__OE54__	Open Elective – I	3	0	0	3
5	19150C55	Theory of Computation	3	0	0	3
6	19150C56	Object Oriented Analysis and Design	3	0	0	3
<b>PRACTICAL</b>						
7	19150L57	Microprocessors and Microcontrollers Laboratory	0	0	4	2
8	19150L58	Object Oriented Analysis and Design Laboratory	0	0	4	2
9	19150L59	Networks Laboratory	0	0	4	2
<b>Research Skill Based (RSB) Course</b>						
10	19150CRM	Research Methodology	3	0	0	3
<b>TOTAL</b>			<b>22</b>	<b>0</b>	<b>12</b>	<b>28</b>

**SEMESTER VI**

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1	19150C61	Internet Programming	3	0	0	3
2	19150C62	Artificial Intelligence	3	0	0	3
3	19150C63	Mobile Computing	3	0	0	3
4	19150C64	Compiler Design	3	2	0	4
5	19150C65	Distributed Systems	3	0	0	3
6	19150E66	Elective - I	3	0	0	3
<b>PRACTICAL</b>						
7	19150L61	Internet Programming Laboratory	0	0	4	2
8	19150L62	Mobile Application Development Laboratory	0	0	4	2
9	19150L63	Mini Project	0	0	4	2
10	19150L64	Professional Communication	0	0	2	1
<b>Research Skill Based (RSB) Course</b>						
11	19150CBR	Participation in Bounded Research				1
<b>TOTAL</b>			<b>18</b>	<b>2</b>	<b>14</b>	<b>27</b>

**SEMESTER VII**

SI. No	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1	19150S71	Principles of Management	3	0	0	3
2	19150C72	Cryptography and Network Security	3	0	0	3
3	19150C73	Cloud Computing	3	0	0	3
4	191__OE74__	Open Elective - II	3	0	0	3
5	19150E75__	Elective – II	3	0	0	3
6	19150E76__	Elective – III	3	0	0	3
<b>PRACTICAL</b>						
7	19150L77	Cloud Computing Laboratory	0	0	4	2
8	19150L78	Security Laboratory	0	0	4	2
<b>Research Skill Based (RSB) Course</b>						
9	19150CSR	Design / Socio-Technical Project				3
<b>TOTAL</b>			<b>18</b>	<b>0</b>	<b>8</b>	<b>25</b>

**SEMESTER VIII**

SI. No	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1	19150E81__	Elective – IV	3	0	0	3
2	19150E82__	Elective – V	3	0	0	3
<b>PRACTICAL</b>						
3	19150P83	Project Work	0	0	20	10
4	19150PEE	Program Exit Examination				2
<b>TOTAL</b>			<b>6</b>	<b>0</b>	<b>20</b>	<b>18</b>

**ELECTIVE I (SEMESTER VI)**

SI. No	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1	19150E66A	Data Warehousing and Data Mining	3	0	0	3
2	19150E66B	Software Testing	3	0	0	3
3	19150E66C	Embedded Systems	3	0	0	3
4	19150E66D	Graph Theory and Applications	3	0	0	3
5	19150E66E	Digital Signal Processing	3	0	0	3



**ELECTIVE II (SEMESTER VII)**

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1	19150E75A	Big Data Analytics	3	0	0	3
2	19150E75B	Machine Learning Techniques	3	0	0	3
3	19150E75C	Software Project Management	3	0	2	3
4	19150E75D	Internet of Things	3	0	0	3
5	19150E75E	Service Oriented Architecture	3	0	0	3

**ELECTIVE III (SEMESTER VII)**

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1	19150E76A	Multi-core Architectures And Programming	3	0	0	3
2	19150E76B	Human Computer Interaction	3	0	0	3
3	19150E76C	C# and .Net Programming	3	0	0	3
4	19150E76D	Wireless Adhoc and Sensor Networks	3	0	2	3
5	19150E76E	Advanced Topics on Databases	3	0	0	3

**ELECTIVE IV (SEMESTER VIII)**

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1	19150E81A	Digital Image Processing	3	0	0	3
2	19150E81B	Social Network Analysis	3	0	0	3
3	19150E81C	Information Security	3	0	0	3
4	19150E81D	Cyber Forensics	3	0	0	3
5	19150E81E	Soft Computing	3	0	0	3

**ELECTIVE V (SEMESTER VIII)**

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1	19150E82A	Information Retrieval Techniques	3	0	0	3
2	19150E82B	Natural Language Processing	3	0	2	3
3	19150E82C	Parallel Algorithms	3	0	0	3
4	19150E82D	Speech Processing	3	0	0	3
5	19150E82E	Fundamentals of Nano Science	3	0	0	3

**OPENELECTIVE I (SEMESTER V)**

Sl. No	DEPT	COURSE CODE	COURSE TITLE	L	T	P	C
1.	ECE	19152OE54A	Basics Of Bio Medical Instrumentation	3	0	0	3
2.		19152OE54B	Sensors And Transducers	3	0	0	3
3.	EEE	19153OE54A	Industrial Nano Technology	3	0	0	3
4.		19153OE54B	Energy Conservation and Management	3	0	0	3
5.	MECH	19154OE54A	Renewable energy sources	3	0	0	3
6.		19154OE54B	Automotive Systems	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

**OPENELECTIVE II (SEMESTER VII)**

Sl. No	DEPT	COURSE CODE	COURSE TITLE	L	T	P	C
1.	ECE	19152OE74A	Robotics	3	0	0	3
2.		19152OE74B	Electronic Devices	3	0	0	3
3.	EEE	19153OE74A	Basic Circuit Theory	3	0	0	3
4.		19153OE74B	Introduction To Renewable Energy Systems	3	0	0	3
5.	MECH	19154OE74A	Industrial Safety	3	0	0	3
6.		19154OE74B	Testing Of Materials	3	0	0	3
7.	CIVIL	19155OE74A	Green Building Design	3	0	0	3
8.		19155OE74B	Waste Water Treatment	3	0	0	3

**TOTAL CREDITS - 197****Human value****Environment and****sustainability Gender****Sensitization****Professional Ethics**

**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.

**TOTAL : 60 PERIODS**

## **OUTCOMES:**

### **AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

- Read articles of a general kind in magazines and newspapers.
- Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.
- Comprehend conversations and short talks delivered in English
- Write short essays of a general kind and personal letters and emails in English

## **TEXTBOOKS:**

1. Board of Editors. **Using English** A Coursebook for Undergraduate Engineers and Technologists. Orient BlackSwan Limited, Hyderabad: 2015
2. Richards, C. Jack. **Interchange Students' Book-2** New Delhi: CUP, 2015.

## **REFERENCES:**

1. Bailey, Stephen. Academic Writing: A practical guide for students. New York: Rutledge, 2011.
2. Means, L. Thomas and Elaine Langlois. English & Communication For Colleges. Cengage Learning, USA: 2007
3. Redston, Chris & Gillies Cunningham Face2Face (Pre-intermediate Student's Book & Workbook) Cambridge University Press, New Delhi: 2005
4. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011
5. Dutt P. Kiranmai and Rajeev n Geeta. Basic Communication Skills, Foundation Books: 2013.

**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 EQUATION 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 differentiation 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.

**TEXTBOOKS:**

1. Grewal B.S., —Higher Engineering MathematicsI, 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 MathematicsI, 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
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****12**

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****12**

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****12**

Transfer of heat energy – thermal expansion of solids and liquids – expansion joints - bimetallic strips - thermal conduction, convection and radiation – heat conduction 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****12**

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.

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 : 60 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.

**TEXTBOOKS:**

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.

**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 converter) – 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<sub>2</sub>-O<sub>2</sub> 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.

## TEXTBOOKS:

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.

<b>19150S16</b>	<b>PROBLEM SOLVING AND PYTHON PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>5</b>	<b>1</b>	<b>0</b>	<b>4</b>

## 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.

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.

**TOTAL : 45 PERIODS****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.

**TEXTBOOKS:**

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. John V Guttag, —Introduction to Computation and Programming Using Python``, Revised and 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. Timothy A. Budd, —Exploring Python!, Mc-Graw Hill Education (India) Private Ltd., 2015.
4. Kenneth A. Lambert, —Fundamentals of Python: First Programs!, CENGAGE Learning, 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 to Computer Science using Python 3!, Second edition, Pragmatic Programmers, LLC, 2013.

**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 BOOKS:**

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. 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. 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

## LABORATORY

L P T C

0 0 3 2

### 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

**TOTAL: 60 PERIODS**

### 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.

19149L18

**PYSICS AND CHEMISTRY LABORATORY**  
**(Common to all branches of B.E. / B.Tech Programmes)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>

**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)**

- Determination of rigidity modulus – Torsion pendulum
- Determination of Young's modulus by non-uniform bending method
- (a) Determination of wavelength, and particle size using Laser  
(b) Determination of acceptance angle in an optical fiber.
- Determination of thermal conductivity of a bad conductor – Lee's Disc method.
- Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
- Determination of wavelength of mercury spectrum – spectrometer grating
- Determination of band gap of a semiconductor
- Determination of thickness of a thin wire – Air wedge method

**TOTAL : 30 PERIODS****OUTCOMES:****Upon completion of the course, the students will be able to:**

- 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 viscometry.

**LIST OF EXPERIMENTS**

- Estimation of HCl using  $\text{Na}_2\text{CO}_3$  as primary standard and Determination of alkalinity in water sample.
- Determination of total, temporary & permanent hardness of water by EDTA method.
- Determination of DO content of water sample by Winkler's method.
- Determination of chloride content of water sample by argentometric method.
- Estimation of copper content of the given solution by Iodometry.
- Determination of strength of given hydrochloric acid using pH meter.
- Determination of strength of acids in a mixture of acids using conductivity meter.
- Estimation of iron content of the given solution using potentiometer.
- Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
- Estimation of sodium and potassium present in water using flame photometer.
- Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
- Pseudo first order kinetics-ester hydrolysis.
- Corrosion experiment-weight loss method.
- Determination of CMC.
- Phase change in a solid.
- 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.

**TEXTBOOK:**

- Vogel's Textbook of Quantitative Chemical Analysis (8<sup>TH</sup> edition, 2014).

**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 specialization.

**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- newspapers- 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 charts, graphs- Vocabulary Development- vocabulary used 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/ talks 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:****Learners should 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.

**TEXTBOOKS:**

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. Raman, Meenakshi and Sharma, Sangeetha- Technical Communication Principles and Practice.Oxford University Press: New Delhi,2014.
2. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad,2015
3. Booth-L. Diana, Project Work, Oxford University Press, Oxford: 2014.
4. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007
5. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges. Cengage Learning, USA: 2007

**Students can be asked to read Tagore, Chetan Bhagat and for supplementary reading.**



**OBJECTIVES:**

- The Course prepares second semester engineering and Technology students to:
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- Foster their ability to write convincing job applications and effective reports.
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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 charts, graphs- Vocabulary Development- vocabulary used in formal letters/emails and reports Language Development- impersonal passive voice, numerical adjectives.

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**TOTAL : 60 PERIODS**

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- 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.

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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. Raman, Meenakshi and Sharma, Sangeetha- Technical Communication Principles and Practice.Oxford University Press: New Delhi,2014.
2. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad,2015
3. Booth-L. Diana, Project Work, Oxford University Press, Oxford: 2014.
4. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007
5. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges. Cengage Learning, USA: 2007

**Students can be asked to read Tagore, Chetan Bhagat and for supplementary reading.**

**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  $w=z+c, cz, 1/z, z^2$ - 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.

**TOTAL : 60****PERIODS OUTCOMES:Learners should be able to:**

- After successfully completing the course, the student will have a good understanding of the following topics and their applications:
- Eigen values 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

- 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.

**TEXTBOOKS:**

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 I, 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.

**OBJECTIVES:**

- To understand the essential principles of Physics of semiconductor device and Electron transport properties. Become proficient in magnetic and optical properties of materials and Nano-electronic devices.

**UNIT I ELECTRICAL PROPERTIES OF MATERIALS 12**

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 – Energy bands in solids – tight binding approximation - Electron effective mass – concept of hole

**UNIT II SEMICONDUCTOR PHYSICS 12**

Intrinsic Semiconductors – Energy band diagram – direct and indirect band gap semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Variation of carrier concentration with temperature – variation of Fermi level with temperature and impurity concentration – Carrier transport in Semiconductor: random motion, drift, mobility and diffusion – Hall effect and devices – Ohmic contacts – Schottky diode.

**UNIT III MAGNETIC PROPERTIES OF MATERIALS 12**

Magnetic dipole moment – atomic magnetic moments- magnetic permeability and susceptibility - Magnetic material classification: diamagnetism – paramagnetism – ferromagnetism – antiferromagnetism – ferrimagnetism – Ferromagnetism: origin and exchange interaction- saturation magnetization and Curie temperature – Domain Theory- M versus H behaviour – Hard and soft magnetic materials – examples and uses— Magnetic principle in computer data storage – Magnetic hard disc (GMR sensor).

**UNIT IV OPTICAL PROPERTIES OF MATERIALS 12**

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 - LED – Organic LED – Laser diodes – Optical data storage techniques.

**UNIT V NANO DEVICES 12**

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 structure - Band gap of nanomaterials – Tunneling: single electron phenomena and single electron transistor – Quantum dot laser. Conductivity of metallic nanowires – Ballistic transport – Quantum resistance and conductance – Carbon nanotubes: Properties and applications .

**TOTAL : 60 PERIODS**

**OUTCOMES:****Learners should be able to:**

- Gain knowledge on classical and quantum electron theories, and energy band structure,
- Acquire knowledge on basics of semiconductor physics and its applications in various devices,
- Get knowledge on magnetic properties of materials and their applications in data storage,
- Have the necessary understanding on the functioning of optical materials for optoelectronics,
- Understand the basics of quantum structures and their applications in carbon electronics..

**TEXTBOOKS:**

1. Jasprit Singh, —Semiconductor Devices: Basic Principles, Wiley 2012.
2. Kasap, S.O. —Principles of Electronic Materials and Devices, McGraw-Hill Education, 2007.
3. Kittel, C. —Introduction to Solid State Physics, Wiley, 2005.

**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.

**19153S25A BASIC ELECTRICAL, ELECTRONICS AND MEASUREMENT  
ENGINEERING**

**OBJECTIVES:**

- To understand the fundamentals of electronic circuit constructions.
- To learn the fundamental laws, theorems of electrical circuits and also to analyze them
- To study the basic principles of electrical machines and their performance
- To study the different energy sources, protective devices and their field applications
- To understand the principles and operation of measuring instruments and transducers

**UNIT I ELECTRICAL CIRCUITS ANALYSIS 12**

Ohms Law, Kirchhoff's Law-Instantaneous power- series and parallel circuit analysis with resistive, capacitive and inductive network - nodal analysis, mesh analysis- network theorems – Thevenin's theorem, Norton theorem, maximum power transfer theorem and superposition theorem, three phase supply-Instantaneous, Reactive and apparent power-star delta conversion.

**UNIT II ELECTRICAL MACHINES 12**

DC and AC ROTATING MACHINES:Types, Construction, principle, Emf and torque equation, application Speed Control- Basics of Stepper Motor – Brushless DC motors- Transformers- Introduction- types and construction, working principle of Ideal transformer-Emf equation- All day efficiency calculation.

**UNIT III UTILIZATION OF ELECTRICAL POWER 12**

Renewable energy sources-wind and solar panels. Illumination by lamps- Sodium Vapour, Mercury vapour, Fluorescent tube. Domestic refrigerator and air conditioner- Electric circuit, construction and working principle. Batteries-NiCd, Pb Acid and Li ion– Charge and Discharge Characteristics. Protection- need for earthing, fuses and circuit breakers.Energy Tariff calculation for domestic loads.

**UNIT IV ELECTRONIC CIRCUITS 12**

PN Junction-VI Characteristics of Diode, zener diode, Transistors configurations - amplifiers. Op amps- Amplifiers, oscillator,rectifiers, differentiator, integrator, ADC, DAC. Multi vibrator using 555 Timer IC . Voltage regulator IC using LM 723,LM 317.

**UNIT V ELECTRICAL MEASUREMENT 12**

Characteristic of measurement-errors in measurement, torque in indicating instruments- moving coil and moving iron meters, Energy meter and watt meter. Transducers- classification-thermo electric, RTD, Strain gauge, LVDT, LDR and piezoelectric. Oscilloscope-CRO.

**TOTAL : 60 PERIODS**

**OUTCOMES:**

**Learners should be able to:**

- Discuss the essentials of electric circuits and analysis.
- Discuss the basic operation of electric machines and transformers
- Introduction of renewable sources and common domestic loads.
- Introduction to measurement and metering for electric circuits.

**TEXTBOOKS:**

1. D.P. Kotharti and I.J Nagarath, Basic Electrical and Electronics Engineering, Mc Graw Hill, 2016,Third Edition.
2. M.S. Sukhija and T.K. Nagsarkar, Basic Electrical and Electronic Engineering, Oxford, 2016.

**REFERENCES:**

1. S.B. Lal Seksena and Kaustuv Dasgupta, Fundaments of Electrical Engineering, Cambridge, 2016
2. B.L Theraja, Fundamentals of Electrical Engineering and Electronics. Chand & Co, 2008.
3. S.K.Sahdev, Basic of Electrical Engineering, Pearson, 2015
4. John Bird, —Electrical and Electronic Principles and Technology, Fourth Edition, Elsevier, 2010.
5. Mittle,Mittal, Basic Electrical Engineering, 2nd Edition, Tata McGraw-Hill Edition, 2016.
6. C.L.Wadhwa, —Generation, Distribution and Utilisation of Electrical Energy, New Age international pvt.ltd.,2003.



**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.

12

**UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY**

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**

12

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 ENVIRONMENTAL POLLUTION**

12

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 12**

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 12**

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 : 60 PERIODS**

#### **OUTCOMES:**

##### **Learners should be able to:**

- 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 disas

#### **TEXTBOOKS:**

1. Benny Joseph, ‘\_Environmental Science and Engineering’, Tata McGraw-Hill, New Delhi, 2006.
2. 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. 2. Erach Bharucha, ‘—Textbook of Environmental Studies’, Universities Press(I) PVT, LTD, Hyderabad, 2015.
3. 3. Rajagopalan, R, ‘\_Environmental Studies-From Crisis to Cure’, Oxford University Press, 2005.
4. 4. G. Tyler Miller and Scott E. Spoolman, ‘—Environmental Sciencel’, Cengage Learning India PVT, LTD, Delhi, 2014.

**OBJECTIVES**

5 1 0 4

- To develop C Programs using basic programming constructs
- To develop C programs using arrays and strings
- To develop applications in C using functions , pointers and structures
- To do input/output and file handling in C

**UNIT I BASICS OF C PROGRAMMING**

12

Introduction to programming paradigms - Structure of C program - C programming: 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

**UNIT II ARRAYS AND STRINGS**

9+3

Introduction to Arrays: Declaration, Initialization – One dimensional array – Example Program: Computing Mean, Median and Mode - Two dimensional arrays – Example Program: Matrix Operations (Addition, Scaling, Determinant and Transpose) - String operations: length, compare, concatenate, copy – Selection sort, linear and binary search

**UNIT III FUNCTIONS AND POINTERS**

9+3

Introduction to functions: Function prototype, function definition, function call, Built-in functions (string functions, math functions) – Recursion – Example Program: Computation of Sine series, Scientific calculator using built-in functions, Binary Search using recursive functions – Pointers – Pointer operators– Pointer arithmetic – Arrays and pointers – Array of pointers – Example Program: Sorting of names– Parameter passing: Pass by value, Pass by reference – Example Program: Swapping of two numbers and changing the value of a variable using pass by reference

**UNIT IV STRUCTURES**

9+3

Structure - Nested structures – Pointer and Structures – Array of structures – Example Program using structures and pointers – Self referential structures – Dynamic memory allocation - Singly linked list - typedef

**UNIT V FILE PROCESSING**

9+3

Files – Types of file processing: Sequential access, Random access – Sequential access file - Example Program: Finding average of numbers stored in sequential access file - Random access file - Example Program: Transaction processing using random access files – Command line arguments

**TOTAL : 60****PERIODS OUTCOMES:****Learners should be able to:**

- Develop simple applications in C using basic constructs
- Design and implement applications using arrays and strings
- Develop and implement applications in C using functions and pointers.
- Develop applications in C using structures.
- Design applications using sequential and random access file processing.

**TEXTBOOKS:**

1. Reema Thareja, —Programming in C++, Oxford University Press, Second Edition, 2016.
2. Kernighan, B.W and Ritchie,D.M, —The C Programming language, Second Edition, Pearson Education, 2006

**REFERENCES:**

1. Paul Deitel and Harvey Deitel, —C How to Program, Seventh edition, Pearson Publication
2. Juneja, B. L and Anita Seth, —Programming in C++, CENGAGE Learning India Pvt. Ltd., 2011
3. Pradip Dey, Manas Ghosh, —Fundamentals of Computing and Programming in C++, First Edition, Oxford University Press, 2009
4. Anita Goel and Ajay Mittal, —Computer Fundamentals and Programming in C++, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
5. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", McGraw-Hill Education, 1996.

**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)****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.

**TOTAL: 60 PERIODS**

#### **OUTCOMES:**

**On successful completion of this course, the student will be able to:**

- 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, foundry and fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, soldering practices.

## **CIVIL**

- |   |                  |
|---|------------------|
| 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 |         |

**OBJECTIVES:**

- To develop programs in C using basic constructs.
- To develop applications in C using strings, pointers, functions, structures.
- To develop applications in C using file processing.

**LIST OF EXPERIMENTS:**

1. Programs using I/O statements and expressions.
2. Programs using decision-making constructs.
3. Write a program to find whether the given year is leap year or Not? (Hint: not every centurion year is a leap. For example 1700, 1800 and 1900 is not a leap year)
4. Design a calculator to perform the operations, namely, addition, subtraction, multiplication, division and square of a number.
5. Check whether a given number is Armstrong number or not?
6. Given a set of numbers like <10, 36, 54, 89, 12, 27>, find sum of weights based on the following conditions.
  - 5 if it is a perfect cube.
  - 4 if it is a multiple of 4 and divisible by 6.
  - 3 if it is a prime number.Sort the numbers based on the weight in the increasing order as shown below <10,its weight>,<36,its weight><89,its weight>
7. Populate an array with height of persons and find how many persons are above the average height.
8. Populate a two dimensional array with height and weight of persons and compute the Body Mass Index of the individuals.
9. Given a string —a\$bcd./fg| find its reverse without changing the position of special characters.  
(Example input:a@gh%;j and output:j@hg%;a)
10. Convert the given decimal number into binary, octal and hexadecimal numbers using user defined functions.
11. From a given paragraph perform the following using built-in functions:
  - a. Find the total number of words.
  - b. Capitalize the first word of each sentence.
  - c. Replace a given word with another word.
12. Solve towers of Hanoi using recursion.
13. Sort the list of numbers using pass by reference.
14. Generate salary slip of employees using structures and pointers.
15. Compute internal marks of students for five different subjects using structures and functions.
16. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using random access file.



17. Count the number of account holders whose balance is less than the minimum balance using sequential access file.

**Mini project**

18. Create a —Railway reservation system with the following modules

- Booking
- Availability checking
- Cancellation
- Prepare chart

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- Develop C programs for simple applications making use of basic constructs, arrays and strings.
- Develop C programs involving functions, recursion, pointers, and structures.

**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 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****12**

Propositional logic – Propositional equivalences - Predicates and quantifiers – Nested quantifiers – Rules of inference - Introduction to proofs – Proof methods and strategy.

**UNIT II COMBINATORICS****12**

Mathematical induction – Strong induction and well ordering – The basics of counting – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications

**UNIT III GRAPHS****12**

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****12**

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****12**

Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra.

**TOTAL : 60 PERIODS****OUTCOMES:****At the end of the course, students would:**

- Have knowledge of the concepts needed to test the logic of a program.
- Have an understanding in identifying structures on many levels.
- Be aware of a class of functions which transform a finite set into another finite set which relates to input and output functions in computer science.
- Be aware of the counting principles.
- Be exposed to concepts and properties of algebraic structures such as groups, rings and fields.

**TEXTBOOKS:**

1. Rosen, K.H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2011.
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", 4th Edition, Pearson Education Asia, Delhi, 2007.
2. Lipschutz, S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.

**OBJECTIVES:**

- To design digital circuits using simplified Boolean functions
- To analyze and design combinational circuits
- To analyze and design synchronous and asynchronous sequential circuits
- To understand Programmable Logic Devices
- To write HDL code for combinational and sequential circuits

**UNIT I BOOLEAN ALGEBRA AND LOGIC GATES 12**

Number Systems - Arithmetic Operations - Binary Codes- Boolean Algebra and Logic Gates- Theorems and Properties of Boolean Algebra - Boolean Functions - Canonical and Standard Forms- Simplification of Boolean Functions using Karnaugh Map - Logic Gates – NAND and NOR Implementations.

**UNIT II COMBINATIONAL LOGIC 12**

Combinational Circuits – Analysis and Design Procedures - Binary Adder-Subtractor - Decimal Adder - Binary Multiplier - Magnitude Comparator - Decoders – Encoders – Multiplexers - Introduction to HDL – HDL Models of Combinational circuits.

**UNIT III SYNCHRONOUS SEQUENTIAL LOGIC 12**

Sequential Circuits - Storage Elements: Latches , Flip-Flops - Analysis of Clocked Sequential Circuits - State Reduction and Assignment - Design Procedure - Registers and Counters - HDL Models of Sequential Circuits.

**UNIT IV ASYNCHRONOUS SEQUENTIAL LOGIC 12**

Analysis and Design of Asynchronous Sequential Circuits – Reduction of State and Flow Tables – Race- free State Assignment – Hazards.

**UNIT V MEMORY AND PROGRAMMABLE LOGIC 12**

RAM – Memory Decoding – Error Detection and Correction - ROM - Programmable Logic Array – Programmable Array Logic – Sequential Programmable Devices.

**TOTAL : 60 PERIODS****OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Simplify Boolean functions using KMap
- Design and Analyze Combinational and Sequential Circuits
- Implement designs using Programmable Logic Devices
- Write HDL code for combinational and Sequential Circuits

**TEXTBOOKS:**

1. M. Morris R. Mano, Michael D. Ciletti, —Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilogl, 6th Edition, Pearson Education, 2017.

**REFERENCES:**

1. G. K. Kharate, Digital Electronics, Oxford University Press, 2010
2. John F. Wakerly, Digital Design Principles and Practices, Fifth Edition, Pearson Education, 2017.
3. Charles H. Roth Jr, Larry L. Kinney, Fundamentals of Logic Design, Sixth Edition, CENGAGE Learning, 2013
4. Donald D. Givone, Digital Principles and Designl, Tata Mc Graw Hill, 2003.

**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.

**TEXTBOOKS:**

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

**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****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

**TEXTBOOKS:**

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.

**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

**UNIT II 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,

**TOTAL : 45 PERIODS****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.

**TEXTBOOKS:**

1. H Taub, D L Schilling, G Saha, —Principles of Communication Systems|| 3/e, 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 Press, 2007
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.

**OBJECTIVES:**

- To implement linear and non-linear data structures
- To understand the different operations of search trees
- To implement graph traversal algorithms
- To get familiarized to sorting and searching algorithms
  
- Array implementation of Stack and Queue ADTs
- Array implementation of List ADT
- Linked list implementation of List, Stack and Queue ADTs
- Applications of List, Stack and Queue ADTs
- Implementation of Binary Trees and operations of Binary Trees
- Implementation of Binary Search Trees
- Implementation of AVL Trees
- Implementation of Heaps using Priority Queues.
- Graph representation and Traversal algorithms
- Applications of Graphs
- Implementation of searching and sorting algorithms
- Hashing – any two collision techniques

**TOTAL : 60 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Write functions to implement linear and non-linear data structure operations
- Suggest appropriate linear / non-linear data structure operations for solving a given problem
- Appropriately use the linear / non-linear data structure operations for a given problem
- Apply appropriate hash functions that result in a collision free scenario for data storage and retrieval



**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.

**TOTAL : 60 PERIODS**

**OUTCOMES:**

**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.

**OBJECTIVES:**

- To understand the various basic logic gates
- To design and implement the various combinational circuits
- To design and implement combinational circuits using MSI devices.
- To design and implement sequential circuits
- To understand and code with HDL programming

**LIST OF EXPERIMENTS**

1. Verification of Boolean Theorems using basic gates.
2. Design and implementation of combinational circuits using basic gates for arbitrary functions, code converters.
3. Design and implement Half/Full Adder and Subtractor.
4. Design and implement combinational circuits using MSI devices:
  - a. 4 – bit binary adder / subtractor
  - b. Parity generator / checker
  - c. Magnitude Comparator
  - d. Application using multiplexers
5. Design and implement shift-registers.
6. Design and implement synchronous counters.
7. Design and implement asynchronous counters.
8. Coding combinational circuits using HDL.
9. Coding sequential circuits using HDL.
10. Design and implementation of a simple digital system (Mini Project).

**TOTAL : 60 PERIODS****OUTCOMES:****Upon completion of the course, the students will be able to:**

- Implement simplified combinational circuits using basic logic gates
- Implement combinational circuits using MSI devices
- Implement sequential circuits like registers and counters
- Simulate combinational and sequential circuits using HDL

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:****LABORATORY REQUIREMENT FOR BATCH OF 30 STUDENTS HARDWARE:**

1. Digital trainer kits - 30
2. Digital ICs required for the experiments in sufficient numbers

**SOFTWARE:**

1. HDL simulator.

**19150L39 INTERPERSONAL SKILLS/LISTENING & SPEAKING****L T P C****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, the student should be able to:**

- Listen and respond appropriately.
- Participate in group discussions
- Make effective presentations
- Participate confidently and appropriately in conversations both formal and informal

**TEXTBOOKS:**

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 Mamta Bhatnagar. 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. Vargo, Mari. Speak Now Level 4. Oxford University Press: Oxford, 2013.
4. Richards C. Jack. Person to Person (Starter). Oxford University Press: Oxford, 2006.
5. Ladousse, Gillian Porter. Role Play. Oxford University Press: Oxford, 2014

19148C41A

**PROBABILITY AND QUEUING THEORY**

**L T P C**

**4 0 0 4**

**OBJECTIVES:**

- To provide necessary basic concepts in probability and random processes for applications such as 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.
- To understand the basic concepts of random processes which are widely used in IT fields.
- To understand the concept of queueing models and apply in engineering.
- To understand the significance of advanced queueing models.
- To provide the required mathematical support in real life problems and develop probabilistic models which can be used in several areas of science and engineering.

**12**

**UNIT I PROBABILITY AND RANDOM VARIABLES**

Probability – 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 RANDOM PROCESSES**

**12**

Classification – Stationary process – Markov process - Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations – Limiting distributions.

**UNIT IV QUEUEING MODELS**

**12**

Markovian queues – Birth and death processes – Single and multiple server queueing models – Little’s formula - Queues with finite waiting rooms – Queues with impatient customers : Balking and reneing.

**UNIT V ADVANCED QUEUEING MODELS**

**12**

Finite source models - M/G/1 queue – Pollaczek Khinchin formula - M/D/1 and M/EK/1 as special cases – Series queues – Open Jackson networks.

**TOTAL : 60 PERIODS**

**OUTCOMES:**

**Upon successful completion of the course, students should 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 random processes in engineering disciplines.
- Acquire skills in analyzing queueing models.
- Understand and characterize phenomenon which evolve with respect to time in a

probabilistic manner

**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., —Fundamentals of Applied Probability and Random Processes", Elsevier, 1st Indian Reprint, 2007.

**REFERENCES:**

1. Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill Edition, New Delhi, 2004.
2. Taha, H.A., "Operations Research", 9th Edition, Pearson India Education Services, Delhi, 2016.
3. Trivedi, K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", 2nd Edition, John Wiley and Sons, 2002.
4. Yates, R.D. and Goodman. D. J., "Probability and Stochastic Processes", 2nd Edition, Wiley India Pvt. Ltd., Bangalore, 2012.

**OBJECTIVES:**

- To learn the basic structure and operations of a computer.
- To learn the arithmetic and logic unit and implementation of fixed-point and floating point arithmetic unit.
- To learn the basics of pipelined execution.
- To understand parallelism and multi-core processors.
- To understand the memory hierarchies, cache memories and virtual memories.
- To learn the different ways of communication with I/O devices.

9

**UNIT I BASIC STRUCTURE OF A COMPUTER SYSTEM**

Functional Units – Basic Operational Concepts – Performance – Instructions: Language of the Computer – Operations, Operands – Instruction representation – Logical operations – decision making – MIPS Addressing.

**UNIT II ARITHMETIC FOR COMPUTERS**

9

Addition and Subtraction – Multiplication – Division – Floating Point Representation – Floating Point Operations – Subword Parallelism

**UNIT III PROCESSOR AND CONTROL UNIT**

9

A Basic MIPS implementation – Building a Datapath – Control Implementation Scheme – Pipelining – Pipelined datapath and control – Handling Data Hazards & Control Hazards – Exceptions.

**UNIT IV PARALLELISIM**

9

Parallel processing challenges – Flynn’s classification – SISD, MIMD, SIMD, SPMD, and Vector Architectures - Hardware multithreading – Multi-core processors and other Shared Memory Multiprocessors - Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing Multiprocessors.

**UNIT V MEMORY & I/O SYSTEMS**

9

Memory Hierarchy - memory technologies – cache memory – measuring and improving cache performance – virtual memory, TLB’s – Accessing I/O Devices – Interrupts – Direct Memory Access –Bus structure – Bus operation – Arbitration – Interface circuits - USB.

**TOTAL :45 PERIODS****OUTCOMES:**

**At the end of the course, the student should be able to:**

- Understand the basics structure of computers, operations and instructions.
- Design arithmetic and logic unit.
- Understand pipelined execution and design control unit.
- Understand parallel processing architectures.
- Understand the various memory systems and I/O communication.



**TEXTBOOKS:**

1. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, Morgan Kaufmann / Elsevier, 2014.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, Computer Organization and Embedded Systems, Sixth Edition, Tata McGraw Hill, 2012.

**REFERENCES:**

1. William Stallings, Computer Organization and Architecture – Designing for Performance, Eighth Edition, Pearson Education, 2010.
2. John P. Hayes, Computer Architecture and Organization, Third Edition, Tata McGraw Hill, 2012.
3. John L. Hennessey and David A. Patterson, Computer Architecture – A Quantitative Approach, Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012.

19150C43

**DATABASE MANAGEMENT SYSTEMS**

**L T P C**

**3 0 0 3**

**OBJECTIVES:**

- To learn the fundamentals of data models and to represent a database system using ER diagrams.
- To study SQL and relational database design.
- To understand the internal storage structures using different file and indexing techniques which will help in physical DB design.
- To understand the fundamental concepts of transaction processing- concurrency control techniques and recovery procedures.
- To have an introductory knowledge about the Storage and Query processing Techniques

**UNIT I RELATIONAL DATABASES 9**

Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features – Embedded SQL– Dynamic SQL

**UNIT II DATABASE DESIGN 9**

Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping – Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form

**UNIT III TRANSACTIONS 9**

Transaction Concepts – ACID Properties – Schedules – Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Deadlock – Transaction Recovery - Save Points – Isolation Levels – SQL Facilities for Concurrency and Recovery.

**UNIT IV IMPLEMENTATION TECHNIQUES 9**

RAID – File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics and Cost Estimation.

**UNIT V ADVANCED TOPICS 9**

Distributed Databases: Architecture, Data Storage, Transaction Processing – Object-based Databases: Object Database Concepts, Object-Relational features, ODMG Object Model, ODL, OQL - XML Databases: XML Hierarchical Model, DTD, XML Schema, XQuery – 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:**

- Classify the modern and futuristic database applications based on size and complexity
- Map ER model to Relational model to perform database design effectively
- Write queries using normalization criteria and optimize queries
- Compare and contrast various indexing strategies in different database systems
- Appraise how advanced databases differ from traditional databases.

**TEXTBOOKS:**

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, —Database System Concepts, Sixth Edition, Tata McGraw Hill, 2011.
2. Ramez Elmasri, Shamkant B. Navathe, —Fundamentals of Database Systems, Sixth Edition, Pearson Education, 2011.

**REFERENCES:**

1. 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.
3. G.K.Gupta, "Database Management Systems, Tata McGraw Hill, 2011.

**OBJECTIVES:**

- To understand and apply the algorithm analysis techniques.
- To critically analyze the efficiency of alternative algorithmic solutions for the same problem
- To understand different algorithm design techniques.
- To understand the limitations of Algorithmic power.

**UNIT I INTRODUCTION****9**

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****9**

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****9**

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****9**

The Simplex Method - The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs, Stable marriage Problem.

**UNIT V COPING WITH THE 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 – Travelling Salesman Problem - Approximation Algorithms for NP-Hard Problems – Travelling Salesman problem – Knapsack problem.

**TOTAL : 45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Design algorithms for various computing problems.
- Analyze the time and space complexity of algorithms.
- Critically analyze the different algorithm design techniques for a given problem.
- Modify existing algorithms to improve efficiency.

**TEXTBOOKS:**

1. Anany Levitin, —Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2012.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2007.

**REFERENCES:**

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, Third Edition, PHI Learning Private Limited, 2012.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, —Data Structures and Algorithms, Pearson Education, Reprint 2006.
3. Harsh Bhasin, —Algorithms Design and Analysis, Oxford university press, 2016.
4. S. Sridhar, —Design and Analysis of Algorithms, Oxford university press, 2014.
5. <http://nptel.ac.in/>

**OBJECTIVES:**

- To understand the basic concepts and functions of operating systems.
- To understand Processes and Threads
- To analyze Scheduling algorithms.
- To understand the concept of Deadlocks.
- To analyze various memory management schemes.
- To understand I/O management and File systems.
- To be familiar with the basics of Linux system and Mobile OS like iOS and Android.

**UNIT I OPERATING SYSTEM OVERVIEW****9**

Computer System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview-objectives and functions, Evolution of Operating System.- Computer System Organization Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.

**UNIT II PROCESS MANAGEMENT****9**

Processes - Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication; CPU Scheduling - Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real time scheduling; Threads- Overview, Multithreading models, Threading issues; Process Synchronization - The critical-section problem, Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization, Critical regions, Monitors; Deadlock - System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

**UNIT III STORAGE MANAGEMENT****9**

Main Memory – Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, 32 and 64 bit architecture Examples; Virtual Memory – Background, Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, OS Examples.

**UNIT IV FILE SYSTEMS AND I/O SYSTEMS****9**

Mass Storage system – Overview of Mass Storage Structure, Disk Structure, Disk Scheduling and Management, swap space 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, Efficiency and Performance, Recovery; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem, Streams, Performance.

**UNIT V CASE STUDY****9**

Linux System - Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, Input-Output Management, File System, Inter-process Communication; Mobile OS - iOS and Android - Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Analyze various scheduling algorithms.
- Understand deadlock, prevention and avoidance algorithms.
- Compare and contrast various memory management schemes.
- Understand the functionality of file systems.
- Perform administrative tasks on Linux Servers.
- Compare iOS and Android Operating Systems.

**TEXTBOOKS:**

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, —Operating System Concepts, 9th Edition, John Wiley and Sons Inc., 2012.

**REFERENCES:**

1. Ramaz Elmasri, A. Gil Carrick, David Levine, —Operating Systems – A Spiral Approach, Tata McGraw Hill Edition, 2010.
2. Achyut S.Godbole, Atul Kahate, —Operating Systems, McGraw Hill Education, 2016.
3. Andrew S. Tanenbaum, —Modern Operating Systems, Second Edition, Pearson Education, 2004.
4. Gary Nutt, —Operating Systems, Third Edition, Pearson Education, 2004.
5. Harvey M. Deitel, —Operating Systems, Third Edition, Pearson Education, 2004.
6. Daniel P Bovet and Marco Cesati, —Understanding the Linux kernel, 3rd edition, O'Reilly, 2005.
7. Neil Smyth, —iPhone iOS 4 Development Essentials – Xcode, Fourth Edition, Payload media, 2011.

**OBJECTIVES:**

- To understand the phases in a software project
- To understand fundamental concepts of requirements engineering and Analysis Modeling.
- To understand the various software design methodologies
- To learn various testing and maintenance measures

**UNIT I SOFTWARE PROCESS AND AGILE DEVELOPMENT 9**

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models – Introduction to Agility-Agile process-Extreme programming-XP Process.

**UNIT II REQUIREMENTS ANALYSIS AND SPECIFICATION 9**

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.

**UNIT III SOFTWARE DESIGN 9**

Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design -Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.

**UNIT IV TESTING AND MAINTENANCE 9**

Software testing fundamentals-Internal and external views of Testing-white box testing - basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing And Debugging –Software Implementation Techniques: Coding practices-Refactoring-Maintenance and Reengineering-BPR model-Reengineering process model-Reverse and Forward Engineering.

**UNIT V PROJECT MANAGEMENT 9**

Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection - Risk Management-Risk Identification-RMMM Plan-CASE TOOLS

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Identify the key activities in managing a software project.
- Compare different process models.
- Concepts of requirements engineering and Analysis Modeling.
- Apply systematic procedure for software design and deployment.



- Compare and contrast the various testing and maintenance.
- Manage project schedule, estimate project cost and effort required.

**TEXTBOOKS:**

1. Roger S. Pressman, —Software Engineering – A Practitioner’s Approach, Seventh Edition, McGraw-Hill International Edition, 2010.
2. Ian Sommerville, —Software Engineering, 9th Edition, Pearson Education Asia, 2011.

**REFERENCES:**

1. Rajib Mall, —Fundamentals of Software Engineering, Third Edition, PHI Learning Private Limited, 2009.
2. Pankaj Jalote, —Software Engineering, A Precise Approach, Wiley India, 2010.
3. Kelkar S.A., —Software Engineering, Prentice Hall of India Pvt Ltd, 2007.
4. Stephen R. Schach, —Software Engineering, Tata McGraw-Hill Publishing Company Limited, 2007.
5. <http://nptel.ac.in>

19150L47

**DATABASE MANAGEMENT SYSTEMS  
LABORATORY**

**L T P C**

**0 0 3 2**

**OBJECTIVES:**

- The aim of this laboratory is to inculcate the abilities of applying the principles of the database management systems. This course aims to prepare the students for projects where a proper implementation of databases will be required
  - To understand data definitions and data manipulation commands
  - To learn the use of nested and join queries
  - To understand functions, procedures and procedural extensions of data bases
  - To be familiar with the use of a front end tool
  - To understand design and implementation of typical database applications
1. Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements
  2. Database Querying – Simple queries, Nested queries, Sub queries and Joins
  3. Views, Sequences, Synonyms
  4. Database Programming: Implicit and Explicit Cursors
  5. Procedures and Functions
  6. Triggers
  7. Exception Handling
  8. Database Design using ER modeling, normalization and Implementation for any application
  9. Database Connectivity with Front End Tools
  10. Case Study using real life database applications

**TOTAL:60 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- Use typical data definitions and manipulation commands.
- Design applications to test Nested and Join Queries
- Implement simple applications that use Views
- Implement applications that require a Front-end Tool
- Critically analyze the use of Tables, Views, Functions and Procedures

**OBJECTIVES:**

- To learn Unix commands and shell programming
- To implement various CPU Scheduling Algorithms
- To implement Process Creation and Inter Process Communication.
- To implement Deadlock Avoidance and Deadlock Detection Algorithms
- To implement Page Replacement Algorithms
- To implement File Organization and File Allocation Strategies.

**LIST OF EXPERIMENTS**

1. Basics of UNIX commands
2. Write programs using the following system calls of UNIX operating system fork, exec, getpid, exit, wait, close, stat, opendir, readdir
3. Write C programs to simulate UNIX commands like cp, ls, grep, etc.
4. Shell Programming
5. Write C programs to implement the various CPU Scheduling Algorithms
6. Implementation of Semaphores
7. Implementation of Shared memory and IPC 8. Bankers Algorithm for Deadlock Avoidance
9. Implementation of Deadlock Detection Algorithm
10. Write C program to implement Threading & Synchronization Applications
11. Implementation of the following Memory Allocation Methods for fixed partition
  - a) First Fit
  - b) Worst Fit
  - c) Best Fit
12. Implementation of Paging Technique of Memory Management
13. Implementation of the following Page Replacement Algorithms
  - a) FIFO
  - b) LRU
  - c) LFU
14. Implementation of the various File Organization Techniques
15. Implementation of the following File Allocation Strategies
  - a) Sequential
  - b) Indexed
  - c) Linked

**TOTAL : 60 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Compare the performance of various CPU Scheduling Algorithms
- Implement Deadlock avoidance and Detection Algorithms
- Implement Semaphores
- Create processes and implement IPC
- Analyze the performance of the various Page Replacement Algorithms
- Implement File Organization and File Allocation Strategies

**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- visumes – 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, the student should be able to:**

- Write different types of essays.
- Write winning job applications.
- Read and evaluate texts critically.
- Display critical thinking in various professional contexts.

**TEXTBOOKS:**

1. Gramer F. Margot and Colin S. Ward **Reading and Writing (Level 3)** Oxford University Press: Oxford, 2011
2. Debra Daise, CharlNorloff, and Paul Carne **Reading and Writing (Level 4)** 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, 2000

**OBJECTIVES:**

- To introduce the basic notions of groups, rings, fields which will then be used to solve related problems.
- To introduce and apply the concepts of rings, finite fields and polynomials.
- To understand the basic concepts in number theory
- To examine the key questions in the Theory of Numbers.
- 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 GROUPS AND RINGS****12**

Groups : Definition - Properties - Homomorphism - Isomorphism - Cyclic groups - Cosets - Lagrange's theorem. Rings: Definition - Sub rings - Integral domain - Field - Integer modulo  $n$  - Ring homomorphism.

**UNIT II FINITE FIELDS AND POLYNOMIALS****9**

Rings - Polynomial rings - Irreducible polynomials over finite fields - Factorization of polynomials over finite fields.

**UNIT III DIVISIBILITY THEORY AND CANONICAL DECOMPOSITIONS****9**

Division algorithm – Base -  $b$  representations – Number patterns – Prime and composite numbers – GCD – Euclidean algorithm – Fundamental theorem of arithmetic – LCM.

**UNIT IV DIOPHANTINE EQUATIONS AND CONGRUENCES****9**

Linear Diophantine equations – Congruence's – Linear Congruence's - Applications: Divisibility tests - Modular exponentiation-Chinese remainder theorem –  $2 \times 2$  linear systems.

**UNIT V CLASSICAL THEOREMS AND MULTIPLICATIVE FUNCTIONS****9**

Wilson's theorem – Fermat's little theorem – Euler's theorem – Euler's Phi functions – Tau and Sigma functions.

**TOTAL : 60 PERIODS****OUTCOMES:**

**At the end of the course, the student should be able to:**

- Apply the basic notions of groups, rings, fields which will then be used to solve related problems.
- Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
- Demonstrate accurate and efficient use of advanced algebraic techniques.
- Demonstrate their mastery by solving non - trivial problems related to the concepts, and by proving simple theorems about the, statements proven by the text.
- Apply integrated approach to number theory and abstract algebra, and provide a firm basis for further reading and study in the subject.

**TEXTBOOKS:**

1. Grimaldi, R.P and Ramana, B.V., "Discrete and Combinatorial Mathematics", Pearson Education, 5th Edition, New Delhi, 2007.
2. Koshy, T., —Elementary Number Theory with Applications, Elsevier Publications, New Delhi, 2002.

**REFERENCES:**

1. Lidl, R. and Pitz, G, "Applied Abstract Algebra", Springer Verlag, New Delhi, 2nd Edition, 2006.
2. Niven, I., Zuckerman.H.S., and Montgomery, H.L., —An Introduction to Theory of Numbers, John Wiley and Sons , Singapore, 2004.
3. San Ling and Chaoping Xing, —Coding Theory – A first Course, Cambridge Publications, Cambridge, 2004.

**OBJECTIVES:**

- To understand the protocol layering and physical level communication.
- To analyze the performance of a network.
- To understand the various components required to build different networks.
- 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 PHYSICAL LAYER**

9

Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks – Packet Switching.

**UNIT II DATA-LINK LAYER & MEDIA ACCESS**

9

Introduction – Link-Layer Addressing – DLC Services – Data-Link Layer Protocols – HDLC – PPP - Media Access Control - Wired LANs: Ethernet - Wireless LANs – Introduction – IEEE 802.11, Bluetooth – Connecting Devices.

**UNIT III NETWORK LAYER**

9

Network Layer Services – Packet switching – Performance – IPV4 Addresses – Forwarding of IP Packets - Network Layer Protocols: IP, ICMP v4 – Unicast Routing Algorithms – Protocols – Multicasting Basics – IPV6 Addressing – IPV6 Protocol.

**UNIT IV TRANSPORT LAYER**

9

Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol – Transmission Control Protocol – SCTP.

**UNIT V APPLICATION LAYER**

9

WWW and HTTP – FTP – Email – Telnet – SSH – DNS – SNMP.

**TOTAL : 45 PERIODS****OUTCOMES:**

**At the end of the course, the student should be able to:**

- Understand the basic layers and its functions in computer networks.
- Evaluate the performance of a network.
- Understand the basics of how data flows from one node to another.
- Analyze and design routing algorithms.
- Design protocols for various functions in the network.
- Understand the working of various application layer protocols.

**TEXTBOOKS:**

1. Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition TMH, 2013.

**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 and Fred Baker, Computer Networks: An Open Source Approach, McGraw Hill Publisher, 2011.
5. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Sixth Edition, Pearson Education, 2013.

**OBJECTIVES:**

- To understand the Architecture of 8086 microprocessor.
- To learn the design aspects of I/O and Memory Interfacing circuits.
- To interface microprocessors with supporting chips.
- To study the Architecture of 8051 microcontroller.
- To design a microcontroller based system

**UNIT I THE 8086 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 – Interrupts and interrupt service routines – Byte and String Manipulation.

**UNIT II 8086 SYSTEM BUS STRUCTURE****9**

8086 signals – Basic configurations – System bus timing – System design using 8086 – I/O programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors.

**UNIT III I/O INTERFACING****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 – Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.

**UNIT IV MICROCONTROLLER****9**

Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

**UNIT V INTERFACING MICROCONTROLLER****9**

Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARM processors

**TOTAL : 45 PERIODS****OUTCOMES:**

**At the end of the course, the student should be able to:**

- Understand and execute programs based on 8086 microprocessor.
- Design Memory Interfacing circuits.
- Design and interface I/O circuits.
- Design and implement 8051 microcontroller based systems.

**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. (UNIT I- 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)

**REFERENCES:**

1. Douglas V.Hall, —Microprocessors and Interfacing, Programming and Hardware, TMH, 2012
2. A.K.Ray, K.M.Bhurchandi, —Advanced Microprocessors and Peripherals —3<sup>rd</sup> edition, Tata McGrawHill, 2012



**OBJECTIVES:**

- To understand the language hierarchy
- To construct automata for any given pattern and find its equivalent regular expressions
- To design a context free grammar for any given language
- To understand Turing machines and their capability
- To understand undecidable problems and NP class problems.

**UNIT I AUTOMATA FUNDAMENTALS 9**

Introduction to formal proof – Additional forms of Proof – Inductive Proofs –Finite Automata – Deterministic Finite Automata – Non-deterministic Finite Automata – Finite Automata with Epsilon Transitions

**UNIT II REGULAR EXPRESSIONS AND LANGUAGES 9**

Regular Expressions – FA and Regular Expressions – Proving Languages not to be regular – Closure Properties of Regular Languages – Equivalence and Minimization of Automata.

**UNIT III CONTEXT FREE GRAMMAR AND LANGUAGES 9**

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.

**UNIT IV PROPERTIES OF CONTEXT FREE LANGUAGES 9**

Normal Forms for CFG – Pumping Lemma for CFL – Closure Properties of CFL – Turing Machines – Programming Techniques for TM.

**UNIT V UNDECIDABILITY 9**

Non Recursive Enumerable (RE) Language – Undecidable Problem with RE – Undecidable Problems about TM – Post's Correspondence Problem, The Class P and NP.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Construct automata, regular expression for any pattern.
- Write Context free grammar for any construct.
- Design Turing machines for any language.
- Propose computation solutions using Turing machines.
- Derive whether a problem is decidable or not.

**TEXTBOOKS:**

1. J.E.Hopcroft, R.Motwani and J.D Ullman, —Introduction to Automata Theory, Languages and Computations, Second Edition, Pearson Education, 2003.

**REFERENCES:**

1. H.R.Lewis and C.H.Papadimitriou, —Elements of the theory of Computation, Second Edition, PHI, 2003.
2. J.Martin, —Introduction to Languages and the Theory of Computation, Third Edition, TMH, 2003.
3. Micheal Sipser, —Introduction of the Theory and Computation, Thomson Brokecole, 1997

**OBJECTIVES:**

- To understand the fundamentals of object modeling
- To understand and differentiate Unified Process from other approaches.
- To design with static UML diagrams.
- To design with the UML dynamic and implementation diagrams.
- To improve the software design with design patterns.
- To test the software against its requirements specification

**UNIT I UNIFIED PROCESS AND USE CASE DIAGRAMS 9**

Introduction to OOAD with OO Basics - Unified Process – UML diagrams – Use Case –Case study – the Next Gen POS system, Inception -Use case Modelling – Relating Use cases – include, extend and generalization – When to use Use-cases

**UNIT II STATIC UML DIAGRAMS 9**

Class Diagram— Elaboration – Domain Model – Finding conceptual classes and description classes – Associations – Attributes – Domain model refinement – Finding conceptual class Hierarchies – Aggregation and Composition - Relationship between sequence diagrams and use cases – When to use Class Diagrams.

**UNIT III DYNAMIC AND IMPLEMENTATION UML DIAGRAMS 9**

Dynamic Diagrams – UML interaction diagrams - System sequence diagram – Collaboration diagram – When to use Communication Diagrams - State machine diagram and Modelling –When to use State Diagrams - Activity diagram – When to use activity diagrams

**UNIT IV DESIGN PATTERNS 9**

GRASP: Designing objects with responsibilities – Creator – Information expert – Low Coupling – High Cohesion – Controller. Design Patterns – creational – factory method – structural – Bridge – Adapter – behavioural -Strategy – observer –Applying GoF design patterns – Mapping design to code.

**UNIT V TESTING 9**

Object Oriented Methodologies – Software Quality Assurance – Impact of object orientation on Testing – Develop Test Cases and Test Plans

**TOTAL : 45 PERIODS****OUTCOMES: At the end of the course, the student should be able to:**

- Express software design with UML diagrams
- Design software applications using OO concepts.
- Identify various scenarios based on software requirements
- Transform UML based software design into pattern based design using design patterns
- Understand the various testing methodologies for OO software

**TEXTBOOKS:**

1. Craig Larman, —Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development, Third Edition, Pearson Education, 2005.
2. Ali Bahrami - Object Oriented Systems Development - McGraw Hill International Edition - 1999

**REFERENCES:**

1. Erich Gamma, and Richard Helm, Ralph Johnson, John Vlissides, —Design patterns: Elements of Reusable Object-Oriented Software, Addison-Wesley, 1995.
2. Martin Fowler, —UML Distilled: A Brief Guide to the Standard Object Modeling Language, Third edition, Addison Wesley, 2003.

**19150L57 MICROPROCESSORS AND MICROCONTROLLERS  
LABORATORY**

L	T	P	C
0	0	3	2

**OBJECTIVES:**

- To Introduce ALP concepts, features and Coding methods
- Write ALP for arithmetic and logical operations in 8086 and 8051
- Differentiate Serial and Parallel Interface
- Interface different I/Os with Microprocessors
- Be familiar with MASM

**LIST OF EXPERIMENTS**

8086 Programs using kits and MASM

1. Basic arithmetic and Logical operations
2. Move a data block without overlap
3. Code conversion, decimal arithmetic and Matrix operations.
4. Floating point operations, string manipulations, sorting and searching
5. Password checking, Print RAM size and system date
6. Counters and Time Delay

Peripherals and Interfacing Experiments

7. Traffic light controller
8. Stepper motor control
9. Digital clock
10. Key board and Display
11. Printer status
12. Serial interface and Parallel interface
13. A/D and D/A interface and Waveform Generation

8051 Experiments using kits and MASM

14. Basic arithmetic and Logical operations
15. Square and Cube program, Find 2's complement of a number
16. Unpacked BCD to ASCII

**TOTAL : 60 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Write ALP Programmes for fixed and Floating Point and Arithmetic operations
- Interface different I/Os with processor
- Generate waveforms using Microprocessors
- Execute Programs in 8051
- Explain the difference between simulator and Emulator

**19150L58 OBJECT ORIENTED ANALYSIS AND DESIGN  
LABORATORY**

**L T P C**

**0 0 3 2**

**OBJECTIVES:**

- To capture the requirements specification for an intended software system
- To draw the UML diagrams for the given specification
- To map the design properly to code
- To test the software system thoroughly for all scenarios
- To improve the design by applying appropriate design patterns.

**LIST OF EXPERIMENTS**

Draw standard UML diagrams using an UML modeling tool for a given case study and map design to code and implement a 3 layered architecture. Test the developed code and validate whether the SRS is satisfied.

1. Identify a software system that needs to be developed.
2. Document the Software Requirements Specification (SRS) for the identified system.
3. Identify use cases and develop the Use Case model.
4. Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that.
5. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams
6. Draw relevant State Chart and Activity Diagrams for the same system.
7. Implement the system as per the detailed design
8. Test the software system for all the scenarios identified as per the usecase diagram
9. Improve the reusability and maintainability of the software system by applying appropriate design patterns.
10. Implement the modified system and test it for various scenarios

**SUGGESTED DOMAINS FOR MINI-PROJECT:**

1. Passport automation system.
2. Book bank
3. Exam registration
4. Stock maintenance system.
5. Online course reservation system
6. Airline/Railway reservation system
7. Software personnel management system
8. Credit card processing
9. e-book management system
10. Recruitment system
11. Foreign trading system
12. Conference management system
13. BPO management system
14. Library management system
15. Student information system

**TOTAL : 60 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:
  - Perform OO analysis and design for a given problem specification.
  - Identify and map basic software requirements in UML mapping.
- Improve the software quality using design patterns and to explain the rationale behind applying specific design patterns
- Test the compliance of the software with the SRS

**OBJECTIVES:**

- To learn and use network commands.
- To learn socket programming.
- To implement and analyze various network protocols.
- To learn and use simulation tools.
- To use simulation tools to analyze the performance of various network protocols.

**LIST OF EXPERIMENTS**

1. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and traceroute 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
  - c. File Transfer
4. Simulation of DNS using UDP sockets.
5. Write a code simulating ARP /RARP protocols.
6. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.
7. Study of TCP/UDP performance using Simulation tool.
8. Simulation of Distance Vector/ Link State Routing algorithm.
9. Performance evaluation of Routing protocols using Simulation tool.
10. Simulation of error correction code (like CRC).

**TOTAL : 60 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Implement various protocols using TCP and UDP.
- Compare the performance of different transport layer protocols.
- Use simulation tools to analyze the performance of various network protocols.
- Analyze various routing algorithms.
- Implement error correction codes.

19150CRM

**RESEARCH METHODOLOGY**

Common to (Civil, Mechanical, EEE, ECE, CSE)

L T P C

3 0 0 3

**OBJECTIVES:**

To create a basic appreciation towards research process and awareness of various research publication

- 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 standard laboratory precautions and best practices for experimental work
- To provide orientation for basic mathematical computation useful in basic research

**UNIT I**

9

Introduction to Research – Definition, Objectives, Motivation and purpose – types of research – Pure and applied, survey, case study experimental, exploratory – Research Design – Steps in selection and formulation of research problem - Steps in research – Criteria of Good Research, Problems Encountered by Researchers in India.

**UNIT II**

9

Research Problem: Definition of research problem, selecting the problem - Necessity of defining the problem - Techniques involved in defining the problem - Research design - Needs and features of good design - Different research design - Basic principles of experimental designs. Development of a research plan, Formulation of Hypothesis – Sampling techniques – Sampling error and sample size. Literature types- compendia and tables of information, Reviews, General treatises, Monographs.

**UNIT III**

9

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. 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.

**UNIT IV**

9

Processing and analysis of data – editing – coding – transcription – tabulation – outline of statistical analysis- Uncertainty, accuracy and precision- Mean value; standard deviation; error on the mean-Using a spreadsheet for data analysis- Graphs and graph plotting-Least squares methods – descriptive statistics – elements of processing through computer- packages for analysis (Excel

**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, Technical Presentation.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Ability to carry out independent literature survey corresponding to the specific publication type and assess basic experimental as well as conceptual set up.

**TEXTBOOKS:**

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

**REFERENCES:**

1. Rajammal.P. Devadas, 1976, A hand book of methodology of research, RMM Vidyalaya Press.
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. W.J. DeCoursey, Statistics and Probability for Engineering Applications With Microsoft® Excel, Newnes, 2003.
5. Archibald Fripp, Jon Fripp, Michael Fripp; Just-in-Time Math for Engineers, Elsevier Science & Technology Books, 2003.

**OBJECTIVES:**

- To understand different Internet Technologies.
- To learn java-specific web services architecture To design a context free grammar for any given language

**UNIT I WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0****9**

Web Essentials: Clients, Servers and Communication – The Internet – Basic Internet 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 external style sheets – Rule cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations.

**UNIT II CLIENT SIDE PROGRAMMING****9**

ava Script: An introduction to JavaScript–JavaScript DOM Model-Date and Objects,- Regular Expressions- Exception Handling-Validation-Built-in objects-Event Handling- DHTML with JavaScript- JSON introduction – Syntax – Function Files – Http Request – SQL.

**UNIT III SERVER SIDE PROGRAMMING****9**

Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- Installing and Configuring Apache Tomcat Web Server- DATABASE CONNECTIVITY: JDBC perspectives, JDBC program example - JSP: Understanding Java Server Pages- JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code.

**UNIT IV PHP and 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: Basic XML- Document Type Definition- XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).

**UNIT V INTRODUCTION TO AJAX and WEB SERVICES****9**

AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods; Web Services: Introduction- Java web services Basics – Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service, Database Driven web service from an application – SOAP.

**TOTAL : 45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Construct a basic website using HTML and Cascading Style Sheets.
- Build dynamic web page with validation using Java Script objects and by applying different event handling mechanisms.
- Develop server side programs using Servlets and JSP.



- Construct simple web pages in PHP and to represent data in XML format.
- Use AJAX and web services to develop interactive web applications. Derive whether a problem is decidable or not.

**TEXTBOOKS:**

1. J. Deitel and Deitel and Nieto, —Internet and World Wide Web - How to Program, Prentice Hall, 5th Edition, 2011.

**REFERENCES:**

1. Stephen Wynkoop and John Burke —Running a Perfect Website, QUE, 2nd Edition, 1999.
2. Chris Bates, Web Programming – Building Intranet Applications, 3rd Edition, Wiley Publications, 2009.
3. Jeffrey C and Jackson, —Web Technologies A Computer Science Perspective, Pearson Education, 2011.
4. Gopalan N.P. and Akilandeswari J., —Web Technology, Prentice Hall of India, 2011.
5. Uttam K. Roy, —Web Technologies, Oxford University Press, 2011.

**OBJECTIVES:**

- To understand the various characteristics of Intelligent agents
- To learn the different search strategies in AI
- To learn to represent knowledge in solving AI problems
- To understand the different ways of designing software agents
- To know about the various applications of AI.

**UNIT I INTRODUCTION 9**

Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

**UNIT II PROBLEM SOLVING METHODS 9**

Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations - Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search - Game Playing - Optimal Decisions in Games – Alpha - Beta Pruning - Stochastic Games

**UNIT III KNOWLEDGE REPRESENTATION 9**

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation - Ontological Engineering-Categories and Objects – Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information

**UNIT IV SOFTWARE AGENTS 9**

Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.

9

**UNIT V APPLICATIONS**

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving.

**TOTAL : 45 PERIODS****OUTCOMES:**

**At the end of the course, the student should be able to:**

- Use appropriate search algorithms for any AI problem
- Represent a problem using first order and predicate logic
- Provide the apt agent strategy to solve a given problem
- Design software agents to solve a problem
- Design applications for NLP that use Artificial Intelligence.

**TEXTBOOKS:**

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2009.
2. I. Bratko, —Prolog: Programming for Artificial Intelligence, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.

## REFERENCES:

1. M. Tim Jones, —Artificial Intelligence: A Systems Approach(Computer Science)ll, Jones and Bartlett Publishers, Inc.; First Edition, 2008
2. Nils J. Nilsson, —The Quest for Artificial Intelligencell, Cambridge University Press, 2009.
3. William F. Clocksin and Christopher S. Mellish,| Programming in Prolog: Using the ISO Standardll, Fifth Edition, Springer, 2003.
4. Gerhard Weiss, —Multi Agent Systemsll, Second Edition, MIT Press, 2013.
5. David L. Poole and Alan K. Mackworth, —Artificial Intelligence: Foundations of Computational Agentsll, Cambridge University Press, 2010.

**OBJECTIVES:**

- To understand the basic concepts of mobile computing.
- To learn the basics of mobile telecommunication system .
- To be familiar with the network layer protocols and Ad-Hoc networks.
- To know the basis of transport and application layer protocols.
- To gain knowledge about different mobile platforms and application development.

**UNIT I INTRODUCTION****9**

Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA- CDMA.

**UNIT II MOBILE TELECOMMUNICATION SYSTEM****9**

Introduction to Cellular Systems - GSM – Services & Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS- UMTS – Architecture – Handover – Security.

**UNIT III MOBILE NETWORK LAYER****9**

Mobile IP – DHCP – AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV , Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks ( VANET) –MANET Vs VANET – Security.

**UNIT IV MOBILE TRANSPORT AND APPLICATION LAYER****9**

Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML

**UNIT V MOBILE PLATFORMS AND APPLICATIONS****9**

Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues

**TOTAL : 45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Explain the basics of mobile telecommunication systems
- Illustrate the generations of telecommunication systems in wireless networks
- Determine the functionality of MAC, network layer and Identify a routing protocol for a given Ad hoc network
- Explain the functionality of Transport and Application layers
- Develop a mobile application using android/blackberry/ios/Windows SDK

**TEXTBOOKS:**

1. Jochen Schiller, —Mobile Communications, PHI, Second Edition, 2003.
2. Prasant Kumar Pattnaik, Rajib Mall, —Fundamentals of Mobile Computing, PHI Learning Pvt.Ltd, New Delhi – 2012

## REFERENCES:

1. Dharma Prakash Agarwal, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005.
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, —Principles of
3. Mobile Computing, Springer, 2003.
4. William.C.Y.Lee,—Mobile Cellular Telecommunications-Analog and Digital Systems, Second Edition, TataMcGraw Hill Edition ,2006.
6. C.K.Toh, —AdHoc Mobile Wireless Networks, First Edition, Pearson Education, 2002.
7. Android Developers : <http://developer.android.com/index.html>
8. Apple Developer : <https://developer.apple.com/>
9. Windows Phone DevCenter : <http://developer.windowsphone.com>
10. BlackBerry Developer : <http://developer.blackberry.com>

**OBJECTIVES:**

- To learn the various phases of compiler.
- To learn the various parsing techniques.
- To understand intermediate code generation and run-time environment.
- To learn to implement front-end of the compiler.
- To learn to implement code generator.

**UNIT I INTRODUCTION TO COMPILERS 9**

Structure of a compiler – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens – Lex – Finite Automata – Regular Expressions to Automata – Minimizing DFA.

**UNIT II SYNTAX ANALYSIS 9**

Role of Parser – Grammars – Error Handling – Context-free grammars – Writing a grammar – Top Down Parsing - General Strategies Recursive Descent Parser Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser-LR (0)Item Construction of SLR Parsing Table - Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC..

**UNIT III INTERMEDIATE CODE GENERATION 9**

Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking.

**UNIT IV RUN-TIME ENVIRONMENT AND CODE GENERATION 9**

Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management - Issues in Code Generation - Design of a simple Code Generator.

9

**UNIT V CODE OPTIMIZATION**

Principal Sources of Optimization – Peep-hole optimization - DAG- Optimization of Basic Blocks- Global Data Flow Analysis - Efficient Data Flow Algorithm.

**TOTAL : 45 PERIODS****OUTCOMES:**

**At the end of the course, the student should be able to:**

- Understand the different phases of compiler.
- Design a lexical analyzer for a sample language.
- Apply different parsing algorithms to develop the parsers for a given grammar.
- Understand syntax-directed translation and run-time environment.
- Learn to implement code optimization techniques and a simple code generator.
- Design and implement a scanner and a parser using LEX and YACC tools.

**TEXTBOOKS:**

1. J Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles, Techniques and Tools, Second Edition, Pearson Education, 2009.

**REFERENCES:**

1. Randy Allen, Ken Kennedy, Optimizing Compilers for Modern Architectures: A Dependence based Approach, Morgan Kaufmann Publishers, 2002.
2. Steven S. Muchnick, Advanced Compiler Design and Implementation, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
3. Keith D Cooper and Linda Torczon, Engineering a Compiler, Morgan Kaufmann Publishers Elsevier Science, 2004.
4. V. Raghavan, Principles of Compiler Design, Tata McGraw Hill Education Publishers, 2010.
5. Allen I. Holub, Compiler Design in C, Prentice-Hall Software Series, 1993.

**OBJECTIVES:**

- To understand the foundations of distributed systems.
- To learn issues related to clock Synchronization and the need for global state in distributed systems.
- To learn distributed mutual exclusion and deadlock detection algorithms.
- To understand the significance of agreement, fault tolerance and recovery protocols in Distributed Systems.
- To learn the characteristics of peer-to-peer and distributed shared memory systems.

**UNIT I INTRODUCTION****9**

Introduction: Definition –Relation to computer system components –Motivation –Relation to parallel systems – 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 – Cuts –Past and future cones of an event –Models of process communications. Logical Time: A framework for a system of logical clocks –Scalar time –Vector time – Physical clock synchronization: NTP.

**UNIT II MESSAGE ORDERING & SNAPSHOTS****9**

Message ordering and group communication: Message ordering paradigms –Asynchronous execution with synchronous communication –Synchronous program order on an asynchronous system –Group communication – Causal order (CO) - Total order. Global state and snapshot recording algorithms: Introduction –System model and definitions –Snapshot algorithms for FIFO channels.

**9****UNIT III DISTRIBUTED MUTEX & DEADLOCK**

Distributed mutual exclusion algorithms: Introduction – Preliminaries – Lamport's algorithm – Ricart-Agrawala algorithm – Maekawa's algorithm – Suzuki-Kasami's broadcast algorithm. Deadlock detection in distributed systems: Introduction – System model – Preliminaries – Models of deadlocks – Knapp's classification – Algorithms for the single resource model, the AND model and the OR model.

**9****UNIT IV RECOVERY & CONSENSUS**

Checkpointing and rollback recovery: Introduction – Background and definitions – Issues in failure recovery – Checkpoint-based recovery – Log-based rollback recovery – Coordinated checkpointing algorithm – Algorithm for asynchronous checkpointing and recovery. Consensus and agreement algorithms: Problem definition – Overview of results – Agreement in a failure – free system – Agreement in synchronous systems with failures.

**UNIT V P2P & DISTRIBUTED SHARED MEMORY****9**

Peer-to-peer computing and overlay graphs: Introduction – Data indexing and overlays – Chord – Content addressable networks – Tapestry. Distributed shared memory: Abstraction and advantages – Memory consistency models –Shared memory Mutual Exclusion.

**TOTAL : 45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Elucidate the foundations and issues of distributed systems
- Understand the various synchronization issues and global state for distributed systems.



- Understand the Mutual Exclusion and Deadlock detection algorithms in distributed systems
- Describe the agreement protocols and fault tolerance mechanisms in distributed systems.
  - Describe the features of peer-to-peer and distributed shared memory systemsnot.

**TEXTBOOKS:**

1. Kshemkalyani, Ajay D., and Mukesh Singhal. Distributed computing: principles, algorithms, and systems. Cambridge University Press, 2011.
2. George Coulouris, Jean Dollimore and Tim Kindberg, —Distributed Systems Concepts and Designl, Fifth Edition, Pearson Education, 2012.

**REFERENCES:**

1. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
2. Mukesh Singhal and Niranjana G. Shivaratri. Advanced concepts in operating systems. McGraw-Hill, Inc., 1994.
3. Tanenbaum A.S., Van Steen M., —Distributed Systems: Principles and Paradigmsl, Pearson Education, 2007.
4. Liu M.L., —Distributed Computing, Principles and Applicationsl, Pearson Education, 2004.
5. Nancy A Lynch, —Distributed Algorithmsl, Morgan Kaufman Publishers, USA, 2003.

**OBJECTIVES:**

- To be familiar with Web page design using HTML/XML and style sheets
- To be exposed to creation of user interfaces using Java frames and applets.
- To learn to create dynamic web pages using server side scripting.
- To learn to write Client Server applications.
- To be familiar with the PHP programming.
- To be exposed to creating applications with AJAX

**LIST OF EXPERIMENTS**

1. Create a web page with the following using HTML
  - a. To embed a map in a web page
  - b. To fix the hot spots in that map
  - c. Show all the related information when the hot spots are clicked.
2. Create a web page with the following.
  - a. Cascading style sheets.
  - b. Embedded style sheets.
  - c. Inline style sheets. Use our college information for the web pages.
3. Validate the Registration, user login, user profile and payment by credit card pages using JavaScript.
4. Write programs in Java using Servlets:
  - i. To invoke servlets from HTML forms
  - ii. Session tracking using hidden form fields and Session tracking for a hit count
5. Write programs in Java to create three-tier applications using servlets for conducting on- line examination for displaying student mark list. Assume that student information is available in a database which has been stored in a database server.
6. Install TOMCAT web server. Convert the static web pages of programs into dynamic web pages using servlets (or JSP) and cookies. Hint: Users information (user id, password, credit card number) would be stored in web.xml. Each user should have a separate
  4. Shopping Cart.
7. Redo the previous task using JSP by converting the static web pages into dynamic web pages. Create a database with user information and books information. The books catalogue should be dynamically loaded from the database.
8. Create and save an XML document at the server, which contains 10 users Information.
  5. Write a Program, which takes user Id as an input and returns the User details by taking the user information from the XML document
6. i. Validate the form using PHP regular expression. ii. PHP stores a form data into database.
7. Write a web service for finding what people think by asking 500 people's opinion for any
8. consumer product.

**TOTAL : 60 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Construct Web pages using HTML/XML and style sheets.
- Build dynamic web pages with validation using Java Script objects and by applying different event handling mechanisms.
- Develop dynamic web pages using server side scripting.
- Use PHP programming to develop web applications.
- Construct web applications using AJAX and web services.

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**MOBILE APPLICATION DEVELOPMENT  
LABORATORY**

**L T P C**

**0 0 3 2**

**OBJECTIVES:**

- To understand the components and structure of mobile application development frameworks for Android and windows OS based mobiles.
- To understand how to work with various mobile application development frameworks.
- To learn the basic and important design concepts and issues of development of mobile applications.
- To understand the capabilities and limitations of mobile devices.

**LIST OF EXPERIMENTS**

1. Develop an application that uses GUI components, Font and Colours
2. Develop an application that uses Layout Managers and event listeners.
3. Write an application that draws basic graphical primitives on the screen.
4. Develop an application that makes use of databases.
5. Develop an application that makes use of Notification Manager
6. Implement an application that uses Multi-threading
7. Develop a native application that uses GPS location information
8. Implement an application that writes data to the SD card.
9. Implement an application that creates an alert upon receiving a message
10. Write a mobile application that makes use of RSS feed
11. Develop a mobile application to send an email.
12. Develop a Mobile application for simple needs (Mini Project)

**TOTAL : 60 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Develop mobile applications using GUI and Layouts.
- Develop mobile applications using Event Listener.
- Develop mobile applications using Databases.
- Develop mobile applications using RSS Feed, Internal/External Storage, SMS, Multi- threading and GPS.
- Analyze and discover own mobile app for simple needs.

**OBJECTIVES:**

- 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****9**

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****9**

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****9**

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****9**

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****9**

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 : 45 PERIODS****OUTCOMES:**

**At the end of the course, the student should 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. JGlobearena
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, 5
3. Interact English Lab Manual for Undergraduate Students,. OrientBlackSwan: Hyderabad, 2016.
4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
5. S. Hariharanetal. Soft Skills. MJP Publishers: Chennai, 2010.

**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.

**9****UNIT V CONTROLLING**

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****OUTCOMES:****At the end of the course, the student should be able to:**

- 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, —Managementl, Prentice Hall (India) Pvt. Ltd., 10th Edition,2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert —Managementl, Pearson Education, 6thEdition, 2004.

**REFERENCES:**

1. Stephen A. Robbins & David A. Decenzo & Mary Coulter, —Fundamentals of Managementl Pearson Education, 7th Edition, 2011.
2. Robert Kreitner & Mamata Mohapatra, — Managementl, Biztantra, 2008.
3. Harold Koontz & Heinz Weihrich —Essentials of managementl Tata McGraw Hill,1998.
4. Tripathy PC & Reddy PN, —Principles of Managementl, Tata McGraw Hill, 1999

**OBJECTIVES:**

- To understand Cryptography Theories, Algorithms and Systems.
- To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks..

**UNIT I INTRODUCTION****9**

Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography- Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis.

**UNIT II SYMMETRIC KEY CRYPTOGRAPHY****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 PUBLIC KEY CRYPTOGRAPHY****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.

**UNIT IV MESSAGE AUTHENTICATION AND INTEGRITY****9**

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA – Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications - Kerberos, X.509

**UNIT V SECURITY PRACTICE AND SYSTEM SECURITY****9**

Electronic Mail security – PGP, S/MIME – IP security – Web Security - SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.

**TOTAL : 45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Understand the fundamentals of networks security, security architecture, threats and vulnerabilities
- Apply the different cryptographic operations of symmetric cryptographic algorithms
- Apply the different cryptographic operations of public key cryptography
- Apply the various Authentication schemes to simulate different applications.
- Understand various Security practices and System security standards

**TEXTBOOKS:**

1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 3rd Edition, 2006.

**REFERENCES:**

1. C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd
2. Behrouz A. Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.
3. Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN 0-13-046019-2



**OBJECTIVES:**

- To understand the concept of cloud computing.
- To appreciate the evolution of cloud from the existing technologies.
- 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****9**

Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning.

**UNIT II CLOUD ENABLING TECHNOLOGIES****9**

Service Oriented Architecture – REST and Systems of Systems – Web Services – Publish-Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices –Virtualization Support and Disaster Recovery.

**UNIT III CLOUD ARCHITECTURE, SERVICES AND STORAGE****9**

Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds - IaaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.

**UNIT IV RESOURCE MANAGEMENT AND SECURITY IN CLOUD****9**

Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods– Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges –Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM –Security Standards.

**UNIT V CLOUD TECHNOLOGIES AND ADVANCEMENTS****9**

Hadoop – MapReduce – Virtual Box -- Google App Engine – Programming Environment for Google App Engine — Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation.

**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.
- Evaluate and choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.

**TEXTBOOKS:**

- 1 Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Rittinghouse, John W., and James F. Ransome, —Cloud Computing: Implementation, Management and Securityl, CRC Press, 2017.

**REFERENCES:**

- 1 Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, —Mastering Cloud Computingl, Tata Mcgraw Hill, 2013.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approachl, Tata Mcgraw Hill, 2009.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)l, O'Reilly, 2009.

**OBJECTIVES:**

- To develop web applications in cloud
- To learn the design and development process involved in creating a cloud based application
- To learn to implement and use parallel programming using Hadoop

**LIST OF EXPERIMENTS**

1. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Install Google App Engine. Create hello world app and other simple web applications using python/java.
4. Use GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Find a procedure to launch virtual machine using trystack (Online Openstack DemoVersion)
8. Install Hadoop single node cluster and run simple applications like wordcount.

**TOTAL : 60 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Configure various virtualization tools such as Virtual Box, VMware workstation.
- Design and deploy a web application in a PaaS environment.
- Learn how to simulate a cloud environment to implement new schedulers.
- Install and use a generic cloud environment that can be used as a private cloud.
- Manipulate large data sets in a parallel environment.

**OBJECTIVES:**

- To learn different cipher techniques
- To implement the algorithms DES, RSA,MD5,SHA-1
- To use network security tools and vulnerability assessment tools

**LIST OF EXPERIMENTS**

1. Perform encryption, decryption using the following substitution techniques  
(i) Ceaser cipher, (ii) playfair cipher iii) Hill Cipher iv) Vigenere cipher
2. Perform encryption and decryption using following transposition techniques i) Rail fence ii) row & Column Transformation
3. Apply DES algorithm for practical applications.
4. Apply AES algorithm for practical applications.
5. Implement RSA Algorithm using HTML and JavaScript
6. Implement the Diffie-Hellman Key Exchange algorithm for a given problem.
7. Calculate the message digest of a text using the SHA-1 algorithm.
8. Implement the SIGNATURE SCHEME - Digital Signature Standard.
9. Demonstrate intrusion detection system (ids) using any tool eg. Snort or any other s/w.
10. Automated Attack and Penetration Tools  
Exploring N-Stalker, a Vulnerability Assessment Tool
11. Defeating Malware  
i) Building Trojans ii) Rootkit Hunter

**TOTAL : 60 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Develop code for classical Encryption Techniques to solve the problems.
- Build cryptosystems by applying symmetric and public key encryption algorithms.
- Construct code for authentication algorithms.
- Develop a signature scheme using Digital signature standard.
- Demonstrate the network security system using open source tools

-LIST OF ELECTIVES -

<b>19150E66A</b>	<b>DATA WAREHOUSING AND DATA MINING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand data warehouse concepts, architecture, business analysis and tools
- To understand data pre-processing and data visualization techniques
- To study algorithms for finding hidden and interesting patterns in data
- To understand and apply various classification and clustering techniques using tools.

**UNIT I DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE ANALYTICAL PROCESSING(OLAP) 9**

Basic Concepts - Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors - Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies -Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP.

**UNIT II DATA MINING – INTRODUCTION 9**

Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques– Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

**UNIT III DATA MINING - FREQUENT PATTERN ANALYSIS 9**

Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns

**UNIT IV CLASSIFICATION AND CLUSTERING 9**

Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines — Lazy Learners – Model Evaluation and Selection- Techniques to improve Classification Accuracy.

Clustering Techniques – Cluster analysis-Partitioning Methods - Hierarchical Methods – Density Based Methods - Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods.

**UNIT V WEKA TOOL 9**

Datasets – Introduction, Iris plants database, Breast cancer database, Auto imports database - Introduction to WEKA, The Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association–rule learners.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Design a Data warehouse system and perform business analysis with OLAP tools.
- Apply suitable pre-processing and visualization techniques for data analysis
- Apply frequent pattern and association rule mining techniques for data analysis
- Apply appropriate classification and clustering techniques for data analysis

**TEXTBOOKS:**

1. Jiawei Han and Micheline Kamber, —Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012.

**REFERENCES:**

1. Alex Berson and Stephen J. Smith, —Data Warehousing, Data Mining & OLAP, Tata McGraw – Hill Edition, 35th Reprint 2016.
2. K.P. Soman, Shyam Diwakar and V. Ajay, —Insight into Data Mining Theory and Practice, Eastern Economy Edition, Prentice Hall of India, 2006.
3. Ian H. Witten and Eibe Frank, —Data Mining: Practical Machine Learning Tools and Techniques, Elsevier, Second Edition.

**OBJECTIVES:**

- To learn the criteria for test cases.
- To learn the design of test cases.
- To understand test management and test automation techniques.
- To apply test metrics and measurements.

**UNIT I INTRODUCTION****9**

Testing as an Engineering Activity – Testing as a Process – Testing Maturity Model- Testing axioms – Basic definitions – Software Testing Principles – The Tester’s Role in a Software Development Organization – Origins of Defects – Cost of defects – Defect Classes – The Defect Repository and Test Design –Defect Examples- Developer/Tester Support of Developing a Defect Repository.

**UNIT II TEST CASE DESIGN STRATEGIES****9**

Test case Design Strategies – Using Black Box Approach to Test Case Design – Boundary Value Analysis – Equivalence Class Partitioning – State based testing – Cause-effect graphing – Compatibility testing – user documentation testing – domain testing - Random Testing – Requirements based 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 – code complexity testing – Additional White box testing approaches- Evaluating Test Adequacy Criteria.

**UNIT III LEVELS OF TESTING****9**

The need for Levels of Testing – Unit Test – Unit Test Planning – Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – Scenario testing – Defect bash elimination System Testing – Acceptance testing – Performance testing – Regression Testing – Internationalization testing – Ad-hoc testing – Alpha, Beta Tests – Testing OO systems – Usability and Accessibility testing – Configuration testing –Compatibility testing – Testing the documentation – Website testing.

**UNIT IV TEST MANAGEMENT****9**

People and organizational issues in testing – Organization structures for testing teams – testing services – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process – Reporting Test Results – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group- The Structure of Testing Group- .The Technical Training Program.

**UNIT V TEST AUTOMATION****9**

Software test automation – skills needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Design test cases suitable for a software development for different domains.
- Identify suitable tests to be carried out.
- Prepare test planning based on the document.
- Document test plans and test cases designed.
- Use automatic testing tools.
- Develop and validate a test plan.

**TEXTBOOKS:**

1. Srinivasan Desikan and Gopaldaswamy Ramesh, —Software Testing – Principles and Practices, Pearson Education, 2006.
2. Ron Patton, —Software Testing, Second Edition, Sams Publishing, Pearson Education, 2007.  
AU Library.com

**REFERENCES:**

1. Ilene Burnstein, —Practical Software Testing, Springer International Edition, 2003.
2. Edward Kit, Software Testing in the Real World – Improving the Process, Pearson Education, 1995.
3. Boris Beizer, Software Testing Techniques – 2nd Edition, Van Nostrand Reinhold, New York, 1990.
4. Aditya P. Mathur, —Foundations of Software Testing \_ Fundamental Algorithms and Techniques, Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008.



**OBJECTIVES:**

- To learn the architecture and programming of ARM processor.
- To become familiar with the embedded computing platform design and analysis.
- To get thorough knowledge in interfacing concepts
- To design an embedded system and to develop programs.

**UNIT I INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS 9**

Complex systems and micro processors– Embedded system design process –Design example: Model train controller- Instruction sets preliminaries - ARM Processor – CPU: programming input and output-supervisor mode, exceptions and traps – Co-processors- Memory system mechanisms – CPU performance- CPU power consumption..

**UNIT II EMBEDDED COMPUTING PLATFORM DESIGN 9**

The CPU Bus-Memory devices and systems–Designing with computing platforms – consumer electronics architecture – platform-level performance analysis - 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.

**UNIT III SENSOR INTERFACING WITH ARDUINO 9**

Basics of hardware design and functions of basic passive components-sensors and actuators- Arduino code - library file for sensor interfacing-construction of basic applications

**UNIT IV EMBEDDED FIRMWARE 9**

Reset Circuit, Brown-out Protection Circuit-Oscillator Unit - Real Time Clock-Watchdog Timer - Embedded Firmware Design Approaches and Development Languages.

**UNIT V EMBEDDED C PROGRAMMING 9**

Introduction-Creating \_hardware delays‘ using Timer 0 and Timer 1-Reading switches-Adding Structure to the code-Generating a minimum and maximum delay-Example: Creating a portable hardware delay- Timeout mechanisms-Creating loop timeouts-Testing loop timeouts- hardware timeouts-Testing a hardware timeout

**TOTAL : 45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Describe the architecture and programming of ARM processor.
- Explain the concepts of embedded systems
- Understand the Concepts of peripherals and interfacing of sensors.
- Capable of using the system design techniques to develop firmware
- Illustrate the code for constructing a system

**TEXTBOOKS:**

1. Marilyn Wolf, —Computers as Components - Principles of Embedded Computing System
2. Designl, Third Edition —Morgan Kaufmann Publisher (An imprint from Elsevier), 2012. (unit I & II)
3. <https://www.coursera.org/learn/interface-with-arduino#syllabus> (Unit III)
4. Michael J. Pont, —Embedded Cl, 2 nd Edition, Pearson Education, 2008.(Unit IV & V)

**REFERENCES:**

1. Shibu K.V, —Introduction to Embedded Systemsl, McGraw Hill.2014
2. Jonathan W.Valvano, —Embedded Microcomputer Systems Real Time Interfacingsl, Third Edition Cengage Learning, 2012
3. Raj Kamal, —Embedded Systems-Architecture,programming and designl, 3 edition,TMH.2015
4. Lyla, —Embedded Systemsl, Pearson , 2013
5. David E. Simon, —An Embedded Software Primerl, Pearson Education,2000.

**OBJECTIVES:**

- To understand fundamentals of graph theory.
- To study proof techniques related to various concepts in graphs.
- To explore modern applications of graph theory.

**UNIT I**

9

Introduction - Graph Terminologies - Types of Graphs - Sub Graph- Multi Graph - Regular Graph - Isomorphism - Isomorphic Graphs - Sub-graph - Euler graph - Hamiltonian Graph - Related Theorems.

**UNIT II**

9

Trees -Properties- Distance and Centres - Types - Rooted Tree-- Tree Enumeration- Labeled Tree - Unlabeled Tree - Spanning Tree - Fundamental Circuits- Cut Sets - Properties - Fundamental Circuit and Cut-set- Connectivity- Separability -Related Theorems.

**UNIT III**

9

Network Flows - Planar Graph - Representation - Detection - Dual Graph - Geometric and Combinatorial Dual - Related Theorems - Digraph - Properties - Euler Digraph.

9

**UNIT IV**

Matrix Representation - Adjacency matrix- Incidence matrix- Circuit matrix - Cut-set matrix - Path Matrix- Properties - Related Theorems - Correlations. Graph Coloring - Chromatic Polynomial - Chromatic Partitioning - Matching - Covering - Related Theorems.

**UNIT V**

9

Graph Algorithms- Connectedness and Components- Spanning Tree- Fundamental Circuits- Cut Vertices- Directed Circuits- Shortest Path - Applications overview.

**TOTAL : 45 PERIODS****OUTCOMES:**

**At the end of the course, the student should be able to:**

- Understand the basic concepts of graphs, and different types of graphs
- Understand the properties, theorems and be able to prove theorems.
- Apply suitable graph model and algorithm for solving applications.

**TEXTBOOKS:**

- 1.Narsingh Deo, "Graph Theory with Application to Engineering and Computer Science", Prentice-Hall of India Pvt.Ltd, 2003.
2. L.R.Foulds , "Graph Theory Applications", Springer ,2016.

**REFERENCES:**

- 1 .Bondy, J. A. and Murty, U.S.R., "Graph Theory with Applications", North Holland Publication,2008.
2. West, D. B., —Introduction to Graph Theory, Pearson Education, 2011.
3. John Clark, Derek Allan Holton, —A First Look at Graph Theory, World Scientific Publishing Company, 1991.
4. Diestel, R, "Graph Theory", Springer,3rd Edition,2006.
5. Kenneth H.Rosen, "Discrete Mathematics and Its Applications", Mc Graw Hill, 2007.

**OBJECTIVES:**

- To understand the basics of discrete time signals, systems and their classifications.
- To analyze the discrete time signals in both time and frequency domain.
- To design lowpass digital IIR filters according to predefined specifications based on analog filter theory and analog-to-digital filter transformation.
- To design Linear phase digital FIR filters using fourier method, window technique
- To realize the concept and usage of DSP in various engineering fields.

**UNIT I DISCRETE TIME SIGNALS AND SYSTEMS 9**

Introduction to DSP – Basic elements of DSP– Sampling of Continuous time signals–Representation, Operation and Classification of Discrete Time Signal–Classification of Discrete Time Systems– Discrete Convolution: Linear and Circular–Correlation

**UNIT II ANALYSIS OF LTI DISCRETE TIME SIGNALS AND SYSTEMS 9**

Analysis of LTI Discrete Time Systems using DFT–Properties of DFT–Inverse DFT– Analysis of LTI Discrete Time Systems using FFT Algorithms– Inverse DFT using FFT Algorithm.

**UNIT III INFINITE IMPULSE RESPONSE FILTERS 9**

Frequency response of Analog and Digital IIR filters–Realization of IIR filter–Design of analog low pass filter–Analog to Digital filter Transformation using Bilinear Transformation and Impulse Invariant method– Design of digital IIR filters (LPF, HPF, BPF, and BRF) using various transformation techniques.

**UNIT IV FINITE IMPULSE RESPONSE FILTERS 9**

Linear Phase FIR filter–Phase delay–Group delay–Realization of FIR filter–Design of Causal and Non-causal FIR filters (LPF, HPF, BPF and BRF) using Window method (Rectangular, Hamming window, Hanning window) –Frequency Sampling Technique.

**UNIT V APPLICATIONS OF DSP 9**

Multirate Signal Processing: Decimation, Interpolation, Spectrum of the sampled signal –Processing of Audio and Radar signal.

**TOTAL : 45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Perform mathematical operations on signals.
- Understand the sampling theorem and perform sampling on continuous-time signals to get discrete time signal by applying advanced knowledge of the sampling theory.
- Transform the time domain signal into frequency domain signal and vice-versa.
- Apply the relevant theoretical knowledge to design the digital IIR/FIR filters for the given analog specifications.

**TEXTBOOKS:**

1. John G. Proakis & Dimitris G.Manolakis, —Digital Signal Processing – Principles, Algorithms & Applications, Fourth Edition, Pearson Education / Prentice Hall, 2007.

**REFERENCES:**

1. Richard G. Lyons, —Understanding Digital Signal Processing. Second Edition, Pearson Education.

2. A.V.Oppenheim, R.W. Schafer and J.R. Buck, —Discrete-Time Signal Processing, 8th Indian Reprint, Pearson, 2004.
3. Emmanuel C.Ifeachor, & Barrie.W.Jervis, —Digital Signal Processing, Second Edition, Pearson Education / Prentice Hall, 2002.
4. William D. Stanley, —Digital Signal Processing, Second Edition, Reston Publications.

**OBJECTIVES:**

- To know the fundamental concepts of big data and analytics.
- To explore tools and practices for working with big data
- To learn about stream computing.
- To know about the research that requires the integration of large amounts of data

**UNIT I INTRODUCTION TO BIG DATA****9**

Evolution of Big data - Best Practices for Big data Analytics - Big data characteristics – Validating - The Promotion of the Value of Big Data - Big Data Use Cases- Characteristics of Big Data Applications - Perception and Quantification of Value -Understanding Big Data Storage - A General Overview of High-Performance Architecture - HDFS - MapReduce and YARN - Map Reduce Programming Model

**9****UNIT II CLUSTERING AND CLASSIFICATION**

Advanced Analytical Theory and Methods: Overview of Clustering - K-means - Use Cases - Overview of the Method - Determining the Number of Clusters - Diagnostics - Reasons to Choose and Cautions - Classification: Decision Trees - Overview of a Decision Tree - The General Algorithm - Decision Tree Algorithms - Evaluating a Decision Tree - Decision Trees in R - Naïve Bayes - Bayes' Theorem - Naïve Bayes Classifier.

**UNIT III ASSOCIATION AND RECOMMENDATION SYSTEM****9**

Advanced Analytical Theory and Methods: Association Rules - Overview - Apriori Algorithm - Evaluation of Candidate Rules - Applications of Association Rules - Finding Association & finding similarity - Recommendation System: Collaborative Recommendation- Content Based Recommendation - Knowledge Based Recommendation- Hybrid Recommendation Approaches.

**UNIT IV STREAM MEMORY****9**

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. Using Graph Analytics for Big Data: Graph Analytics

**UNIT V NOSQL DATA MANAGEMENT FOR BIG DATA AND VISUALIZATION****9**

NoSQL Databases : Schema-less Models: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores - Tabular Stores - Object Data Stores - Graph Databases Hive - Sharding – Hbase – Analyzing big data with twitter - Big data for E-Commerce Big data for blogs - Review of Basic Data Analytic Methods using R.

**TOTAL : 45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Work with big data tools and its analysis techniques
- Analyze data by utilizing clustering and classification algorithms
- Learn and apply different mining algorithms and recommendation systems for large data
- Perform analytics on data streams
- Learn NoSQL databases and management..

**TEXTBOOKS:**

- Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/Elsevier Publishers, 2013.

**REFERENCES:**

- EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.
2. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.
  3. Dietmar Jannach and Markus Zanker, "Recommender Systems: An Introduction", Cambridge University Press, 2010.
  4. Kim H. Pries and Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers " CRC Press, 2015.
  5. Jimmy Lin and Chris Dyer, "Data-Intensive Text Processing with MapReduce", Synthesis Lectures on Human Language Technologies, Vol. 3, No. 1, Pages 1-177, Morgan Claypool publishers, 2010.

**OBJECTIVES:**

- To understand the need for machine learning for various problem solving
- To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning
- To understand the latest trends in machine learning
- To design appropriate machine learning algorithms for problem solving

**UNIT I INTRODUCTION 9**

Introduction - Graph Terminologies - Types of Graphs - Sub Graph- Multi Graph - Regular Graph - Isomorphism - Isomorphic Graphs - Sub-graph - Euler graph - Hamiltonian Graph - Related Theorems.

**UNIT II NEURAL NETWORKS AND GENETIC ALGORITHMS 9**

Trees -Properties- Distance and Centres - Types - Rooted Tree-- Tree Enumeration - Labelled Tree - Unlabelled Tree - Spanning Tree - Fundamental Circuits- Cut Sets - Properties - Fundamental Circuit and Cut-set- Connectivity - Separability - Related Theorems.

**UNIT III BAYESIAN AND COMPUTATIONAL LEARNING 9**

Network Flows - Planar Graph - Representation - Detection - Dual Graph - Geometric and Combinatorial Dual - Related Theorems - Digraph - Properties - Euler Digraph.

**UNIT IV INSTANT BASED LEARNING 9**

Matrix Representation - Adjacency matrix- Incidence matrix- Circuit matrix - Cut-set matrix - Path Matrix- Properties - Related Theorems - Correlations. Graph Coloring - Chromatic Polynomial - Chromatic Partitioning - Matching - Covering - Related Theorems.

**UNIT V ADVANCED LEARNING 9**

Graph Algorithms- Connectedness and Components- Spanning Tree- Fundamental Circuits- Cut Vertices- Directed Circuits- Shortest Path - Applications overview.

**TOTAL : 45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Differentiate between supervised, unsupervised, semi-supervised machine learning approaches
- Discuss the decision tree algorithm and identify and overcome the problem of overfitting
- Discuss and apply the back propagation algorithm and genetic algorithms to various problems
- Apply the Bayesian concepts to machine learning
- Analyse and suggest appropriate machine learning approaches for various types of problems

**TEXTBOOKS:**

1. Tom M. Mitchell, —Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.

**REFERENCES:**

1. Ethem Alpaydin, —Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
2. Stephen Marsland, —Machine Learning: An Algorithmic Perspective, CRC Press, 2009.



**OBJECTIVES:**

- To understand the Software Project Planning and Evaluation techniques.
- To plan and manage projects at each stage of the software development life cycle (SDLC).
- To learn about the activity planning and risk management principles.
- To manage software projects and control software deliverables.
- To develop skills to manage the various phases involved in project management and people management.
- To deliver successful software projects that support organization's strategic goals.

**UNIT I PROJECT EVALUATION AND PROJECT PLANNING 9**

Importance of Software Project Management – Activities - Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

**UNIT II PROJECT LIFE CYCLE AND EFFORT ESTIMATION 9**

Software process and Process Models – Choice of Process models - Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II - a Parametric Productivity Model.

**UNIT III ACTIVITY PLANNING AND RISK MANAGEMENT 9**

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning – Risk Management – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

**UNIT IV PROJECT MANAGEMENT AND CONTROL 9**

Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.

**UNIT V STAFFING IN SOFTWARE PROJECTS 9**

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.

**TOTAL : 45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Understand Project Management principles while developing software.
- Gain extensive knowledge about the basic project management concepts, framework and the process models.
- Obtain adequate knowledge about software process models and software effort estimation techniques.
- Estimate the risks involved in various project activities.

- Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.
- Learn staff selection process and the issues related to people management

#### **TEXTBOOKS:**

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

#### **REFERENCES:**

1. Robert K. Wysocki —Effective Software Project Management— Wiley Publication, 2011.
2. Walker Royce: —Software Project Management— Addison-Wesley, 1998.
3. Gopalswamy Ramesh, —Managing Global Software Projects— McGraw Hill Education  
(India), Fourteenth Reprint 2013.

**OBJECTIVES:**

- To understand Smart Objects and IoT Architectures
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications

**UNIT I FUNDAMENTALS OF IoT****9**

Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

**UNIT II IoT PROTOCOLS****9**

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

**UNIT III DESIGN AND DEVELOPMENT****9**

Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

**UNIT IV DATA ANALYTICS AND SUPPORTING SERVICES****9**

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG

**UNIT V CASE STUDIES/INDUSTRIAL APPLICATIONS****9**

Cisco IoT system - IBM Watson IoT platform – Manufacturing - Converged Plant wide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control

**TOTAL : 45 PERIODS****OUTCOMES:**

**At the end of the course, the student should be able to:**

- Explain the concept of IoT.
- Analyze various protocols for IoT.
- Design a PoC of an IoT system using Raspberry Pi/Arduino
- Apply data analytics and use cloud offerings related to IoT.
- Analyze applications of IoT in real time scenario

**TEXTBOOKS:**

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, —IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017

**REFERENCES:**

1. Arshdeep Bahga, Vijay Madiseti, —Internet of Things – A hands-on approach, Universities Press, 2015
2. Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things – Key applications and Protocols, Wiley, 2012 (for Unit 2).
3. Jan Höller, Vlasios Tsiatsis , Catherine Mulligan, Stamatias , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting the Internet of Things, Springer, 2011.
5. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O'Reilly Media, 2011.
6. <https://www.arduino.cc/>
7. [https://www.ibm.com/smarterplanet/us/en/?ca=v\\_smarterplanet](https://www.ibm.com/smarterplanet/us/en/?ca=v_smarterplanet)

**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

**UNIT I XML**

9

XML document structure – Well-formed and valid documents – DTD – XML Schema – Parsing XML using DOM, SAX – XPath - XML Transformation and XSL – Xquery

**UNIT II SERVICE ORIENTED ARCHITECTURE (SOA) BASICS**

9

Characteristics of SOA, Benefits of SOA , Comparing SOA with Client-Server and Distributed architectures --- Principles of Service Orientation – Service layers

**UNIT III WEB SERVICES (WS) AND STANDARDS**

8

Web Services Platform – Service descriptions – WSDL – Messaging with SOAP – Service discovery – UDDI – Service-Level Interaction Patterns – Orchestration and Choreography

**UNIT IV WEB SERVICES EXTENSIONS**

8

WS-Addressing - WS-ReliableMessaging - WS-Policy – WS-Coordination – WS -Transactions - WS-Security - Examples

**UNIT V SERVICE ORIENTED ANALYSIS AND DESIGN**

11

SOA delivery strategies – Service oriented analysis – Service Modelling – Service oriented design – Standards and composition guidelines -- Service design – Business process design – CaseStudy

**TOTAL : 45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Understand XML technologies
- Understand service orientation, benefits of SOA
- Understand web services and WS standards
- Use web services extensions to develop solutions
- Understand and apply service modeling, service oriented analysis and design for application development

**TEXTBOOKS:**

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

**REFERENCES:**

1. James McGovern, Sameer Tyagi, Michael E Stevens, Sunil Mathew, —Java Web Services Architecture, Elsevier, 2003.
2. Ron Schmelzer et al. — XML and Web Services, Pearson Education, 2002.
3. Frank P.Coyle, —XML, Web Services and the Data Revolution, Pearson Education,2002

**OBJECTIVES:**

- To understand the need for multi-core processors, and their architecture.
- To understand the challenges in parallel and multi-threaded programming.
- To learn about the various parallel programming paradigms,
- To develop multicore programs and design parallel solutions

**UNIT I MULTI-CORE PROCESSORS 9**

Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks - Symmetric and Distributed Shared Memory Architectures – Cache coherence - Performance Issues – Parallel program design.

**UNIT II PARALLEL PROGRAM CHALLENGES 9**

Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutexes, locks, semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes).

**UNIT III SHARED MEMORY PROGRAMMING WITH OpenMP 9**

OpenMP Execution Model – Memory Model – OpenMP Directives – Work-sharing Constructs - Library functions – Handling Data and Functional Parallelism – Handling Loops - Performance Considerations.

**UNIT IV DISTRIBUTED MEMORY PROGRAMMING WITH MPI 9**

MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived datatypes – Performance evaluation

**UNIT V PARALLEL PROGRAM DEVELOPMENT 9**

Case studies - n-Body solvers – Tree Search – OpenMP and MPI implementations and Comparison.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Describe multicore architectures and identify their characteristics and challenges.
- Identify the issues in programming Parallel Processors.
- Write programs using OpenMP and MPI.
- Design parallel programming solutions to common problems.
- Compare and contrast programming for serial processors and parallel processors.

**TEXTBOOKS:**

1. Peter S. Pacheco, —An Introduction to Parallel Programming, Morgan-Kaufman/Elsevier, 2011.
2. Darryl Gove, —Multicore Application Programming for Windows, Linux, and Oracle Solaris, Pearson, 2011 (unit 2)

**REFERENCES:**

1. Michael J Quinn, —Parallel programming in C with MPI and OpenMPI, Tata McGraw Hill, 2003.
2. Victor Alessandrini, Shared Memory Application Programming, 1st Edition, Concepts and Strategies in Multicore Application Programming, Morgan Kaufmann, 2015.

**OBJECTIVES:**

- To learn the foundations of Human Computer Interaction.
- To become familiar with the design technologies for individuals and persons with disabilities.
- To be aware of mobile HCI.
- To learn the guidelines for user interface.

**UNIT I FOUNDATIONS OF HCI 9**

The Human: I/O channels – Memory – Reasoning and problem solving; The Computer: Devices– Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles –elements – interactivity- Paradigms. - Case Studies

**UNIT II DESIGN & SOFTWARE PROCESS 9**

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4,802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

**UNIT III MODELS AND THEORIES 9**

Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

**UNIT IV MOBILE HCI 9**

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning– No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG

**UNIT V WEB INTERFACE DESIGN 9**

Cisco IoT system - IBM Watson IoT platform – Manufacturing - Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control

**TOTAL : 45 PERIODS****OUTCOMES:**

**At the end of the course, the student should be able to:**

- Design effective dialog for HCI
- Design effective HCI for individuals and persons with disabilities.
- Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.
- Develop meaningful user interface.

**TEXTBOOKS:**

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, —Human Computer Interactionll, 3rd Edition, Pearson Education, 2004 (UNIT I, II & III)
2. Brian Fling, —Mobile Design and Developmentll, First Edition, O'Reilly Media Inc., 2009 (UNIT –IV)
3. 3. Bill Scott and Theresa Neil, —Designing Web Interfacesll, First Edition, O'Reilly, 2009. (UNIT-V)

**OBJECTIVES:**

- To learn basic programming in C# and the object oriented programming concepts.
- To update and enhance skills in writing Windows applications, ADO.NET and ASP.NET.
- To study the advanced concepts in data connectivity, WPF, WCF and WWF with C# and .NET 4.5.
- To implement mobile applications using .Net compact framework
- To understand the working of base class libraries, their operations and manipulation of data using XML.

**UNIT I C# LANGUAGE BASICS 9**

.Net Architecture - Core C# - Variables - Data Types - Flow control - Objects and Types- Classes and Structs - Inheritance- Generics – Arrays and Tuples - Operators and Casts - Indexers

**UNIT II IoT PROTOCOLS 9**

Delegates - Lambdas - Lambda Expressions - Events - Event Publisher - Event Listener - Strings and Regular Expressions - Generics - Collections - Memory Management and Pointers - Errors and Exceptions - Reflection

**UNIT III DESIGN AND DEVELOPMENT 9**

Diagnostics -Tasks, Threads and Synchronization - .Net Security - Localization - Manipulating XML-SAX and DOM - Manipulating files and the Registry- Transactions - ADO.NET- Peer-to-Peer Networking - PNRP - Building P2P Applications - Windows Presentation Foundation (WPF).

**UNIT IV DATA ANALYTICS AND SUPPORTING SERVICES 9**

Window based applications - Core ASP.NET- ASP.NET Web forms -Windows Communication Foundation (WCF)- Introduction to Web Services - .Net Remoting - Windows Service - Windows Workflow Foundation (WWF) - Activities – Workflows

**UNIT V CASE STUDIES/INDUSTRIAL APPLICATIONS 9**

Assemblies - Shared assemblies - Custom Hosting with CLR Objects - Appdomains - Core XAML - Bubbling and Tunneling Events- Reading and Writing XAML - .Net Compact Framework - Compact Edition Data Stores – Errors, Testing and Debugging – Optimizing performance – Packaging and Deployment – Networking and Mobile Devices

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Write various applications using C# Language in the .NET Framework.
- Develop distributed applications using .NET Framework.
- Create mobile applications using .NET compact Framework.

**TEXTBOOKS:**

1. Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson, Morgan Skinner . —Professional C# 2012 and .NET 4.5l, Wiley, 2012
2. Harsh Bhasin, —Programming in C#, Oxford University Press, 2014.



**REFERENCES:**

1. Ian Gariffiths, Mathew Adams, Jesse Liberty, —Programming C# 4.0, O\_Reilly, Fourth Edition, 2010.
2. Andrew Troelsen, Pro C# 5.0 and the .NET 4.5 Framework, Apress publication, 2012.
3. Andy Wigley, Daniel Moth, Peter Foot, —Mobile Development Handbook, Microsoft Press, 2011.

**OBJECTIVES:**

- To learn about the issues and challenges in the design of wireless ad hoc networks.
- To understand the working of MAC and Routing Protocols for ad hoc and sensor networks
- To learn about the Transport Layer protocols and their QoS for ad hoc and sensor networks.
- To understand various security issues in ad hoc and sensor networks and the corresponding solution

**UNIT I MAC & ROUTING IN AD HOC NETWORKS 9**

Introduction – Issues and challenges in ad hoc networks – MAC Layer Protocols for wireless ad hoc networks – Contention-Based MAC protocols – MAC Protocols Using Directional Antennas – Multiple- Channel MAC Protocols – Power-Aware MAC Protocols – Routing in Ad hoc Networks – Design Issues – Proactive, Reactive and Hybrid Routing Protocols

**UNIT II TRANSPORT & QOS IN AD HOC NETWORKS 9**

TCP’s challenges and Design Issues in Ad Hoc Networks – Transport protocols for ad hoc networks – Issues and Challenges in providing QoS – MAC Layer QoS solutions – Network Layer QoS solutions – QoS Model

**UNIT III MAC & ROUTING IN WIRELESS SENSOR NETWORKS 9**

Introduction – Applications – Challenges – Sensor network architecture – MAC Protocols for wireless sensor networks – Low duty cycle protocols and wakeup concepts – Contention- Based protocols – Schedule-Based protocols – IEEE 802.15.4 Zigbee – Topology Control – Routing Protocols

**UNIT IV TRANSPORT & QOS IN WIRELESS SENSOR NETWORKS 9**

Data-Centric and Contention-Based Networking – Transport Layer and QoS in Wireless Sensor Networks – Congestion Control in network processing – Operating systems for wireless sensor networks – Examples

**UNIT V SECURITY IN AD HOC AND SENSOR NETWORKS 9**

Security Attacks – Key Distribution and Management – Intrusion Detection – Software based Anti-tamper techniques – Water marking techniques – Defense against routing attacks - Secure Ad hoc routing protocols – Broadcast authentication WSN protocols – TESLA – Biba – Sensor Network Security Protocols – SPINS

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Identify different issues in wireless ad hoc and sensor networks
- To analyze protocols developed for ad hoc and sensor networks
- To identify and understand security issues in ad hoc and sensor networks.

**TEXTBOOKS:**

1. C.Siva Ram Murthy and B.S.Manoj, —Ad Hoc Wireless Networks – Architectures and 2 Protocolsl, Pearson Education, 2006.
2. Holger Karl, Andreas Willing, —Protocols and Architectures for Wireless Sensor Networks|, John Wiley & Sons, Inc., 2005.

**REFERENCES:**

1. Subir Kumar Sarkar, T G Basavaraju, C Puttamadappa, —Ad Hoc Mobile Wireless Networks Auerbach Publications, 2008.
2. Carlos De Morais Cordeiro, Dharma Prakash Agrawal, —Ad Hoc and Sensor Networks: Theory and Applications (2nd Edition)|, World Scientific Publishing, 2011.
3. Walteneus Dargie, Christian Poellabauer, —Fundamentals of Wireless Sensor Networks Theory and Practicel, John Wiley and Sons, 2010
4. Xiang-Yang Li , “Wireless Ad Hoc and Sensor Networks: Theory and Applications|, 1227 th edition, Cambridge university Press,2008.

**OBJECTIVES:**

- To learn the modeling and design of databases.
- To acquire knowledge on parallel and distributed databases and their applications.
- To study the usage and applications of Object Oriented and Intelligent databases.
- To understand the usage of advanced data models.
- To learn emerging databases such as XML, Cloud and Big Data.
- To acquire inquisitive attitude towards research topics in 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 – Design of Parallel Systems- Distributed Database Concepts - Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing – 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 INTELLIGENT DATABASES 9**

Active Databases: Syntax and Semantics (Starburst, Oracle, DB2)- Taxonomy- Applications- Design Principles for Active Rules- Temporal Databases: Overview of Temporal Databases- TSQL2- Deductive Databases: Logic of Query Languages – Datalog- Recursive Rules-Syntax and Semantics of Datalog Languages- Implementation of Rules and Recursion- Recursive Queries in SQL- Spatial Databases- Spatial Data Types- Spatial Relationships- Spatial Data Structures- Spatial Access Methods- Spatial DB Implementation.

**UNIT IV ADVANCED DATA MODELS 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- Multimedia Databases- Information Retrieval- Data Warehousing- Data Mining- Text Mining.

**UNIT V EMERGING TECHNOLOGIES 9**

XML Databases: XML-Related Technologies-XML Schema- XML Query Languages- Storing XML in Databases-XML and SQL- Native XML Databases- Web Databases- Geographic Information Systems- Biological Data Management- Cloud Based Databases: Data Storage Systems on the Cloud- Cloud Storage Architectures-Cloud Data Models- Query Languages- Introduction to Big Data-Storage-Analysis.

**TOTAL : 45 PERIODS**

## **OUTCOMES:**

### **At the end of the course, the student should be able to:**

- To develop in-depth understanding of relational databases and skills to optimize database performance in practice.
- To understand and critique on each type of databases.
- To design faster algorithms in solving practical database problems.
- To implement intelligent databases and various data models.

## **TEXTBOOKS:**

1. Ramez Elmasri, Shamkant B. Navathe, —Fundamentals of Database Systems, Sixth Edition Pearson, 2011.
2. Thomas Cannolly and Carolyn Begg, —Database Systems, A Practical Approach to Design, Implementation and Management, Fourth Edition, Pearson Education, 2008.

## **REFERENCES:**

1. Henry F Korth, Abraham Silberschatz, S. Sudharshan, —Database System Concepts, Sixth Edition, McGraw Hill, 2011.
2. C.J.Date, A.Kannan, S.Swamynathan, —An Introduction to Database Systems, Eighth Edition, Pearson Education, 2006.
3. Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, Richard T.Snodgrass, V.S.Subrahmanian, Roberto Zicari, —Advanced Database Systems, Morgan Kaufmann publishers,2006.

**OBJECTIVES:**

- To become familiar with digital image fundamentals
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition methods

**UNIT I DIGITAL IMAGE FUNDAMENTALS****9**

Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.

**UNIT II IMAGE ENHANCEMENT****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 IMAGE RESTORATION****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 IV IMAGE SEGMENTATION****9**

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.

**UNIT V IMAGE COMPRESSION AND RECOGNITION****9**

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

**TOTAL : 45 PERIODS****OUTCOMES:**

**At the end of the course, the student should be able to:**

- Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.
- Operate on images using the techniques of smoothing, sharpening and enhancement.
- Understand the restoration concepts and filtering techniques.
- Learn the basics of segmentation, features extraction, compression and recognition methods for color models.

**TEXTBOOKS:**

1. Rafael C. Gonzalez, Richard E. Woods, *‘Digital Image Processing’*, Pearson, Third Edition, 2010.
2. Anil K. Jain, *‘Fundamentals of Digital Image Processing’*, Pearson, 2002.

**REFERENCES:**

1. Kenneth R. Castleman, *‘Digital Image Processing’*, Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, *‘Digital Image Processing using MATLAB’*, Pearson Education, Inc., 2011.
3. D.E. Dudgeon and R.M. Mersereau, *‘Multidimensional Digital Signal Processing’*, Prentice Hall Professional Technical Reference, 1990.
4. William K. Pratt, *‘Digital Image Processing’*, John Wiley, New York, 2002
5. Milan Sonka et al *‘Image processing, analysis and machine vision’*, Brookes/Cole, Vikas Publishing House, 2nd edition, 1999

- To understand the concept of semantic web and related applications.
- To learn knowledge representation using ontology.
- To understand human behaviour in social web and related communities.
- To learn visualization of social networks.

**UNIT I INTRODUCTION 9**

Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.

**UNIT II MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION 9**

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Advanced representations.

**UNIT III EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS 9**

Extracting evolution of Web Community from a Series of Web Archive - 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 - Decentralized online social networks - Multi- Relational characterization of dynamic social network communities.

**UNIT IV PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES 9**

Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

**UNIT V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS 9**

Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation networks.

**TOTAL : 45 PERIODS**



**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Develop semantic web related applications.
- Represent knowledge using ontology.
- Predict human behaviour in social web and related communities.
- Visualize social networks

**TEXTBOOKS:**

1. Peter Mika, —Social Networks and the Semantic Webl, First Edition, Springer 2007.
2. Borko Furht, —Handbook of Social Network Technologies and Applicationsl, 1st Edition, Springer, 2010.

**REFERENCES:**

1. Guandong Xu ,Yanchun Zhang and Lin Li, —Web Mining and Social Networking – Techniques and applicationsl, First Edition, Springer, 2011.
2. Dion Goh and Schubert Foo, —Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectivelyl, IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, —Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modellingl, IGI Global Snippet, 2009.
4. John G. Breslin, Alexander Passant and Stefan Decker, —The Social Semantic Webl, Springer,2009.

**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 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

**UNIT II SECURITY INVESTIGATION 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

**UNIT III SECURITY ANALYSIS 9**

Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk - Systems: Access Control Mechanisms, Information Flow and Confinement Problem

**UNIT IV LOGICAL DESIGN 9**

Blueprint for Security, Information Security Policy, Standards and Practices, ISO 17799/BS 7799, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity

**UNIT V PHYSICAL DESIGN 9**

Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access Control Devices, Physical Security, Security and Personnel

**TOTAL : 45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Discuss the basics of information security
- Illustrate the legal, ethical and professional issues in information security
- Demonstrate the aspects of risk management.
- Become aware of various standards in the Information Security System
- Design and implementation of Security Techniques.

**TEXTBOOKS:**

1. Michael E Whitman and Herbert J Mattord, —Principles of Information Security, Vikas Publishing House, New Delhi, 2003

**REFERENCES:**

1. Micki Krause, Harold F. Tipton, — Handbook of Information Security Management, Vol 1-3 CRC Press LLC, 2004.
2. Stuart McClure, Joel Scrambray, George Kurtz, —Hacking Exposed, Tata McGraw- Hill, 2003
3. Matt Bishop, — Computer Security Art and Science, Pearson/PHI, 2002.

**OBJECTIVES:**

- To learn computer forensics
- To become familiar with forensics tools
- To learn to analyze and validate forensics data.

**UNIT I INTRODUCTION TO COMPUTER FORENSICS 9**

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques - Incident and incident response methodology - Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.

**UNIT II EVIDENCE COLLECTION AND FORENSICS TOOLS 9**

Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.

**UNIT III ANALYSIS AND VALIDATION 9**

Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics

**UNIT IV ETHICAL HACKING 9**

Introduction to Ethical Hacking - Footprinting and Reconnaissance - Scanning Networks - Enumeration - System Hacking - Malware Threats - Sniffing.

**UNIT V ETHICAL HACKING IN WEB 9**

Social Engineering - Denial of Service - Session Hijacking - Hacking Web servers – Hacking Web Applications – SQL Injection - Hacking Wireless Networks - Hacking Mobile Platforms.

**TOTAL : 45 PERIODS****OUTCOMES:**

**At the end of the course, the student should be able to:**

- Understand the basics of computer forensics
- Apply a number of different computer forensic tools to a given scenario
- Analyze and validate forensics data
- Identify the vulnerabilities in a given network infrastructure
- Implement real-world hacking techniques to test system security.

**TEXTBOOKS:**

1. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, —Computer Forensics and Investigations, Cengage Learning, India Edition, 2016.
2. CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, 2015.

**REFERENCES:**

1. John R.Vacca, —Computer Forensics, Cengage Learning, 2005
2. MarjieT.Britz, —Computer Forensics and Cyber Crimel: An Introduction, 3rd Edition, Prentice Hall, 2013.
3. AnkitFadia — Ethical Hacking, Second Edition, Macmillan India Ltd, 2006
4. Kenneth C.Brancik —Insider Computer Fraud, Auerbach Publications Taylor & Francis Group–2008.

**OBJECTIVES:**

- To learn the basic concepts of Soft Computing
- To become familiar with various techniques like neural networks, genetic algorithms and fuzzy systems.
- To apply soft computing techniques to solve problems.

**UNIT I INTRODUCTION TO SOFT 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 ARTIFICIAL NEURAL NETWORKS****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 FUZZY SYSTEMS****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 GENETIC ALGORITHMS****9**

Basic Concepts- Working Principles -Encoding- Fitness Function - Reproduction - Inheritance Operators - Cross Over - Inversion and Deletion -Mutation Operator - Bit-wise Operators -Convergence of Genetic Algorithm.

**UNIT V HYBRID 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 Fuzzy BP - Fuzzy ArtMap: A Brief Introduction - Soft Computing Tools - GA in Fuzzy Logic Controller Design - Fuzzy Logic Controller

**TOTAL : 45 PERIODS****OUTCOMES:**

**At the end of the course, the student should be able to:**

- Apply suitable soft computing techniques for various applications.
- Integrate various soft computing techniques for complex problems.

**TEXTBOOKS:**

1. N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming", Oxford University Press, 2015.
2. S.N.Sivanandam , S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt. Ltd., 2nd Edition, 2011.
3. S.Rajasekaran, G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications ", PHI Learning Pvt. Ltd., 2017.

**REFERENCES:**

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, —Neuro-Fuzzy and Soft Computing, Prentice-Hall of India, 2002.
2. Kwang H.Lee, —First course on Fuzzy Theory and Applications, Springer, 2005.
3. George J. Klir and Bo Yuan, —Fuzzy Sets and Fuzzy Logic-Theory and Applications, Prentice Hall, 1996.
4. James A. Freeman and David M. Skapura, —Neural Networks Algorithms, Applications, and Programming Techniques, Addison Wesley, 2003.

**OBJECTIVES:**

- To understand the basics of Information Retrieval.
- To understand machine learning techniques for text classification and clustering.
- To understand various search engine system operations.
- To learn different techniques of recommender system.

**UNIT I 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 – How the web changed Search – Practical Issues on the Web – How People Search – Search Interfaces Today – Visualization in Search Interfaces.

**UNIT II MODELING AND RETRIEVAL EVALUATION****9**

Basic IR Models - Boolean Model - TF-IDF (Term Frequency/Inverse Document Frequency) Weighting - Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference Collection – User- based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback.

**UNIT III TEXT CLASSIFICATION AND CLUSTERING****9**

A Characterization of Text Classification – Unsupervised Algorithms: Clustering – Naïve Text Classification – Supervised Algorithms – Decision Tree – k-NN Classifier – SVM Classifier – Feature Selection or Dimensionality Reduction – Evaluation metrics – Accuracy and Error – Organizing the classes – Indexing and Searching – Inverted Indexes – Sequential Searching – Multi-dimensional Indexing.

**UNIT IV WEB RETRIEVAL AND WEB CRAWLING****9**

The Web – Search Engine Architectures – Cluster based Architecture – Distributed Architectures – Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank – Evaluations -- Search Engine Ranking – Search Engine User Interaction – Browsing – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation.

**UNIT V RECOMMENDER SYSTEM****9**

Recommender Systems Functions – Data and Knowledge Sources – Recommendation Techniques – Basics of Content-based Recommender Systems – High Level Architecture – Advantages and Drawbacks of Content-based Filtering – Collaborative Filtering – Matrix factorization models – Neighborhood models..

**TOTAL : 45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Use an open source search engine framework and explore its capabilities
- Apply appropriate method of classification or clustering.
- Design and implement innovative features in a search engine.
- Design and implement a recommender system.

**TEXTBOOKS:**

1. Ricardo Baeza-Yates and Berthier Ribeiro-Neto, —Modern Information Retrieval: The Concepts and Technology behind Search, Second Edition, ACM Press Books, 2011.
2. Ricci, F, Rokach, L. Shapira, B.Kantor, —Recommender Systems Handbook, First Edition, 2011.

**REFERENCES:**

1. C. Manning, P. Raghavan, and H. Schütze, —Introduction to Information Retrieval, Cambridge University Press, 2008.
2. Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, —Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.

**OBJECTIVES:**

- To learn the fundamentals of natural language processing
- To understand the use of CFG and PCFG in NLP
- To understand the role of semantics of sentences and pragmatics
- To apply the NLP techniques to IR applications

**UNIT I INTRODUCTION****9**

Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance

**UNIT II WORD LEVEL ANALYSIS****9**

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

**UNIT III SYNTACTIC ANALYSIS****9**

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures.

**UNIT IV SEMANTICS AND PRAGMATICS****10**

Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

**UNIT V DISCOURSE ANALYSIS AND LEXICAL RESOURCES****8**

Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC)

**TOTAL : 45 PERIODS****OUTCOMES:**

**At the end of the course, the student should be able to:**

- To tag a given text with basic Language features
- To design an innovative application using NLP components
- To implement a rule based system to tackle morphology/syntax of a language
- To design a tag set to be used for statistical processing for real-time applications
- To compare and contrast the use of different statistical approaches for different types of NLP applications.



**TEXTBOOKS:**

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python, First Edition, O'Reilly Media, 2009.

**REFERENCES:**

1. Breck Baldwin, —Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
2. Richard M Reese, —Natural Language Processing with Java, O'Reilly Media, 2015.
3. Nitin Indurkha and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
4. Tanveer Siddiqui, U.S. Tiwary, —Natural Language Processing and Information Retrieval, Oxford University Press, 2008.

**OBJECTIVES:**

- To understand different parallel architectures and models of computation.
- To introduce the various classes of parallel algorithms.
- To study parallel algorithms for basic problems.

**UNIT I INTRODUCTION 9**

Need for Parallel Processing - Data and Temporal Parallelism - Models of Computation - RAM and PRAM Model – Shared Memory and Message Passing Models- Processor Organisations - PRAM Algorithm – Analysis of PRAM Algorithms- Parallel Programming Languages.

**UNIT II PRAM ALGORITHMS 9**

Parallel Algorithms for Reduction – Prefix Sum – List Ranking –Preorder Tree Traversal – Searching - Sorting - Merging Two Sorted Lists – Matrix Multiplication - Graph Coloring - Graph Searching.

**UNIT III SIMD ALGORITHMS -I 9**

2D Mesh SIMD Model - Parallel Algorithms for Reduction - Prefix Computation - Selection - Odd-Even Merge Sorting - Matrix Multiplication.

**UNIT IV SIMD ALGORITHMS -II 9**

Hypercube SIMD Model - Parallel Algorithms for Selection- Odd-Even Merge Sort- Bitonic Sort- Matrix Multiplication Shuffle Exchange SIMD Model - Parallel Algorithms for Reduction -Bitonic Merge Sort - Matrix Multiplication - Minimum Cost Spanning Tree

**UNIT V MIMD ALGORITHMS 9**

UMA Multiprocessor Model -Parallel Summing on Multiprocessor- Matrix Multiplication on Multiprocessors and Multicomputer - Parallel Quick Sort - Mapping Data to Processors.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Develop parallel algorithms for standard problems and applications.
- Analyse efficiency of different parallel algorithms.

**TEXTBOOKS:**

1. Michael J. Quinn, "Parallel Computing : Theory & Practice", Tata McGraw Hill Edition, Second edition, 2017.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", University press, Second edition , 2011.
3. V Rajaraman, C Siva Ram Murthy, " Parallel computers- Architecture and Programming ", PHI learning, 2016.

**REFERENCES:**

1. Ananth Grame, George Karpis, Vipin Kumar and Anshul Gupta, "Introduction to Parallel Computing", 2nd Edition, Addison Wesley, 2003.
2. M Sasikumar, Dinesh Shikhare and P Ravi Prakash , " Introduction to Parallel Processing", PHI learning , 2013.
3. S.G.Akl, "The Design and Analysis of Parallel Algorithms", PHI, 1989.

**OBJECTIVES:**

- To understand the fundamentals of the speech processing
- Explore the various speech models
- Gather knowledge about the phonetics and pronunciation processing
- Perform wavelet analysis of speech
- To understand the concepts of speech recognition

**UNIT I INTRODUCTION 9**

Introduction - knowledge in speech and language processing - ambiguity - models and algorithms - language - thought - understanding - regular expression and automata - words & transducers – N grams

9

**UNIT II SPEECH MODELLING**

Word classes and part of speech tagging – hidden markov model – computing likelihood: the forward algorithm – training hidden markov model – maximum entropy model – transformation- based tagging – evaluation and error analysis – issues in part of speech tagging – noisy channel model for spelling.

**UNIT III SPEECH PRONUNCIATION AND SIGNAL PROCESSING 9**

Phonetics - speech sounds and phonetic transcription - articulatory phonetics - phonological categories and pronunciation variation - acoustic phonetics and signals - phonetic resources - articulatory and gestural phonology

**UNIT IV SPEECH IDENTIFICATION 9**

Speech synthesis - text normalization - phonetic analysis - prosodic analysis – diphone waveform synthesis - unit selection waveform synthesis - evaluation

**UNIT V SPEECH RECOGNITION 9**

Automatic speech recognition - architecture - applying hidden markov model - feature extraction: mfcc vectors - computing acoustic likelihoods - search and decoding - embedded training - multipass decoding: n-best lists and lattices- a\* (‘\_stack’) decoding - context-dependent acoustic models: triphones - discriminative training - speech recognition by humans.

**TOTAL : 45 PERIODS****OUTCOMES:**

**At the end of the course, the student should be able to:**

- Create new algorithms with speech processing
- Derive new speech models
- Perform various language phonetic analysis
- Create a new speech identification system
- Generate a new speech recognition system

**TEXTBOOKS:**

1. Daniel Jurafsky and James H. Martin, — Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition, Pearson education,2013.

## REFERENCES:

1. Kai-Fu Lee, —Automatic Speech Recognition, The Springer International Series in Engineering and Computer Science, 1999.
2. Himanshu Chaurasiya, —Soft Computing Implementation of Automatic Speech Recognition, LAP Lambert Academic Publishing, 2010.
3. Claudio Becchetti, Klucio Prina Ricotti, —Speech Recognition: Theory and C++ Implementation Wiley publications 2008.
4. Ikrami Eldirawy , Wesam Ashour, —Visual Speech Recognition, Wiley publications , 2011

**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-thin films-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<sub>2</sub>, MgO, ZrO<sub>2</sub>, NiO, nanoalumina, CaO, AgTiO<sub>2</sub>, 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, Nanobiotechnology: 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:**

**At the end of the course, the student should be able to:**

- Familiarize about the science of nanomaterials
- Demonstrate the preparation of nanomaterials
- Develop knowledge in characteristic nanomaterial

**TEXTBOOKS:**

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 Characterisation of surfaces & Interfaces, 2nd edition,
3. 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.

## LIST OF FREE ELECTIVE - I

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CLOUD COMPUTING

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### 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 - IaaS – 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.

**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.

**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 ELECTRODE CONFIGURATIONS 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-ELECTRICAL PARAMETERS 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 physiological 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.



**OBJECTIVES:**

- To understand the concepts of measurement technology.
- To learn the various sensors used to measure various physical parameters.
- To learn the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development.

**UNIT I INTRODUCTION 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 Output Signal Types.

**UNIT II MOTION, PROXIMITY AND RANGING SENSORS 9**

Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer.,– GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).

**UNIT III FORCE, MAGNETIC AND HEADING SENSORS 9**

Strain Gage, Load Cell, Magnetic Sensors –types, principle, requirement and advantages: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclinometers

**UNIT IV OPTICAL, PRESSURE AND TEMPERATURE SENSORS 9**

Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC, Thermistor, RTD, Thermocouple. Acoustic Sensors – flow and level measurement, Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors, LASER sensors.

**UNIT V ALTERNATIVE ENERGY SOURCES**

Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and multi channel data acquisition – Data logging - applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring.

**TOTAL : 45 PERIODS****OUTCOMES:**

**At the end of the course, the student should be able to:**

- CO1.** Expertise in various calibration techniques and signal types for sensors.  
**CO2.** Apply the various sensors in the Automotive and Mechatronics applications  
**CO3.** Study the basic principles of various smart sensors.  
**CO4.** Implement the DAQ systems with different sensors for real time applications

**TEXTBOOKS:**

1. Ernest O Doebelin, “Measurement Systems – Applications and Design”, Tata McGraw-Hill, 2009.
2. Sawney A K and Puneet Sawney, “A Course in Mechanical Measurements and Instrumentation and Control”, 12<sup>th</sup> edition, Dhanpat Rai & Co, New Delhi, 2013.

**REFERENCES:**

1. Patranabis D, “Sensors and Transducers”, 2<sup>nd</sup> Edition, PHI, New Delhi, 2010.
2. John Turner and Martyn Hill, “Instrumentation for Engineers and Scientists”, Oxford Science Publications, 1999.
3. Richard Zurawski, “Industrial Communication Technology Handbook” 2<sup>nd</sup> edition, CRC Press, 2015.

**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**

Nanocatalysts – 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:**

1. 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)

**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.energymanagertraining.com](http://www.energymanagertraining.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.

**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 tilted 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

**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:**

1. 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.

**OBJECTIVES:**

- To impart knowledge on the principle and design of control of Indoor/ particulate/ gaseous air pollutant and its emerging trends.

**UNIT I INTRODUCTION**

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
- 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.

**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 Elevation 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



## LIST OF FREE ELECTIVE - II

19150FE74A

INTRODUCTION TO C PROGRAMMING

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### 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: Reema Thareja (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: Reema Thareja (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: Reema Thareja (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: Reema Thareja (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: Reema Thareja (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. Reema Thareja, "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

**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<sup>nd</sup> Edition, Pearson Education, 1997.
2. Brian W. Kernighan and Dennis M. Ritchie, “The C Programming Language”, 2<sup>nd</sup> 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. Yashvant Kanetkar, “Data Structures Through C”, BPB publications, II edition, 2003

**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-Variou 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., Chmielewski T.A and Negin M., "Robotic Engineering - An Integrated Approach", Prentice Hall, 2003. 2. Groover M.P., "Industrial Robotics -Technology Programming and Applications", McGraw Hill, 2001.

**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- Gummel Poonmodel, 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 diode-Zener 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", 4<sup>th</sup> 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", 4<sup>TH</sup> Edition, McGraw Hill, 2016.

**REFERENCES:**

1. Donald A Neaman, "Semiconductor Physics and Devices", 4<sup>th</sup> Edition, McGraw Hill, 2012.
2. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory" Pearson Prentice Hall, 11<sup>th</sup> Edition, 2014.
3. Bhattacharya and Sharma, "Solid State Electronic Devices", 2<sup>nd</sup> Edition, Oxford University Press, 2014.
4. R.S.Sedha, "A Textbook of Electronic Devices and Circuits", 2<sup>nd</sup> Edition, S.Chand Publications, 2008.
5. David A. Bell, "Electronic Devices and Circuits", 5<sup>th</sup> Edition, Oxford University Press, 2008.

**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 introduce Phasor diagrams and analysis of three phase circuits

**UNIT I BASIC CIRCUITS ANALYSIS****9**

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 CIRCUITS****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 AC CIRCUITS****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: voltage and current division, source transformation –mesh and node analysis, Thevenins and Norton Theorems – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem – Millman's theorem.

**UNIT IV THREE PHASE CIRCUITS****9**

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****9**

Series and parallel resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Ability to introduce electric circuits and its analysis
- Ability to impart knowledge on solving circuit equations using network theorems
- Ability to introduce the phenomenon of resonance in coupled circuits.
- Ability to introduce Phasor diagrams and analysis of three phase circuits

**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.

**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****9**

Reference theory fundamentals-principle of operation and analysis: IG and PMSG

**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. Trzynadlowski, „Introduction to Modern Power Electronics“, Second edition, wiley India Pvt. Ltd, 2012.

**OBJECTIVES :**

To impart knowledge on safety engineering fundamentals and safety management practices.

**UNIT I INTRODUCTION****9**

Evolution of modern safety concepts – Fire prevention – Mechanical hazards – Boilers, Pressure vessels, Electrical Exposure.

**UNIT II CHEMICAL HAZARDS****9**

Chemical exposure – Toxic materials – Ionizing Radiation and Non-ionizing Radiation - Industrial Hygiene – Industrial Toxicology.

**UNIT III ENVIRONMENTAL CONTROL****9**

Industrial Health Hazards – Environmental Control – Industrial Noise - Noise measuring instruments, Control of Noise, Vibration, - Personal Protection.

**UNIT IV HAZARD ANALYSIS****9**

System Safety Analysis –Techniques – Fault Tree Analysis (FTA), Failure Modes and Effects Analysis (FMEA), HAZOP analysis and Risk Assessment

**UNIT V SAFETY REGULATIONS****9**

Explosions – Disaster management – catastrophe control, hazard control, Safety education and training - Factories Act, Safety regulations Product safety – case studies

**TOTAL : 45 PERIODS****OUTCOMES:**

- Students must be able to identify and prevent chemical, environmental mechanical, fire hazard through analysis and apply proper safety techniques on safety engineering and management

**TEXT BOOK:**

1. John V.Grimaldi, "Safety Management", AITB S Publishers, 2003.

**REFERENCES:**

1. Safety Manual, "EDEL Engineering Consultancy", 2000.
2. David L.Goetsch, "Occupational Safety and Health for Technologists", 5th Edition, Engineers and Managers, Pearson Education Ltd., 2005.



**OBJECTIVE:**

To understand the various destructive and non destructive testing methods of materials and its industrial applications.

**UNIT I INTRODUCTION TO MATERIALS TESTING 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 MECHANICAL TESTING 9**

Introduction to mechanical testing, Hardness test (Vickers, Brinell, Rockwell), Tensile test, Impact test (Izod, Charpy) - Principles, Techniques, Methods, Advantages and Limitations, Applications. Bend test, Shear test, Creep and Fatigue test - Principles, Techniques, Methods, Advantages and Limitations, Applications.

**UNIT III NON DESTRUCTIVE TESTING 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 MATERIAL CHARACTERIZATION TESTING 9**

Macroscopic and Microscopic observations, Optical and Electron microscopy (SEM and TEM) Principles, Types, Advantages and Limitations, Applications. Diffraction techniques, Spectroscopic Techniques, Electrical and Magnetic Techniques- Principles, Types, Advantages and Limitations, Applications.

**UNIT V OTHER TESTING 9**

Thermal Testing: Differential scanning calorimetry, Differential thermal analysis. Thermo-mechanical and Dynamic mechanical analysis: Principles, Advantages, Applications. Chemical Testing: X-Ray Fluorescence, Elemental Analysis by Inductively Coupled Plasma-Optical Emission Spectroscopy and Plasma-Mass Spectrometry.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Identify suitable testing technique to inspect industrial component
- Ability to use the different technique and know its applications and limitations

**TEXT BOOKS:**

1. Baldev Raj, T.Jayakumar, M.Thavasimuthu “Practical Non-Destructive Testing”, Narosa Publishing House, 2009.
2. Cullity, B. D., “Elements of X-ray diffraction”, 3<sup>rd</sup> Edition, Addison-Wesley Company Inc., New York, 2000.
3. P. Field Foster, “The Mechanical Testing of Metals and Alloys” 7<sup>th</sup> Edition, Cousens Press, 2007.

**REFERENCES:**

1. Metals Handbook: Mechanical testing, (Volume 8) ASM Handbook Committee, 9 Edition, American Society for Metals, 1978.
2. ASM Metals Handbook, “Non-Destructive Evaluation and Quality Control”, American Society of Metals, Metals Park, Ohio, USA.
3. Brandon D.G., “Modern Techniques in Metallography”, Von Nostrand Inc. NJ, USA, 1986.

**UNIT I ENVIRONMENTAL IMPLICATIONS OF BUILDINGS 9**

Energy use, carbon emissions, water use, waste disposal; Building materials: sources, methods of production and environmental Implications. Embodied Energy in Building Materials: Transportation Energy for Building Materials; Maintenance Energy for Buildings.

**UNIT II IMPLICATIONS OF BUILDING TECHNOLOGIES EMBODIED ENERGY OF BUILDINGS 9**

Framed Construction, Masonry Construction. Resources for Building Materials, Alternative concepts. Recycling of Industrial and Buildings Wastes. Biomass Resources for buildings.

**UNIT III COMFORTS IN BUILDING 9**

Thermal Comfort in Buildings- Issues; Heat Transfer Characteristic of Building Materials and Building Techniques. Incidence of Solar Heat on Buildings-Implications of Geographical Locations.

**UNIT IV UTILITY OF SOLAR ENERGY IN BUILDINGS 9**

Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings.

**UNIT V GREEN COMPOSITES FOR BUILDINGS 9**

Concepts of Green Composites. Water Utilisation in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes. Management of Sullage Water and Sewage. Urban Environment and Green Buildings. Green Cover and Built Environment.

**TOTAL: 45****PERIODS TEXT BOOKS:**

1. K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao. Alternative Building Materials and Technologies. New Age International, 2007.
2. Low Energy Cooling For Sustainable Buildings. John Wiley and Sons Ltd, 2009.
3. Sustainable Building Design Manual. Vol 1 and 2, Teri, New Delhi, 2004.

**REFERENCES:**

1. Osman Attmann Green Architecture Advanced Technologies and Materials. McGraw Hill, 2010.
2. Jerry Yudelson Green building Through Integrated Design. McGraw Hill, 2009.
3. Fundamentals of Integrated Design for Sustainable Building By Marian Keeler, Bill Burke

**OBJECTIVES**

- To make the student conversant with the water treatment methods including adsorption and oxidation process.
- To provide basic understandings 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”, 4<sup>th</sup> ed., McGraw Hill Higher Edu., 2002.
2. W. Wesley Eckenfelder, Jr., “Industrial Water Pollution Control”, 2<sup>nd</sup> Edn., McGraw Hill Inc., 1989.

**REFERENCES**

1. S.P. Mahajan, “Pollution control in process industries”, 27<sup>th</sup> Ed. Tata McGraw Hill Publishing Company Ltd., 2012.
2. M. Lancaster, “Green Chemistry: An Introductory Text”, 2<sup>nd</sup> edition, RSC publishing, 2010.
3. C.S. Rao, “Environmental Pollution Control Engineering”, New Age International, 2007.

## **\*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 and 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 member, course teams and whole institutions analyze 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.Tech.[CSE) curriculum, the following Research Skill Based Courses are introduced in the curriculum.

Semester	RSB Courses	Credits
IV	Research Led Seminar	1
V	Research Methodology	3
VI	Participation in Bounded Research	2
VII	Design Project/ Socio Technical Project ( Scaffolded Research)	4
VIII	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= 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**

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

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

<b>Continuous Internal Assessment:</b>	<b>20 Marks</b>
● Research Tools( Lab) :	<b>10 Marks</b>
● Tutorial:	<b>10 Marks</b>
<b>Model Paper Writing:</b>	<b>40 Marks</b>
● Abstract:	<b>5 Marks</b>
● Introduction:	<b>10 Marks</b>
● Discussion:	<b>10 Marks</b>
● Review of Literature:	<b>5 Marks</b>
● Presentation:	<b>10 Marks</b>
<b>Semester Examination:</b>	<b>40 Marks</b>
<b>Total:</b>	<b>100 Marks</b>

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**PRIST**  
DEEMED TO BE  
**UNIVERSITY**

THANJAVUR – 613 403 - TAMIL NADU

**SCHOOL OF ENGINEERING AND  
TECHNOLOGY**

**DEPARTMENT OF  
COMPUTER SCIENCE & ENGINEERING**

**PROGRAM HANDBOOK**

**B.TECH CSE(PART-TIME)**

**[REGULATION 2019]**

[for candidates admitted to B.Tech CSE program from June 2019 onwards]

## PROGRAM EDUCATIONAL OBJECTIVES

The program objectives, address our mission of graduating students with solid foundation in computer science and engineering and to engage in activities that improve the welfare of society within a few years after their graduation. Based on the mission and 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. To encourage graduates to pursue advanced education, research and development, and other creative efforts in science and technology.
- III. Graduating students to achieve professional status due to their mastery of Computer Science theory and practice, exposure to emerging hardware technologies.
- IV. To endorse graduates with communication, and interpersonal skills to enable them to work in team effectively in multidisciplinary field and in their professional careers.
- V. To impart the students to engage in lifelong learning and continuing professional development to use their understanding of the impact of technology on society for the benefit of humankind.

## PROGRAM OUTCOMES

Program outcomes are the knowledge, skills, and behaviors that students acquire during the time of graduation through the program objectives. Students should be in possession of:

- a) An ability to apply mathematical, algorithmic principles, and computing techniques in the modeling and design of computer-based systems.
- b) An ability to apply software engineering techniques to design, implement and test a software system, and to evaluate and compare the efficiencies of alternative solutions.
- c) Knowledge to identify and solve the open end problems to meet the requirements in computing industry.
- d) Understanding of network technologies to evolve and deploy network.
- e) An ability to choose best web technologies for solving web client/server problem and to create web pages with dynamic effects.
- f) An ability to work in multi disciplinary projects.
- g) Verbal skills to interact with customers, colleagues, and managers, and possess written communication skills to describe ideas, document processes, and results.
- h) An ability to engage in life-long learning to remain current in their profession and be leaders in technological society.
- i) The broad education necessary to understand the impact of computing in a global, economic, societal context and in all endeavors.
- j) Fundamental knowledge in digital circuits, communication systems and computer hardware.
- k) An ability to map computing ideas into working physical systems with the help of computing technologies for the benefit of society.



**MAPPING OF PEO WITH PO**

PEO	PROGRAM OUTCOMES										
	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

**B.TECH CSE (PT) R-19**  
**SEMESTER I**

Subject Code	Subject Name	Periods Per Week			C
		L	T	P	
19148S11P	Transforms and Partial Differential Equations	3	1	0	4
19150C12P	Digital Systems	3	0	0	3
19150C13P	Data Structures and algorithms	3	1	0	4
19150C14P	Computer Architecture and Organization	3	1	0	4
19150C15P	Object Oriented Programming	3	1	0	4
<b>Total No. of credits</b>					<b>19</b>

**SEMESTER II**

Subject Code	Subject Name	Periods Per Week			C
		L	T	P	
19148S21P	Numerical Methods	3	1	0	4
19150C22P	Microprocessors and Interfacing	3	0	0	3
19150C23P	Database Management Systems	3	1	0	4
19150C24P	Design and Analysis Of Algorithm	3	1	0	4
19150C25P	Software Engineering	3	1	0	4
<b>Total No. of credits</b>					<b>19</b>

**SEMESTER III**

Subject Code	Subject Name	Periods Per Week			C
		L	T	P	
19148S31P	Discrete Mathematics	3	1	0	4
19150C32P	Operating System	4	0	0	4
19150C33P	Artificial Intelligence	4	0	0	4
19150C34P	Computer Networks	4	0	0	4
19150L35P	Operating Systems and Networking Lab	0	0	3	2
<b>Total No. of credits</b>					<b>18</b>

**SEMESTER IV**

Subject Code	Subject Name	Periods Per Week			C
		L	T	P	
19150C41P	Principles Of Cryptography	3	1	0	4
19150C42P	Web Technology	3	1	0	4
19150C43P	C# And .Net Framework	3	1	0	4
19150E44_P	Elective-I	3	1	0	4
19150L45P	Internet Programming Lab	0	0	3	2
<b>Total No. of credits</b>					<b>18</b>

**SEMESTER - V**

Subject Code	Subject Name	Periods Per Week			C
		L	T	P	
19150C51P	Object Oriented Analysis and Design	4	0	0	4
19150C52P	Software Quality Management	3	1	0	4
19150C53P	Graphics and Multimedia	3	1	0	4
19150E54_P	Elective -II	3	1	0	4
19150L55P	Software Development Lab	0	0	3	2
<b>Total No. of credits</b>					<b>18</b>

**SEMESTER - VI**

Subject Code	Subject Name	Periods Per Week			C
		L	T	P	
19150C61P	Embedded Systems	4	0	0	4
19150C62P	Advanced Java programming	3	1	0	4
19150C63P	Software Testing	4	0	0	4
19150E64_P	Elective III	4	0	0	4
19150L65P	Java Programming Lab	0	0	3	2
<b>Total No. of credits</b>					<b>18</b>

**SEMESTER - VII**

Subject Code	Subject Name	Periods Per Week			C
		L	T	P	
19160S71P	Total Quality Management	3	0	0	3
19150C72P	Grid Computing	4	0	0	4
19150C73P	Middleware Technologies	3	1	0	4
19150E74_P	Elective IV	3	0	0	3
19150P75P	Project	0	0	12	6
<b>Total No. of credits</b>					<b>20</b>

### LIST OF ELECTIVES SEMESTER – IV (ELECTIVE I)

Subject Code	Subject Name	Periods Per Week			C
		L	T	P	
19150E44AP	Theory of Computation	3	1	0	4
19150E44BP	Real Time Systems	3	1	0	4
19150E44CP	User Interface Design	3	1	0	4
19150E44DP	Advanced Databases	3	1	0	4

### SEMESTER - V(ELECTIVE II)

Subject Code	Subject Name	Periods Per Week			C
		L	T	P	
19150E54AP	Soft Computing	3	1	0	4
19150E54BP	Principles of Compiler Design	3	1	0	4
19150E54CP	Distributed Systems	3	1	0	4
19150E54DP	Mobile Computing	3	1	0	4

### SEMESTER – VI(ELECTIVE III)

Subject Code	Subject Name	Periods Per Week			C
		L	T	P	
19150E64AP	Principles of Management	4	0	0	4
19150E64BP	Unix Internals	4	0	0	4
19150E64CP	Parallel Computing	4	0	0	4
19150E64DP	Programming paradigms	4	0	0	4

### SEMESTER – VII (ELECTIVE VI)

Subject Code	Subject Name	Periods Per Week			C
		L	T	P	
19150E74AP	High Speed Networks	3	0	0	3
19150E74BP	Bio Informatics	3	0	0	3
19150E74CP	Software Project Management	3	0	0	3
19150E74DP	Digital Image Processing	3	0	0	3

## CREDITS DISTRIBUTION

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
<b>Total Credits</b>								<b>130</b>

<b>TOTAL CREDITS</b>	
Semester – I	<b>19</b>
Semester – II	<b>19</b>
Semester – III	<b>18</b>
Semester – IV	<b>18</b>
Semester – V	<b>18</b>
Semester – VI	<b>18</b>
Semester – VI	<b>20</b>
<b>TOTAL CREDITS</b>	<b>130</b>

# SYLLABI

***CSE/Sem I***

# 17148S11P - TRANSFORMS AND PARTIAL DIFFERENTIAL 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. The course will also serve as a prerequisite for specialized studies and research.

## OBJECTIVES:

- Solve simple second order differential equations;
- Be able to calculate Fourier series;
- Prove the Orthogonality of eigenfunctions of boundary value problems;
- Be able to classify second order partial differential equations and choose the appropriate boundary conditions;
- Apply the method of separation of variables to standard PDEs;
- Understand the wide applications of differential equation;
- Use Laplace transforms to solve simple linear differential equations.

## 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: 60hrs****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.

**REFERENCES:**

1. Narayanan, S., Manicavachagom Pillay, T.K. and Ramanaiyah, 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



**UNIT IV      ASYNCHRONOUS SEQUENTIAL CIRCUITS      9 +3**

Introduction to asynchronous sequential circuits - primitive state / flow table – Minimization of primitive state table –state assignment – Excitation table – Excitation map- cycles – Races –Hazards: Static –Dynamic –Essential –Hazards elimination.

**UNIT V      MEMORY DEVICES      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 Gate Arrays (FPGA)

**TOTAL:60hrs****TEXT BOOKS:**

1. M. Morris Mano, Digital Design, 3.ed., Prentice Hall of India Pvt. Ltd., New Delhi, 2003/Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003 – (Unit I, II, V)
2. John .M Yarbrough, Digital Logic Applications and Design, Thomson- Vikas publishing house, New Delhi, 2002. (Unit III, IV)

**REFERENCES:**

1. S. Salivahanan and S. Arivazhagan, Digital Circuits and Design, 2<sup>nd</sup> ed., Vikas Publishing House Pvt. Ltd, New Delhi, 2004
2. Charles H.Roth. “Fundamentals of Logic Design”, Thomson Publication Company, 2003.
3. Donald P.Leach and Albert Paul Malvino, Digital Principles and Applications, 5 ed., 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. Thomas L. Floyd, Digital Fundamentals, Pearson Education, Inc, New Delhi, 2003

**17150H13P- DATA STRUCTURES AND ALGORITHMS****AIM:**

To emphasize, the practical application of techniques for analyzing the performance of algorithms and to know fundamentals of data structures.

**OBJECTIVES:**

- To learn the systematic way of solving problems
- To understand the different methods of organizing large amounts of data
- To efficiently implement solutions for specific problems
- To gain knowledge of various sorting techniques.
- To efficiently implement the different data structures

**UNIT-I PROBLEM SOLVING 9+3**

Problem solving- Top-Down Design- Implementation - Verification- Efficiency -Analysis - Sample Algorithms

**UNIT II LISTS, STACKS AND QUEUES 9+3**

Abstract Data Type (ADT) – The List ADT – The Stack ADT-Queue as ADT

**UNIT III TREES 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 – Insertion Sort – Heap sort – Merge sort – Quick sort – Bubble sort  
Basic Search Techniques – Linear Search – Indexed Sequential Search , Binary Search – Tree Searching – Inserting into a Binary searching tree – Deleting from a 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: 60 hrs**

**TEXT BOOKS:**

1. R.G.Dromey, "How to solve it by computer", Prentice- Hall of India, 2002.
2. Aaron M. Tenenbaum, Yeedidiah Langsam, Moshe J. Augenstein, 'Data structures using C', Pearson Education, 2004 / PHI.
3. M. A. Weiss, "Data Structures and Algorithm Analysis in C", 2<sup>nd</sup> ed, Pearson Education Asia, 2002

**REFERENCES:**

1. E. Balagurusamy, 'Programming in Ansi C', Second Edition, Tata McGraw Hill Publication, 2003.
2. Robert L. Kruse, Bruce P. Leung Clovis L.Tondo, 'Data Structures and Program Design in C', Pearson Education, 2000 / PHI.
3. Y. Langsam, M. J. Augenstein and A. M. Tenenbaum, "Data Structures using 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. Hopcroft and J. D. Ullman, "Data Structures and Algorithms", Pearson education Asia, 1983.

**17150H14P- COMPUTER ARCHITECTURE AND ORGANIZATION****AIM:**

To understand the basic structure and organization of digital computer.

**OBJECTIVES:**

- To have a thorough understanding of operation of a digital computer.
- To list the operation of the arithmetic unit .
- To study in detail the different types of control and the concept of pipelining.
- To understand the hierarchy of memories.
- To study the different ways of communicating with I/O devices and standard I/O interfaces.

<b>UNIT I</b>	<b>BASIC STRUCTURE OF COMPUTERS</b>	<b>10+3</b>
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Functional units - Basic operational concepts - Bus structures - Software performance – Memory locations and addresses – Memory operations – Instruction and instruction sequencing – Addressing modes – Assembly language

<b>UNIT II</b>	<b>ARITHMETIC UNIT</b>	<b>8+3</b>
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Addition and subtraction of signed numbers – Design of fast adders – Multiplication of positive numbers - Signed operand multiplication and fast multiplication – Integer division

<b>UNIT III</b>	<b>BASIC PROCESSING UNIT</b>	<b>9+3</b>
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Fundamental concepts – Execution of a complete instruction – Multiple bus organization – Hardwired control – Microprogrammed control - Pipelining – Basic concepts – Data hazards – Instruction hazards –Superscalar operation.

<b>UNIT IV</b>	<b>MEMORY SYSTEM</b>	<b>9+3</b>
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Basic concepts – Semiconductor RAMs - ROMs – Speed - size and cost – Cache memories - Performance consideration – Virtual memory- Memory Management requirements – Secondary storage.

<b>UNIT V</b>	<b>I/O ORGANIZATION</b>	<b>9+3</b>
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Accessing I/O devices – Interrupts – Direct Memory Access – Buses – Interface circuits – Standard I/O Interfaces (PCI, SCSI, USB).

**TOTAL: 60hrs**

**TEXT BOOK:**

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, 5<sup>th</sup> Edition “Computer Organization”, McGraw-Hill, 2002.

**REFERENCES:**

1. William Stallings, “Computer Organization and Architecture – Designing for Performance”, 6<sup>th</sup> Edition, Pearson Education, 2003.
2. David A. Patterson and John L.Hennessy, “Computer Organization and Design: The hardware / software interface”, 2<sup>nd</sup> Edition, Morgan Kaufmann, 2002.
3. John P.Hayes, “Computer Architecture and Organization”, 3<sup>rd</sup> Edition, McGraw Hill, 1998.

**17150H15P - OBJECT ORIENTED PROGRAMMING****AIM:**

To introduce the students about object oriented programming and design.

**OBJECTIVES:**

On completion of the class, a student should be able:

- to prepare object-oriented design for small/medium scale problems
- to demonstrate the differences between traditional imperative design and object-oriented design
- to explain class structures as fundamental, modular building blocks
- to understand the role of inheritance, polymorphism, dynamic binding and generic structures in building reusable code
- to write small/medium scale C++ programs with simple graphical user interface
- to use classes written by other programmers when constructing their systems
- to understand and to use fundamental data structures: collections, sets, dictionaries, lists, stacks, queues, trees, graphs.

**UNIT-I**

9

Introduction to OOP: Overview of C++ - classes - structures - union - friend function - friend class - inline function - constructors - static members - scope resolution operator - passing objects to functions - function returning objects

**UNIT-II**

9

Arrays - pointers - this pointer - references - dynamic memory allocation - functions overloading - default arguments - overloading constructors - pointers to functions

**UNIT-III**

9

Operator overloading - member operator function - friend operator function - type conversion - inheritance - types of inheritance - virtual base class - polymorphism - virtual function.

**UNIT-IV**

9

Class templates and generic classes - function templates and generic functions - overloading a function templates - power of templates - exception handling - derived class exception - exception handling functions

**UNIT-V**

9

Streams - formatted I/O with its class functions and manipulators - creating own manipulators - file I/O - conversion functions - standard template library.

Total Hours : 45

**Text Book:**

Balagurusamy E, "Object Oriented Programming with C++", 3/E, TMG, 2006.

**Reference :**

1. Hubbard, "Programming with C++", 2/e, Schaum Outline Series, TMH, 2006.



2. Bjarne Stroustrup, "The C++ Programming Language", Addison Wesley Publications, Second Edition, 1991.
3. Sarang Proonachandra, "Object Oriented Programming with C++", PHI, 2006.
4. Jagadev A K, Rath A M, and Dehuri S, "Object Oriented Programming Using C++", PHI, 2007.

**CSE/Sem II****17148S21P-NUMERICAL METHODS****AIM :**

Students will develop problem solving skills, with Numerical and Statistical Methods, which can be implemented in I.T. field.

**OBJECTIVES :**

- Demonstrate knowledge and understanding of numerical methods to solve ordinary differential equations
- Demonstrate knowledge and understanding of numerical methods to solve simple partial differential equations
- Introduce to students numerical methods and scientific computation techniques for dealing with important computational problems

**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 differencesolution of one dimensional heat equation by explicit and implicit methods – One dimensionalwave equation and two dimensional Laplace and Poisson equations.

**TOTAL: 60hrs****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:**

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.

**CSE/Sem II****17150H22P - MICROPROCESSORS AND INTERFACING****AIM:**

To have an in depth knowledge of the architecture and programming of 8-bit and 16-bit Microprocessors, Microcontrollers and to study how to interface various peripheral devices with them.

**OBJECTIVES:**

- To study the architecture and Instruction set of 8085 and 8086
- To develop assembly language programs in 8085 and 8086.
- To design and understand multiprocessor configurations
- To study different peripheral devices and their interfacing to 8085/8086.
- To study the architecture and programming of 8051 microcontroller.

**UNIT I      8085 CPU      9+3**

8085 Architecture – Instruction set – Addressing modes – Timing diagrams –Interrupts – Memory interfacing – Interfacing, I/O devices.

**UNIT II      PERIPHERALS INTERFACING      9+3**

Interfacing Serial I/O (8251)- parallel I/O (8255) –Keyboard and Display controller 8279Interrupt Controller –DMA controller - Bus: RS232C-RS485

**UNIT III      8086 CPU      9+3**

Intel 8086 Internal Architecture – 8086 Addressing modes- Instruction set- 8086–Interrupts.

**UNIT IV      8086 SYSTEM DESIGN      9+3**

8086 signals and timing – MIN/MAX mode of operation – Addressing memory and I/O — System design using 8086

**UNIT V      8085 APPLICATIONS      9+3**

Stepper motor control – DC motor control –Traffic light control – LCD Controller — Square wave generation –Introduction to microcontroller.- 8051 Architecture.

**TOTAL : 60 Hrs.**

**TEXT BOOKS:**

1. Ramesh S Gaonkar, Microprocessor Architecture, Programming and application with 8085, 4<sup>th</sup> Edition, Penram International Publishing, New Delhi, 2000. (Unit I, II)
2. John Uffenbeck, The 80x86 Family, Design, Programming and Interfacing, Third Edition. Pearson Education, 2002.
3. S.P.Chowdhury , Sunetra Chowdhury, Microprocessor & Peripherals ,First Edition ,Scitech Publications(INDIA )Pvt. Ltd.(Unit V)

**REFERENCES:**

1. A.K. Ray and K.M.Burchandi, Intel Microprocessors Architecture Programming and Interfacing, McGraw Hill International Edition, 2000(Unit III,IV).
2. Kenneth J Ayala, The 8051 Microcontroller Architecture Programming and Application, 2<sup>nd</sup> 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.

**17150H23P-DATABASE MANAGEMENT SYSTEMS****AIM:**

To know the methodologies in database technology and an introduction to the current trends in this field.

**OBJECTIVES:**

- To learn the fundamentals of data models .
- To understand the internal storage structures using different file and indexing techniques.
- To know the fundamental concepts of transaction processing- concurrency control techniques and recovery procedure.
- To understand the basic concepts of the emerging trends in the area of distributed DB- and OODB.

**UNIT I      INTRODUCTION AND CONCEPTUAL MODELING      9 + 3**

Introduction to File and Database systems- Database system structure – Data Models – Introduction to Network and Hierarchical Models – ER model – Relational Model – Relational Algebra and Calculus.

**UNIT II      RELATIONAL MODEL      9 + 3**

SQL – Data definition- Queries in SQL- Updates- Views – Integrity and Security – Relational Database design – Functional dependences and Normalization for Relational Databases (up to BCNF).

**UNIT III      DATA STORAGE AND QUERY PROCESSING      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.

**UNIT IV      TRANSACTION MANAGEMENT      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.

**UNIT V****CURRENT TRENDS****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: 60 Hrs.****TEXTBOOKS:**

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan- “Database System Concepts”, Fourth Edition, McGraw-Hill, 2002.

**REFERENCES:**

1. Ramez Elmasri and Shamkant B. Navathe, “Fundamental Database Systems”, Third Edition, Pearson Education, 2003.
2. Raghu Ramakrishnan, “Database Management System”, Tata McGraw-Hill Publishing Company, 2003.
3. Hector Garcia–Molina, Jeffrey D.Ullman and Jennifer Widom- “Database System Implementation”- Pearson Education- 2000.
4. Peter Rob and Corlos Coronel- “Database System, Design, Implementation and Management”, Thompson Learning Course Technology- Fifth edition, 2

**17150H24P- DESIGN AND ANALYSIS OF ALGORITHMS****AIM:**

This course aims to introduce the classic and complex algorithms in various domains, and techniques for designing and analyzing the efficient algorithms.

**OBJECTIVES:**

- To prove the correctness and analyze the running time of the basic algorithms
- To apply the algorithms and design techniques to solve problems.
- To analyze the complexities of various problems in different domains.

**UNIT I BASIC CONCEPTS OF ALGORITHMS 8 + 3**

Introduction – Notion of Algorithm – Fundamentals of Algorithmic Solving – Important Problem types – Fundamentals of the Analysis Framework – Asymptotic Notations and Basic Efficiency Classes.

**UNIT II MATHEMATICAL ASPECTS AND ANALYSIS OF ALGORITHMS 8 + 3**

Mathematical Analysis of Non-recursive Algorithm – Mathematical Analysis of Recursive Algorithm – Example: Fibonacci Numbers – Empirical Analysis of Algorithms – Algorithm Visualization.

**UNIT III ANALYSIS OF SORTING AND SEARCHING ALGORITHMS 10 + 3**

Brute Force – Bubble Sort – Sequential Search 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.

**UNIT IV ALGORITHMIC TECHNIQUES 10 + 3**

Transform and conquer – Presorting – Balanced Search trees – AVL Trees – Heaps and Heap sort – Dynamic Programming – Warshall's and Floyd's Algorithm – Optimal Binary Search trees – Greedy Techniques – Prim's Algorithm – Kruskal's Algorithm – Dijkstra's Algorithm – Huffman trees.

**UNIT V ALGORITHM DESIGN METHODS 9 + 3**

Backtracking – n-Queen's Problem – Hamiltonian Circuit problem – Subset-Sum problem – Branch and bound – Assignment problem – Knapsack problem – Traveling salesman problem.

**TOTAL : 60 Hrs.**



**TEXT BOOKS:**

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithm", Pearson Education Asia, 2003.

**REFERENCES:**

1. T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, "Introduction to Algorithms", PHI Pvt. Ltd., 2001
2. Sara Baase and Allen Van Gelder, "Computer Algorithms - Introduction to Design and Analysis", Pearson Education Asia, 2003.
3. A.V.Aho, J.E. Hopcroft and J.D.Ullman, "The Design and Analysis Of Computer Algorithms", Pearson Education Asia, 2003.

**17150H25P- SOFTWARE ENGINEERING****AIM:**

To make the students understand the methodologies in preparing a software.

**OBJECTIVES:**

- To know the generic models to structure the software development process.
- To understand different notion of complexity at both the module and system level.
- To be aware of some widely known design methods.
- To understand the role and contents of testing activities in different life cycle phases.

**UNIT I SOFTWARE PROCESS 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.

**UNIT II SOFTWARE REQUIREMENTS 9**

Functional and non-functional - user – system –requirement engineering process – feasibility studies – requirements – elicitation – validation and management – software prototyping – prototyping in the software process – rapid prototyping techniques – user interface prototyping -S/W document. Analysis and modeling – data, functional and behavioral models – structured analysis and data dictionary.

**UNIT III DESIGN CONCEPTS AND PRINCIPLES 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.

**UNIT IV TESTING 9**

Taxonomy of software testing – levels – test activities – types of s/w test – 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 – system testing and debugging.

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- Delphi method.- 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**

**TEXT BOOK:**

1. Roger S.Pressman, Software engineering- A practitioner's Approach, McGraw-Hill International Edition, 5<sup>th</sup> edition, 2001.

**REFERENCES:**

1. Ian Sommerville, Software engineering, Pearson education Asia, 6<sup>th</sup> edition, 2000.
2. Pankaj Jalote- An Integrated Approach to Software Engineering, Springer Verlag, 1997.
3. James F Peters and Witold Pedryez, "Software Engineering – An Engineering Approach", John Wiley and Sons, New Delhi, 2000.
4. Ali Behforooz and Frederick J Hudson, "Software Engineering Fundamentals", Oxford University Press, New Delhi, 1996.

## 17148S31P- DISCRETE MATHEMATICS

### AIM:

This course will develop the intuition for discrete mathematics reasoning involving numbers and sets.

### OBJECTIVES:

On completing the course, students should be able to

- Write a clear statement of a problem as a theorem in mathematical notation;
- Prove and disprove assertions using a variety of techniques.
- Understand the logic of Propositional and predicate formulas and their relationship to informal reasoning, truth tables, validity.
- Understand the Proving of propositional and predicate formulas in a structured way.
- Know the basic set theory. Relations, graphs, and orders

### **UNIT I                    PROPOSITIONAL CALCULUS                    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.

### **UNIT II                    PREDICATE CALCULUS                    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.

### **UNIT III                    SET THEORY                    10 + 3hrs**

Basic concepts – Notations – Subset – Algebra of sets – The power set – Ordered pairs and Cartesian product – Relations on sets – Types of relations and their properties – Relational matrix and the graph of a relation – Partitions – Equivalence relations – Partial ordering – Poset – Hasse diagram – Lattices and their properties – Sublattices – Boolean algebra – Homomorphism.

### **UNIT IV                    FUNCTIONS                    7 + 3hrs**

Definitions of functions – Classification of functions – Type of functions - Examples – Composition of functions – Inverse functions – Binary and n-ary operations – Characteristic function of a set – Hashing functions – Recursive functions – Permutation functions.

**UNIT V****GROUPS****9 + 3hrs**

Algebraic systems – 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. Trembly J.P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 2003.
2. Ralph. P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", Fourth Edition, Pearson Education Asia, Delhi, 2002.

**REFERENCES:**

1. Bernard Kolman, Robert C. Busby, Sharan Cutler Ross, "Discrete Mathematical Structures", Fourth Indian reprint, Pearson Education Pvt Ltd., New Delhi, 2003.
- Kenneth H. Rosen, "Discrete Mathematics and its Applications", Fifth Edition, Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2003.

**CSE/Sem III****17150H32P- OPERATING SYSTEM**

PRIST

31

**AIM:**

To understand the functions of an operating system.

**OBJECTIVES:**

- To have an overview of different types of operating systems.
- To know the components of an operating system.
- To have a knowledge of process management and storage management.
- To know the concepts of I/O and file systems.
- To know the concepts of Distributed Operating System

**UNIT I****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.

**UNIT II****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.

**UNIT III****9**

System Model – Deadlock Characterization – Methods for handling Deadlocks -Deadlock Prevention – Deadlock avoidance – Deadlock detection – Recovery from Deadlocks - Storage Management – Swapping – Contiguous Memory allocation – Paging – Segmentation – Segmentation with Paging.

**UNIT IV****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

**UNIT V****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****TEXT BOOK:**

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, Sixth Edition, John Wiley & Sons (ASIA) Pvt. Ltd, 2003.

**REFERENCES:**

1. Harvey M. Deitel, “Operating Systems”, Second Edition, Pearson Education Pvt. Ltd, 2002.
2. Andrew S. Tanenbaum, “Modern Operating Systems”, Prentice Hall of India Pvt. Ltd, 2003.
3. William Stallings, “Operating System”, Prentice Hall of India, 4<sup>th</sup> Edition, 2003.
4. Pramod Chandra P. Bhatt – “An Introduction to Operating Systems, Concepts and Practice”, PHI, 2003.

**17150H33P- ARTIFICIAL INTELLIGENCE****AIM:**

To create general understanding of major concepts and approaches in knowledge representation, planning, learning, robotics and other AI areas.

**OBJECTIVES:**

- To study various complex problem solving AI tools like Search and optimization
- To facilitate of logic, Probabilistic methods for uncertain reasoning, Classifiers and statistical learning methods, Neural networks, Control theory & Languages.
- To develop programming skills for AI applications.
- To provide exposure to logic programming with practical topics.

**UNIT I INTRODUCTION****8 + 3**

Intelligent Agents – Agents and environments - Good behavior – The nature of environments – structure of agents - Problem Solving - problem solving agents – example problems – searching for solutions – uniformed search strategies - avoiding repeated states – searching with partial information.

**UNIT II SEARCHING TECHNIQUES****10 + 3**

Informed search and exploration – Informed search strategies – heuristic function – local search algorithms and optimistic problems – local search in continuous spaces – online search agents and unknown environments - Structure of 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 – propositional versus first order logic – unification and lifting – forward chaining – backward chaining - Resolution - Knowledge representation -Ontological Engineering - Categories and objects – Actions - Simulation and events - Mental events and mental objects.

**UNIT IV LEARNING****9 + 3**

Learning from observations - forms of learning - Inductive learning - Learning decision 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 .

**UNIT V APPLICATIONS****8 + 3**

Communication – Communication as action – Formal grammar for a fragment of English – Syntactic analysis – Augmented grammars – Semantic interpretation – Ambiguity and disambiguation – Discourse understanding – Grammar induction .



**TEXT BOOK:**

1. Stuart Russell, Peter Norvig, “Artificial Intelligence – A Modern Approach”, 2nd Edition, Pearson Education / Prentice Hall of India, 2004.

**RE`FERENCES:**

1. Nils J. Nilsson, “Artificial Intelligence: A new Synthesis”, Harcourt Asia Pvt. Ltd., 2000.
2. Elaine Rich and Kevin Knight, “Artificial Intelligence”, 2<sup>nd</sup> Edition, Tata McGraw-Hill, 2003.

**17150H34P - COMPUTER NETWORKS****AIM:**

To introduce the concepts, terminologies and technologies used in modern days data communication and computer networking.

**OBJECTIVES:**

- To understand the concepts of data communications.
- To study the functions of different layers.
- To introduce IEEE standards employed in computer networking.
- To make the students to get familiarized with different protocols and network components.

**UNIT I DATA COMMUNICATIONS****9**

Components – Direction of Data flow – networks – Components and Categories – types of Connections – Topologies – Protocols and Standards – ISO / OSI model – Transmission Media – Coaxial Cable – Fiber Optics – Line Coding – Modems – RS232 Interfacing sequences.

**UNIT II DATA LINK LAYER****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 - Ethernet IEEE 802.3 - IEEE 802.4 - IEEE 802.5 - IEEE 802.11 – FDDI - SONET – Bridges.

**UNIT III NETWORK LAYER****9**

Internetworks – Packet Switching and Datagram approach – IP addressing methods – Subnetting – Routing – Distance Vector Routing – Link State Routing – Routers.

**UNIT IV TRANSPORT LAYER****9**

Duties of transport layer – Multiplexing – Demultiplexing – Sockets – User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control – Quality of services (QOS) – Integrated Services.

**UNIT V APPLICATION LAYER****9**

Domain Name Space (DNS) – SMTP – FTP – HTTP - WWW – Security – Cryptography.

**TOTAL: 45hrs**

**TEXT BOOK:**

1. Behrouz A. Forouzan, “Data communication and Networking”, Tata McGraw-Hill, 2004.

**REFERENCES:**

James F. Kurose and Keith W. Ross, “Computer Networking: A Top-Down Approach Featuring the Internet”, Pearson Education, 2003.

Larry L.Peterson and Peter S. Davie, “Computer Networks”, Harcourt Asia Pvt. Ltd., Second Edition.

Andrew S. Tanenbaum, “Computer Networks”, PHI, Fourth Edition, 2003.

William Stallings, “Data and Computer Communication”, Sixth Edition, Pearson Education, 2000.

**17150L35P-OPERATING SYSTEMS AND NETWORKING LAB****LIST OF EXERCISE:****OPERATING SYSTEMS:**

(Implement the following on LINUX platform. Use C for high level language implementation)

1. Shell programming
  - command syntax
  - write simple functions
  - basic tests
2. Shell programming
  - loops
  - patterns
  - expansions
  - substitutions
3. Write programs using the following system calls of UNIX operating system:  
fork, exec, getpid, exit, wait, close, stat, opendir, readdir
4. Write programs using the I/O system calls of UNIX operating system (open, read, write, etc)
5. Write C programs to simulate UNIX commands like ls, grep, etc.
6. Implement some memory management schemes

**NETWORKING:**

1. Simulation of ARP / RARP.
2. Write a program that takes a binary file as input and performs bit stuffing and CRC Computation.
3. Simulation of Sliding-Window protocol.
4. Develop a Client – Server application for chat.
5. Develop a Client that contacts a given DNS Server to resolve a given host name.
6. Write a Client to download a file from a HTTP Server.

**17150H41P- PRINCIPLES OF CRYPTOGRAPHY****AIM:**

To understand the principles of encryption algorithms, conventional and public key cryptography. To have a detailed knowledge about authentication, hash functions and application level security mechanisms.

**OBJECTIVES:**

- To be familiar with the methods of conventional encryption.
- To recognize the concepts of public key encryption and number theory
- To understand authentication and Hash functions.
- To know the network security tools and applications.

**UNIT I      INTRODUCTION      10+3**

OSI Security Architecture - Classical Encryption techniques – Cipher Principles – Data Encryption Standard – Block Cipher Design Principles and Modes of Operation - Evaluation criteria for AES – AES Cipher – Triple DES.

**UNIT II      PUBLIC KEY CRYPTOGRAPHY      10+3**

Key Management - Diffie-Hellman key Exchange - Introduction to Number Theory – Confidentiality using Symmetric Encryption – Public Key Cryptography and RSA.

**UNIT III      AUTHENTICATION AND HASH FUNCTION      9+3**

*Authentication requirements – Authentication functions – Message Authentication Codes – Hash Functions – Security of Hash Functions and MACs – MD5 message Digest algorithm - Secure Hash Algorithm– HMAC Digital Signatures – Authentication Protocols – Digital Signature Standard*

**UNIT IV      NETWORK SECURITY      8+3**

Authentication Applications: Kerberos – X.509 Authentication Service – Electronic Mail Security – PGP – S/MIME - IP Security – Web Security.

**UNIT V      SYSTEM LEVEL SECURITY      8+3**

Intrusion detection – password management – Viruses and related Threats – Virus Counter measures – Firewall Design Principles – Trusted Systems.

**TOTAL : 60 hrs**

**TEXT BOOK:**

1. William Stallings, “Cryptography And Network Security – Principles and Practices”, Prentice Hall of India, Third Edition, 2003.

**REFERENCES:**

1. Atul Kahate, “Cryptography and Network Security”, Tata McGraw-Hill, 2003.
2. Bruce Schneier, “Applied Cryptography”, John Wiley & Sons Inc, 2001.
3. Charles B. Pfleeger, Shari Lawrence Pfleeger, “Security in Computing”, Third Edition, Pearson Education, 2003.

**17150H42P- WEB TECHNOLOGY****AIM:**

To highlight the features of different technologies involved in Web Technology and various Scripting Languages.

**OBJECTIVES:**

- Students will get an introduction about various Scripting Languages.
- Students will be provided with an up-to-date survey of developments in Web Technologies.
- To gain knowledge about the socket programming , RMI and Dynamic web page development.
- Enable the students to know techniques involved to support real-time application development.

**UNIT I****9+3**

Internet principles – Basic Web concepts – Client –Server model – Retriving data from Internet – HTML and Scripting Languages – Protocols and applications.

**UNIT II****9+3**

HTML forms – CGI concepts – HTML tags emulation – Server browser communication – E-mail generation – CGI client side Applets – CGI Server side Applets – Authorization and Security.

**UNIT III****9+3**

Streaming – Networking Principles – Sockets for Clients - Sockets for Servers – Protocols handlers – Content handlers – Multicast sockets – Remote method invocation.

**UNIT IV****9+3**

Server-Dynamic Web content – Cascading Style Sheets, DHTML, XML – Applet-Servlets communication – Interactive Java Servlets – Active and Java Server Pages.

**UNIT V****9+3**

Simple applications – On-line Databases – Monitoring user events – Plugins – Database Connectivity.

**TOTAL : 60hrs****TEXT BOOK:**

1. Eillotte Rusty Harold, “Java Network Programming”, O’Reilly Publications, 1997.

**REFERENCES:**

1. Jason Hunter, William Crawford, “Java Servlets Programming”, O’Reilly Publications, 1998.
2. Jeff Frantzen and Sobotka, “Java Script”, Tata Mc Graw Hill, 1999.
3. Eric Ladd, Jim O’Donnell, “Using HTML 4, XML and JAVA”, Prentice Hall Of India – QUE, 1999.



**17150H43P-C # AND .NET FRAMEWORK****AIM:**

The goal of this course is to provide students with the knowledge and skills they need to develop C# applications for the Microsoft .NET Platform.

**OBJECTIVES:**

- An ability to understand C# program structure, language syntax, and implementation details.
- An ability to develop application using C# on .NET frame work.

**UNIT I      INTRODUCTION TO C#      8+3**

Introducing C#, Understanding .NET, Overview of C#, Literals, Variables, Data Types, Operators, Expressions, Branching, Looping, Methods, Arrays, Strings, Structures, Enumerations.

**UNIT II      OBJECT ORIENTED ASPECTS OF C#      9+3**

Classes, Objects, Inheritance, Polymorphism, Interfaces, Operator Overloading, Delegates, Events, Errors and Exceptions.

**UNIT III      APPLICATION DEVELOPMENT ON .NET      8+3**

Building Windows Applications, Accessing Data with ADO.NET.

**UNIT IV      WEB BASED APPLICATION DEVELOPMENT ON .NET      8+3**

Programming Web Applications with Web Forms, Programming Web Services.

**UNIT V      THE CLR AND THE .NET FRAMEWORK      12+3**

Assemblies, Versioning, Attributes, Reflection, Viewing MetaData, 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 SingleCall, Threads.

**TOTAL : 60hrs**

**TEXT BOOKS:**

1. E. Balagurusamy, "Programming in C#", Tata McGraw-Hill, 2004. (Unit I, II)
2. J. Liberty, "Programming C#", 2<sup>nd</sup> ed., O'Reilly, 2002. (Unit III, IV, V)

**REFERENCES:**

1. Herbert Schildt, "The Complete Reference: C#", Tata McGraw-Hill, 2004.
2. Robinson et al, "Professional C#", 2<sup>nd</sup> ed., Wrox Press, 2002.
3. Andrew Troelsen, "C# and the .NET Platform", A! Press, 2003.
4. S. Thamarai Selvi, R. Murugesan, "A Textbook on C#", Pearson Education, 2003.

**17150L45P- INTERNET PROGRAMMING LAB**

1. Write programs in Java to demonstrate the use of following components Text fields, buttons, Scrollbar, Choice, List and Check box
2. Write Java programs to demonstrate the use of various Layouts like Flow Layout, Border Layout, Grid layout, Grid bag layout and card layout
3. Write programs in Java to create applets incorporating the following features:
4. Create a color palette with matrix of buttons
  - i) Set background and foreground of the control text area by selecting a color from color palette.
  - ii) In order to select Foreground or background use check box control as radio buttons
  - iii) To set background images
5. Write programs in Java to do the following.
  - i) Set the URL of another server.
  - ii) Download the homepage of the server.
  - iii) Display the contents of home page with date, content type, and Expiration date. Last modified and length of the home page.
6. Write programs in Java using sockets to implement the following:
  - i) HTTP request
  - ii) FTP
  - iii) SMTP
  - iv) POP3
7. Write a program in Java for creating simple chat application with datagram sockets and datagram packets.
8. Create a web page with the following using HTML
  - i) To embed a map in a web page
  - ii) To fix the hot spots in that map
  - iii) Show all the related information when the hot spots are clicked.
9. Create a web page with the following.
  - i) Cascading style sheets.
  - ii) Embedded style sheets.
  - iii) Inline style sheets.
  - iv) Use our college information for the web pages.



**TEXT BOOKS:**

1. Ali Bahrami, "Object Oriented Systems Development", Tata McGraw-Hill, 1999 (Unit I, III, IV, V).
2. Martin Fowler, "UML Distilled", Second Edition, PHI/Pearson Education, 2002. (UNIT II)

**REFERENCES:**

1. Stephen R. Schach, "Introduction to Object Oriented Analysis and Design", Tata McGraw-Hill, 2003.
2. James Rumbaugh, Ivar Jacobson, Grady Booch "The Unified Modeling Language Reference Manual", Addison Wesley, 1999.
3. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado, "UML Toolkit", OMG Press Wiley Publishing Inc., 2004.



**TEXT BOOKS:**

1. Allan C. Gillies, “Software Quality: Theory and Management”, Thomson Learning, 2003. (UI : Ch 1-4 ; UV : Ch 7-8)
2. Stephen H. Kan, “Metrics and Models in Software Quality Engineering”, Pearson Education (Singapore) Pte Ltd., 2002. (UI : Ch 3-4; UIII : Ch 5-8 ; UIV : Ch 9-11)

**REFERENCES:**

1. Norman E. Fenton and Shari Lawrence Pfleeger, “Software Metrics” Thomson, 2003
2. Mordechai Ben – Menachem and Garry S.Marliss, “Software Quality”, Thomson Asia Pte Ltd, 2003.
3. Mary Beth Chrissis, Mike Konrad and Sandy Shrum, “CMMI”, Pearson Education (Singapore) Pte Ltd, 2003.
4. ISO 9000-3 “Notes for the application of the ISO 9001 Standard to software development”.

**17150H53P- GRAPHICS AND MULTIMEDIA****AIM:**

Provide an opportunity for students to represent, design and implement two dimensional and three dimensional objects and introducing different media used in multimedia systems.

**OBJECTIVES:**

- Explain two and three dimensional concepts and their applications.
- Identify all techniques related to modern graphics programming concepts.
- Identify the media used in multimedia systems and to assess their relative advantages and disadvantages relative to both user and system points of view.
- Explain the interaction problems introduced by multimedia (e.g., compression and synchronization).

**UNIT I      OUTPUT PRIMITIVES      9+3**

Introduction -Line -Curve and Ellipse Drawing Algorithms – Attributes – Two-Dimensional Geometric Transformations – Two-Dimensional Clipping and Viewing.

**UNIT II      THREE-DIMENSIONAL CONCEPTS      9+3**

Three-Dimensional Object Representations – Three-Dimensional Geometric and Modeling Transformations – Three-Dimensional Viewing – Color models – Animation.

**UNIT III      MULTIMEDIA SYSTEMS DESIGN      9+3**

An Introduction – Multimedia applications – Multimedia System Architecture – Evolving technologies for Multimedia – Defining objects for Multimedia systems – Multimedia Data interface standards – Multimedia Databases.

**UNIT IV      MULTIMEDIA FILE HANDLING      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.

**UNIT V      HYPERMEDIA      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**

**TEXT BOOKS:**

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)

**REFERENCES:**

1. Judith Jeffcoate, “Multimedia in practice technology and Applications”, PHI, 1998.
2. Foley, Vandam, Feiner, Huges, “Computer Graphics: Principles & Practice”, Pearson Education, second edition 2003.



## **17150L55P- SOFTWARE DEVELOPMENT LAB**

### **IMPLEMENTATION OF PROJECT USING SOFTWARE ENGINEERING TECHNIQUES:**

1. PROJECT PLANNING
2. SOFTWARE REQUIREMENT ANALYSIS
3. DATA MODELLING & IMPLEMENTATION
4. SOFTWARE TESTING
5. SOFTWARE DEBUGGING

### **LIST OF EXPERIMENTS**

Develop the following software using software Engineering methodology:

1. Online Railway reservation system
2. Simulator software for parallel processing operation
3. Payroll processing application
4. Inventory system
5. Simulator software for compiler operation
6. Automating the Banking process
7. Software for game
8. Library management system
9. Text editor
10. Create a dictionary
11. Telephone directory
12. Create an E- Book of your choice.

**17150S61P- EMBEDDED SYSTEMS****AIM:**

To teach students all aspects of the design and development of an embedded system, including hardware and embedded software development.

**OBJECTIVES:**

- To Understand and design embedded systems.
- Understand the basics of an embedded system.
- Program an embedded system.
- Design, implement and test an embedded system.

**UNIT I EMBEDDED COMPUTING****9**

Challenges of Embedded Systems – Embedded system design process. Embedded processors – 8051 Microcontroller, ARM processor – Architecture, Instruction sets and programming.

**UNIT II MEMORY AND INPUT / OUTPUT MANAGEMENT****9**

Programming Input and Output – Memory system mechanisms – Memory and I/O devices and interfacing – Interrupts handling.

**UNIT III PROCESSES AND OPERATING SYSTEMS****9**

Multiple tasks and processes – Context switching – Scheduling policies – Interprocess communication mechanisms – Performance issues.

**UNIT IV EMBEDDED SOFTWARE****9**

Programming embedded systems in assembly and C – Meeting real time constraints – Multi-state systems and function sequences. Embedded software development tools – Emulators and debuggers.

**UNIT V EMBEDDED SYSTEM DEVELOPMENT****9**

Design issues and techniques – Case studies – Complete design of example embedded systems.

**TOTAL = 45 hrs****TEXT BOOKS:**

1. Wayne Wolf, “Computers as Components: Principles of Embedded Computer System Design”, Elsevier, 2006.
2. Michael J. Pont, “Embedded C”, Pearson Education , 2007.

**REFERENCES:**

1. Steve Heath, "Embedded System Design", Elsevier, 2005.
2. Muhammed Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems", Pearson Education, Second edition, 2007.



1. Elliotte Rusty Harold, “ Java Network Programming”, O’Reilly publishers, 2000 (UNIT II)
2. Ed Roman, “Mastering Enterprise Java Beans”, John Wiley & Sons Inc., 1999. (UNIT III and UNIT V)
3. Hortsman & Cornell, “CORE JAVA 2 ADVANCED FEATURES, VOL II”, Pearson Education, 2002. (UNIT I and UNIT IV)

**REFERENCES:**

1. Web reference: <http://java.sun.com>.
2. Patrick Naughton, “COMPLETE REFERENCE: JAVA2”, Tata McGraw-Hill, 2003.

## 17150H63P- SOFTWARE TESTING

### AIM:

It explains how to review, test and manage test requirements and how to incorporate testing into the software development life cycle.

### OBJECTIVES:

- To determine software testing objectives and criteria.
- To develop and validate a test plan.
- To select and prepare test cases.
- To identify the need for testing.
- To prepare testing policies and standards.
- To use testing aids and tools.
- To test before buying a software package and Test after maintenance and enhancement changes.
- To measure the success of testing efforts.

### **UNIT I INTRODUCTION**

**9**

Testing as an Engineering Activity – Role of Process in Software Quality – Testing as a Process – Basic Definitions – Software Testing Principles – The Tester’s Role in a Software Development Organization – Origins of Defects – Defect Classes – The Defect Repository and Test Design – Defect Examples – Developer/Tester Support for Developing a Defect Repository.

### **UNIT II TEST CASE DESIGN**

**9**

Introduction to Testing Design Strategies – The Smarter Tester – Test Case Design Strategies – Using Black Box Approach to Test Case Design Random Testing – Requirements based testing – positive and negative testing – Boundary Value Analysis – decision tables - Equivalence Class Partitioning state-based testing – cause effect 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.

### **UNIT III LEVELS OF TESTING**

**9**

The Need for Levels of Testing – Unit Test – Unit Test Planning – Designing the Unit Tests. The Test 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

### **UNIT IV TEST MANAGEMENT**

**9**

People and organizational issues in testing – organization structures for testing teams –testing services - Test Planning – Test Plan Components – Test Plan Attachments –role of three groups in Test Planning and Policy Development – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group.

#### **UNIT V CONTROLLING AND MONITORING 9**

Software test automation – skills needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation- 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**

#### **TEXT BOOKS:**

1. Srinivasan Desikan and Gopalaswamy Ramesh, “ Software Testing – Principles and Practices”, Pearson education, 2006.
2. Aditya P.Mathur, “Foundations of Software Testing”, Pearson Education,2008.

#### **REFERENCES:**

1. Boris Beizer, “Software Testing Techniques”, Second Edition,Dreamtech, 2003
2. Elfriede Dustin, “Effective Software Testing”, First Edition, Pearson Education, 2003.
3. Renu Rajani, Pradeep Oak, “Software Testing – Effective Methods, Tools and Techniques”, Tata McGraw Hill, 2004.

**CSE/Sem VI**

**17150L65P- JAVA PROGRAMMING LAB****LIST OF PRACTICALS****AIM:**

To learn and Practice the basics of JAVA language

**OBJECTIVES:**

1. To learn & practice the Object Oriented concepts like Inheritance, Overloading etc.
2. To learn & practice Interfaces and Packages
3. To learn & practice Java applet programming

**JAVA BASICS**

1. Programs illustrating various data types in Java
2. Programs illustrating class, objects and methods
3. Programs for addition and multiplication of Matrices
4. Programs illustrating Overloading in Java
5. Programs illustrating the implementation of Various forms of Inheritance( Single, Hierarchical, Multilevel )
6. Programs illustrating Overriding methods in Java
7. Programs illustrating Exception Handling
8. Programs to manipulate strings

**JAVA INTERFACES, PACKAGES and THREADS**

9. Programs illustrating Interfaces in Java
10. Programs to create Packages in Java
11. Programs illustrating Threads in Java

**JAVA APPLETS**

12. Programs to write applets to draw the various shapes
13. Programs to manipulate labels, lists, text fields and panels



**17150S71P-TOTAL QUALITY MANAGEMENT****AIM:**

Learning various TQM techniques to tackle and analyze problems in improving quality with particular reference to their own working environment.

**OBJECTIVE:**

- Develop the ability to adopt new techniques and synthesize new knowledge.
- Analyze basic operational and research data using TQM techniques in a systematic way.
- 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.

**UNIT I 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 senior management – Quality council – Quality statements – Strategic planning – Deming philosophy – Barriers to TQM implementation.

**UNIT II TQM PRINCIPLES 9**

Customer Satisfaction – Customer Perception of Quality – Customer Complaints – Service Quality – Customer Retention – Employee Involvement – Motivation – Empowerment – Teams – Recognition and Reward – Performance Appraisal – Benefits – Continuous Process Improvement – Juran Trilogy – PDCA Cycle – 5S – Kaizen – Supplier Partnership – Partnering – Sourcing – Supplier Selection – Supplier Rating – Relationship Development – Performance Measures – Basic Concepts – Strategy – Performance Measure.

**UNIT III STATISTICAL PROCESS CONTROL (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.

**UNIT IV****TQM TOOLS****9**

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.

**UNIT V****QUALITY SYSTEMS****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. Besterfield et al D.H., “Total Quality Management”, Pearson Education, Inc.2003.

**REFERENCES:**

1. Evans, J. R. and Lidsay, W. M., “The Management and Control of Quality”, 5th Edition, South-Western (Thomson Learning), 2002
2. Feigenbaum, A.V., “Total Quality Management”, McGraw-Hill, 1991.
3. Oakland, J.S., “Total Quality Management”, 3rd Edition, Elsevier, 2005.
4. Narayana, V. and Sreenivasan, N. S., “Quality Management - Concepts and Tasks”, New Age International, 1996.
5. Zeiri, “Total Quality Management for Engineers”, Wood Head Publishers, 1991.

**CSE/Sem VII**

**17150H72P - GRID COMPUTING****AIM:**

To introduce the what's, why's and how's of Grid Computing; what is Grid Computing able to do for you today and what will it bring to you in time to come.

**OBJECTIVES:**

- Understand and explain the basic concepts of Grid Computing;
- Explain the advantages of using Grid Computing within a given environment;
- Prepare for any upcoming Grid deployments and be able to get started with a potentially available Grid setup.

<b>UNIT I</b>	<b>GRID COMPUTING</b>	<b>9</b>
Introduction - Definition and Scope of grid computing		
<b>UNIT II</b>	<b>GRID COMPUTING INITIALIVES</b>	<b>9</b>
Grid Computing Organizations and their roles – Grid Computing analog – Grid Computing road map.		
<b>UNIT III</b>	<b>GRID COMPUTING APPLICATIONS</b>	<b>9</b>
Merging the Grid sources – Architecture with the Web Devices Architecture.		
<b>UNIT IV</b>	<b>TECHNOLOGIES</b>	<b>9</b>
OGSA – Sample use cases – OGSA platform components – OGSi – OGSA Basic Services.		
<b>UNIT V</b>	<b>GRID COMPUTING TOOL KITS</b>	<b>9</b>
Globus GT 3 Toolkit – Architecture, Programming model, High level services – OGSi .Net middleware Solutions.		
		<b>TOTAL : 45 hrs</b>

**TEXT BOOK:**

1. Joshy Joseph & Craig Fellenstein, “Grid Computing”, Pearson/PHI PTR-2003.

**REFERENCE:**

1. Ahmar Abbas, “Grid Computing: A Practical Guide to technology and Applications”, Charles River media – 2003.

**17150H73P -MIDDLEWARE TECHNOLOGIES****AIM:**

Students are able to gain in-depth knowledge popular middleware platforms.

**OBJECTIVES:**

Students can able to

- Understand that middleware is an intermediary software layer between the application and the operating system, which encapsulates the heterogeneity of the underlying communication network, operating system or hardware platform.
- Acquire the knowledge of integrating these systems by using middleware technologies.

**UNIT I CLIENT / SERVER CONCEPTS 9+3**

Client server – File server – Database server – Group server – Object server – Web server – Middleware – General middleware – Service specific middleware – Client / Server building blocks – RPC – Messaging – Peer-to-Peer.

**UNIT II EJB ARCHITECTURE 9+3**

EJB – EJB Architecture – Overview of EJB software architecture – View of EJB – Conversation – Building and deploying EJB – Roles in EJB.

**UNIT III EJB APPLICATIONS 9+3**

EJB session beans – EJB entity beans – EJB clients – EJB deployment – Building an application with EJB.

**UNIT IV CORBA 9+3**

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 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: 60 hrs**

**TEXT BOOKS:**

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, “Inside CORBA”, Pearson Education, 2002.

2.Jeremy Rosenberger, "Teach Yourself CORBA in 14 days", TEC Media, 2000.

3.Jason Pritchard, "COM and CORBA Side by Side", Addison Wesley, 2000.

4.Jesse Liberty, "Programming C#", 2nd Edition, O'Reilly Press, 2002.

**CSE/Sem IV/Electives**

## SEMESTER – IV (ELECTIVE I)

### 17150E44AP- THEORY OF COMPUTATION

#### AIM:

To introduces basic computation models and the necessary mathematical techniques to express computer science problems as mathematical statements and to formulate proofs

#### OBJECTIVES:

- To focus on the study of abstract models of computation.
- To assess via formal reasoning what could be achieved through computing when they are using it to solve problems in science and engineering.
- To introduce fundamental questions about problems, such as whether they can or not be computed, and if they can, how efficiently.

#### **UNIT I      AUTOMATA      9+3**

Introduction to formal proof – Additional forms of proof – Inductive proofs –Finite Automata (FA) – Deterministic Finite Automata (DFA)– Non-deterministic Finite Automata (NFA) – Finite Automata with Epsilon transitions.

#### **UNIT II      REGULAR EXPRESSIONS AND LANGUAGES      9+3**

Regular Expression – FA and Regular Expressions – Proving languages not to be regular – Closure properties of regular languages – Equivalence and minimization of Automata.

#### **UNIT III      CONTEXT-FREE GRAMMAR AND LANGUAGES      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.

#### **UNIT IV      PROPERTIES OF CONTEXT-FREE LANGUAGES      9+3**

Normal forms for CFG – Pumping Lemma for CFL - Closure Properties of CFL – Turing Machines – Programming Techniques for TM.

#### **UNIT V      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**

**TEXT BOOK:**

1. J.E.Hopcroft, R.Motwani and J.D Ullman, "Introduction to Automata Theory, Languages and Computations", Second Edition, Pearson Education, 2003.

**REFERENCES:**

1. H.R.Lewis and C.H.Papadimitriou, "Elements of The theory of Computation", Second Edition, Pearson Education/PHI, 2003
2. J.Martin, "Introduction to Languages and the Theory of Computation", Third Edition, TMH, 2003.
3. Micheal Sipser, "Introduction of the Theory and Computation", Thomson Brokecole, 1997.

**17150E44BP- REAL TIME SYSTEMS****AIM:**

To understand the implementation of real time systems

**OBJECTIVES:**

- To be familiar with Real-Time systems, Task scheduling, resource management, real-time operating systems and fault tolerant techniques.
- To study the priorities of transactions in real time databases.
- To understand how to achieve multitasking and concurrency in real time systems.

**UNIT I INTRODUCTION****9+3**

Introduction - Issues in Real Time Computing, Structure of a Real Time System. TaskClasses, Performance Measures for Real Time Systems, Estimating Program Runtimes. Task Assignment and Scheduling - Classical Uniprocessor scheduling algorithms, UniProcessor scheduling of IRIS Tasks, Task Assignment, Mode Changes, and FaultTolerant Scheduling.

**UNIT II PROGRAMMING LANGUAGES AND TOOLS****9+3**

Programming Language and Tools – Desired Language characteristics, Data Typing, Control structures, Facilitating Hierarchical Decomposition, Packages, Run-time(Exception) Error handling, Overloading and Generics, Multitasking, Low Levelprogramming, Task scheduling, Timing Specifications, Programming Environments, Run-time Support.

**UNIT III REAL TIME DATABASES****9+3**

Real time Databases - Basic Definition, Real time Vs General Purpose Databases, MainMemory Databases, Transaction priorities, Transaction Aborts, Concurrency ControlIssues, Disk Scheduling Algorithms, Two-phase Approach to improve Predictability, Maintaining Serialization Consistency, Databases for Hard Real Time systems.

**UNIT IV COMMUNICATION****9+3**

Real-Time Communication - Communications Media, Network Topologies Protocols, Fault Tolerant Routing. Fault Tolerance Techniques - Fault Types, Fault Detection. FaultError containment Redundancy, Data Diversity, Reversal Checks, Integrated Failurehandling.

**UNIT V EVALUATION TECHNIQUES****9+3**

Reliability Evaluation Techniques - Obtaining Parameter Values, Reliability Models forHardware Redundancy, Software Error models. Clock Synchronization - Clock, A Nonfault-Tolerant Synchronization Algorithm, Impact of Faults, Fault TolerantSynchronization in Hardware, Fault Tolerant Synchronization in Software

**TOTAL:60 hrs**

**TEXT BOOKS:**

1. C.M. Krishna, Kang G. Shin, “Real-Time Systems”, McGraw-Hill International Editions, 1997.

**REFERENCES:**

1. Stuart Bennett, “Real Time Computer Control-An Introduction”, Second edition Perntice Hall PTR, 1994.
2. Peter D. Lawrence, “Real time Micro Computer System Design – An Introduction”, McGraw Hill, 1988.
3. S.T. Allworth and R.N. Zobel, “Introduction to real time software design”, Macmillan, II Edition, 1987.
4. R.J.A Buhur, D.L. Bailey, “ An Introduction to Real-Time Systems”, Prentice-Hall International, 1999.



**17150E44CP-USER INTERFACE DESIGN****AIM:**

It focuses on the basic concepts of how human perceives and interacts with computers.

**OBJECTIVES:**

- Able to critique problems that exist in current interactive software and websites.
- To learn several usability evaluation methods.
- To learn several characteristics of controls in windows.
- To understand how to exercise with multimedia tools.
- To learn different kinds of tests in windows.

**UNIT I INTRODUCTION 8+3**

Human-Computer Interface – Characteristics Of Graphics Interface –Direct Manipulation Graphical System – Web User Interface –Popularity –Characteristic & Principles.

**UNIT II HUMAN COMPUTER INTERACTION 10+3**

User Interface Design Process – Obstacles –Usability –Human Characteristics In Design– Human Interaction Speed –Business Functions –Requirement Analysis – Direct –Indirect Methods – Basic Business Functions – Design Standards – System Timings –Human Consideration In Screen Design – Structures Of Menus – Functions Of Menus–Contents Of Menu– Formatting – Phrasing The Menu – Selecting Menu Choice–Navigating Menus– Graphical Menus.

**UNIT III WINDOWS****9+3**

Characteristics– Components– Presentation Styles– Types– Managements–Organizations– Operations– Web Systems– Device– Based Controls Characteristics–Screen – Based Controls – Operate Control – Text Boxes– Selection Control–Combination Control– Custom Control– Presentation Control.

**UNIT IV MULTIMEDIA 9+3**

Text For Web Pages – Effective Feedback– Guidance & Assistance– Internationalization– Accesssibility– Icons– Image– Multimedia – Coloring.

**UNIT V WINDOWS LAYOUT– TEST****9+3**

Prototypes – Kinds Of Tests – Retest – Information Search – Visualization –Hypermedia – WWW– Software Tools.

**TOTAL: 60hrs****TEXT BOOKS:**

1. Wilbent. O. Galitz ,“The Essential Guide To User Interface Design”, John Wiley& Sons, 2001.



**UNIT IV INTELLIGENT DATABASES****9+3**

Enhanced Data Models For Advanced Applications – Active Database Concepts And Triggers – Temporal Database Concepts – Deductive databases – Knowledge Databases.

**UNIT V CURRENT TRENDS****9+3**

Mobile Database – Geographic Information Systems – Genome Data Management – Multimedia Database – Parallel Database – Spatial Databases - Database administration – Data Warehousing and Data Mining.

**TOTAL : 60 hrs****TEXT BOOK:**

1. Thomas M. Connolly, Carolyn E. Begg, “Database Systems - A Practical Approach to Design , Implementation , and Management”, Third Edition , Pearson Education, 2003

**REFERENCES:**

1. Ramez Elmasri & Shamkant B.Navathe, “Fundamentals of Database Systems”, Fourth Edition , Pearson Education , 2004.
2. M.Tamer Ozsü , Patrick Ualduriel, “Principles of Distributed Database Systems”, Second Edition, Pearson Education, 2003.
3. C.S.R.Prabhu, “Object Oriented Database Systems”, PHI, 2003.
4. Peter Rob and Corlos Coronel, “Database Systems – Design, Implementation and Management”, Thompson Learning, Course Technology, 5<sup>th</sup> Edition, 2003.

**SEMESTER - V(ELECTIVE II)****17150E54AP- SOFT COMPUTING****AIM:**

To understand the overall knowledge of soft computing theories and fundamentals.

**OBJECTIVES:**

- To study the fundamentals of artificial neural networks, fuzzy sets and fuzzy logic and genetic algorithms.
- Fuzzy sets to solve hard real-world problems.
- To given an overview of Genetic algorithms and machine learning techniques to solving hard real-world problems.
- To study about the applications of these areas.

**UNIT I FUZZY SET THEORY****10+3**

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+3**

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 ARTIFICIAL INTELLIGENCE****10+3**

Introduction, Knowledge Representation – Reasoning, Issues and Acquisition: Propositional and Predicate Calculus Rule Based knowledge Representation Symbolic Reasoning Under Uncertainty Basic knowledge Representation Issues Knowledge acquisition – Heuristic Search: Techniques for Heuristic search Heuristic Classification -State Space Search: Strategies Implementation of Graph Search Search based on Recursion Patent-directed Search Production System and Learning.

**UNIT IV NEURO FUZZY MODELING****9+3**

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 OF COMPUTATIONAL INTELLIGENCE 8+3**

Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency Prediction – Soft Computing for Color Recipe Prediction.

**TOTAL: 60hrs**

**TEXT BOOKS:**

1. J.S.R.Jang, C.T.Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, PHI, 2004, Pearson Education 2004.
2. N.P.Padhy, “Artificial Intelligence and Intelligent Systems”, Oxford University Press, 2006.

**REFERENCES:**

1. Elaine Rich & Kevin Knight, “Artificial Intelligence” , Second Edition, Tata Mcgraw HillPublishing Comp., 2006, New Delhi.
2. Timothy J.Ross, “Fuzzy Logic with Engineering Applications”, McGraw-Hill, 1997.

**17150E54BP- PRINCIPLES OF COMPILER DESIGN****AIM:**

To understand the design and implementation of a simple compiler.

**OBJECTIVES:**

- To understand the functions of the various phases of a compiler.
- To learn the overview of the design of lexical analyzer and parser.
- To study the design of the other phases in detail.
- To learn the use of compiler construction tools.

**UNIT I INTRODUCTION TO COMPILING 9+3**

Compilers – Analysis of the source program – Phases of a compiler – Cousins of the Compiler – Grouping of Phases – Compiler construction tools – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens.

**UNIT II 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 INTERMEDIATE CODE GENERATION 9+3**

Intermediate languages – Declarations – Assignment Statements – Boolean Expressions – Case Statements – Back patching – Procedure calls.

**UNIT IV CODE GENERATION 9+3**

Issues in the design of code generator – The target machine – Runtime Storage management – Basic Blocks and Flow Graphs – Next-use Information – A simple Code generator – DAG representation of Basic Blocks – Peephole Optimization.

**UNIT V CODE OPTIMIZATION AND RUN TIME ENVIRONMENTS 9+3**

Introduction– Principal Sources of Optimization – Optimization of basic Blocks – Introduction to Global Data Flow Analysis – Runtime Environments – Source Language issues – Storage Organization – Storage Allocation strategies – Access to non-local names – Parameter Passing.

**TOTAL : 60hrs**

**TEXT BOOK:**

1. Alfred Aho, Ravi Sethi, Jeffrey D Ullman, “Compilers Principles, Techniques and Tools”, Pearson Education Asia, 2003.

**REFERENCES:**

1. Allen I. Holub “Compiler Design in C”, Prentice Hall of India, 2003.
2. C. N. Fischer and R. J. LeBlanc, “Crafting a compiler with C”, Benjamin Cummings, 2003.
3. J.P. Bennet, “Introduction to Compiler Techniques”, Second Edition, Tata McGraw-Hill, 2003.
4. Henk Alblas and Albert Nymeyer, “Practice and Principles of Compiler Building with C”, PHI, 2001.
5. Kenneth C. Loudon, “Compiler Construction: Principles and Practice”, Thompson Learning, 2003

**17150E54CP- DISTRIBUTED SYSTEMS****AIM:**

This course discuss the fundamental aspects on design of distributed systems, and the principles underlying them with an emphasis on fault tolerance and security.

**OBJECTIVES:**

- To understand distributed computing system models and introduction to distributes databases.
- To have an in-depth knowledge of distributed algorithms .
- To understand asynchronous shared memory model, mutual exclusion, resource allocation, consensus, asynchronous network model, basic asynchronous network algorithms, shared memory Vs networks and introduction to parallel distributed processing.
- To understand the various security algorithms in distributing environment.

**UNIT I 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

**UNIT II DISTRIBUTED OBJECTS AND FILE SYSTEM 9+3**

Introduction - Communication between distributed objects - Remote procedure call - Events and notifications - Java RMI case Study - Introduction to DFS - File service architecture - Sun network file system - Introduction to Name Services- Name services and DNS - Directory and directory services

**UNIT III DISTRIBUTED OPERATING SYSTEM SUPPORT 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 TRANSACTION AND CONCURRENCY 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 SECURITY AND REPLICATION 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**

**TEXT BOOK:**

1. George Coulouris, Jean Dollimore, Tim Kindberg “Distributed Systems Concepts and Design” Third Edition – 2002- Pearson Education Asia.

**REFERENCES:**

1. A.S.Tanenbaum, M.Van Steen “ Distributed Systems” Pearson Education 2004
2. Mukesh Singhal, Ohio State University, Columbus “Advanced Concepts In Operating Systems” McGraw-Hill Series in Computer Science, 1994.

**17150E54DP- MOBILE COMPUTING****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:**

- To present necessary concepts for Mobile Communication.
- Understanding different mobile devices and system.
- Understanding the Cellular System design.
- Study Co-channel and Non Co-channel Interference.
- Understanding channel assignment and hand off.
- Study Digital Cellular System.

**UNIT I                      WIRELESS COMMUNICATION FUNDAMENTALS                      9+3**

Introduction – Wireless transmission – Frequencies for radio transmission – Signals – Antennas – Signal Propagation – Multiplexing – Modulations – Spread spectrum – MAC – SDMA – FDMA – TDMA – CDMA – Cellular Wireless Networks.

**UNIT II                      TELECOMMUNICATION NETWORKS                      11+3**

Telecommunication systems – GSM – GPRS – DECT – UMTS – IMT-2000 – Satellite Networks - Basics – Parameters and Configurations – Capacity Allocation – FAMA and DAMA – Broadcast Systems – DAB - DVB.

**UNIT III                      WIRELESS LAN                      9+3**

Wireless LAN – IEEE 802.11 - Architecture – services – MAC – Physical layer – IEEE 802.11a - 802.11b standards – HIPERLAN – Blue Tooth.

**UNIT IV                      MOBILE NETWORK LAYER                      9+3**

Mobile IP – Dynamic Host Configuration Protocol - Routing – DSDV – DSR – Alternative Metrics.

**UNIT V                      TRANSPORT AND APPLICATION LAYERS                      7+3**

Traditional TCP – Classical TCP improvements – WAP, WAP 2.0.

**Total:60 hrs****TEXT BOOKS:**

1. Jochen Schiller, “Mobile Communications”, PHI/Pearson Education, Second Edition, 2003.(Unit I Chap 1,2 &3- Unit II chap 4,5 &6-Unit III Chap 7.Unit IV Chap 8- Unit V Chap 9&10.)

2. William Stallings, “Wireless Communications and Networks”, PHI/Pearson Education, 2002. (Unit I Chapter – 7&10-Unit II Chap 9)

**REFERENCES:**

1. Kaveh Pahlavan, Prasanth Krishnamoorthy, “Principles of Wireless Networks”, PHI/Pearson Education, 2003.
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing”, Springer, New York, 2003.
3. Hazysztof Wesolowshi, “Mobile Communication Systems”, John Wiley and Sons Ltd, 2002.

## SEMESTER – VI (ELECTIVE III)

### 17160E64AP– PRINCIPLES OF MANAGEMENT

#### **AIM:**

To understand the basic principles of management.

#### **OBJECTIVES:**

Knowledge on the principles of management is essential for all kinds of people in all kinds 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.

#### **UNIT I      HISTORICAL DEVELOPMENT      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.

#### **UNIT II      PLANNING      9**

Nature & Purpose – Steps involved in planning – Objective – Setting Objectives – Process of Managing by Objectives – Strategies, Policies & Planning premise – Forecasting – Decision-making.

#### **UNIT III      ORGANISING      9**

Nature and purpose – Formal and informal organization – Organization Chart – Structure and Process – Departmentation by difference strategies – Line and Staff authority – Benefits and Limitations – Selection Process – Techniques – HRD – Managerial Effectiveness.

#### **UNIT IV      DIRECTING      9**

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      9**

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:45 hrs**

**TEXT BOOKS:**

1. Harold Kooritz & Heinz Wehrich “Essentials of Management”, Tata McGraw-Hill, 1998.
2. Joseph L Massie “Essentials of Management”, Prentice Hall of India, (pearson) Fourth Edition, 2003.

**REFERENCES**

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 Gillbert Management, pearson Education, Sixth Edition, 2004.
4. Fraidoon Mazda, “Engineering Management”, Addison Wesley, 2000.

**17150E64BP- UNIX INTERNALS****AIM:**

This course focus to bend the learning curve for those system programmers who need to cast free software kernels.

**OBJECTIVES:**

- An ability to understand design and implementation of a multi-programmable operating system.
- A good understanding of the fundamentals of a monolithic kernel.
- A basic-to-intermediate experience in kernel and driver/module programming.

**UNIT I 9**

General Review of the System-History-System structure-User Perspective-OperatingSystem Services- Assumptions About Hardware. Introduction to the Kernel-ArchitectureSystem Concepts-Data Structures- System Administration.

**UNIT II 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.

**UNIT III 9**

System Calls for the File System-Open-Read-Write-Lseek-Close-Create-Special filesCreation-Change Directory and Change Root-Change Owner and Change Mode- Stat-Fstat-Pipes-Dup-Mount-Unmount-Link-Unlink-File System Abstraction-Maintenance.

**UNIT IV 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.

**UNIT V 9**

Memory Management Policies-Swapping-Demand Paging-a Hybrid System-I/OSubsystem-Driver Interfaces-Disk Drivers-Terminal Drivers.

**TOTAL: 45 hrs**

**TEXTBOOK:**

1. Maurice J. Bach, "The Design of the Unix Operating System", Pearson Education, 2002.

**REFERENCES:**

1. Uresh Vahalia, "UNIX Internals: The New Frontiers", Prentice Hall, 2000.
2. John Lion, "Lion's Commentary on UNIX", 6th edition, Peer-to-PeerCommunications, 2004.
3. Daniel P. Bovet & Marco Cesati, "Understanding the Linux Kernel", O'REILLY, ShroffPublishers &Distributors Pvt. Ltd, 2000.
- 4.M. Beck et al, "Linux Kernel Programming", Pearson Education Asia, 2002

**17150E64CP- PARALLEL COMPUTING****AIM:**

To study the scalability & clustering issues, understand the technologies used for parallel computation, study the different inter connection networks and the different software programming models.

**OBJECTIVES:**

- To study the scalability and clustering issues and the technology necessary for them.
- To understand the technologies enabling parallel computing.
- To study the different types of interconnection networks and parallel programming models.
- To study the software support needed for shared memory programming.

**UNIT I SCALABILITY AND CLUSTERING 9**

Evolution of Computer Architecture – Dimensions of Scalability – Parallel Computer Models – Basic Concepts Of Clustering – Scalable Design Principles – Parallel Programming Overview – Processes, Tasks and Threads – Parallelism Issues – Interaction / Communication Issues – Semantic Issues In Parallel Programs.

**UNIT II ENABLING TECHNOLOGIES 9**

System Development Trends – Principles of Processor Design – Microprocessor Architecture Families – Hierarchical Memory Technology – Cache Coherence Protocols – Shared Memory Consistency – Distributed Cache Memory Architecture – Latency Tolerance Techniques – Multithreaded Latency Hiding.

**UNIT III SYSTEM INTERCONNECTS 9**

Basics of Interconnection Networks – Network Topologies and Properties – Buses, Crossbar and Multistage Switches, Software Multithreading – Synchronization Mechanisms.

**UNIT IV PARALLEL PROGRAMMING 9**

Paradigms And Programmability – Parallel Programming Models – Shared Memory Programming.

**UNIT V MESSAGE PASSING PROGRAMMING 9**

Message Passing Paradigm – Message Passing Interface – Parallel Virtual Machine.

**TOTAL : 45hrs**



**TEXT BOOK:**

1. Kai Hwang and Zhi.Weï Xu, “Scalable Parallel Computing”, Tata McGraw-Hill, New Delhi,2003.

**REFERENCES:**

1. David E. Culler & Jaswinder Pal Singh, “Parallel Computing Architecture: A Hardware/Software Approach”, Morgan Kaufman Publishers, 1999.
2. Michael J. Quinn, “Parallel Programming in C with MPI & OpenMP”, Tata McGraw-Hill, NewDelhi,2003.
3. Kai Hwang, “Advanced Computer Architecture” Tata McGraw-Hill, New Delhi, 2003.

## 17150E64DP- PROGRAMMING PARADIGMS

### AIM:

Develop a greater understanding of the issues involved in programming language  
Design and implementation

### OBJECTIVES:

- Develop an in-depth understanding of functional, logic, and object-oriented programming paradigms.
- Implement several programs in languages other than the one emphasized in the core curriculum (Java/C++).
- Understand design/implementation issues involved with variable allocation and binding, control flow, types, subroutines, parameter passing.
- Develop an understanding of the compilation process.

### **UNIT I      OBJECT-ORIENTED PROGRAMMING – FUNDAMENTALS      9**

Review of OOP - Objects and classes in Java – defining classes – methods - access specifiers – static members – constructors – finalize method – Arrays – Strings - Packages – JavaDoc comments

### **UNIT II      OBJECT-ORIENTED PROGRAMMING – INHERITANCE      9**

Inheritance – class hierarchy – polymorphism – dynamic binding – final keyword – abstract classes – the Object class – Reflection – interfaces – object cloning – inner classes – proxies

### **UNIT III      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 – Model-View- Controller design pattern – buttons – layout management – Swing Components

### **UNIT IV      GENERIC PROGRAMMING      9**

Motivation for generic programming – generic classes – generic methods – generic code and virtual machine – inheritance and generics – reflection and generics – exceptions – exception hierarchy – throwing and catching exceptions – Stack Trace Elements - assertions – logging

### **UNIT V      CONCURRENT PROGRAMMING      9**

Multi-threaded programming – interrupting threads – thread states – thread properties – thread

synchronization – thread-safe Collections – Executors – synchronizers – threads and event-driven programming.

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**TOTAL:45hrs**

**TEXT BOOK:**

1. Cay S. Horstmann and Gary Cornell, “Core Java: Volume I – Fundamentals”, Eighth Edition, Sun Microsystems Press, 2008.

**REFERENCES:**

1. D. M. Dhamdhere, “Systems Programming and Operating Systems”, Second Revised Edition, Tata McGraw-Hill, 2000.
2. John J. Donovan “Systems Programming”, Tata McGraw-Hill Edition, 2000.
3. John R. Levine, Linkers & Loaders – Harcourt India Pvt. Ltd., Morgan Kaufmann Publishers, 2000.

## **SEMESTER – VII (ELECTIVE VI)**

### **17150E73AP- HIGH SPEED NETWORKS**

**AIM:**

This course provides introduction to emerging high speed network technologies and facilitates the students identify where the new technology can be used to enhance performance of business networks.

**OBJECTIVES:**

- Good understanding of packet-switched networking concepts and principles of operation.
- Good understanding of Internet protocols and architectures (e.g., IP protocol stack).
- Solid foundation in computer operating systems fundamentals.
- Ability to perform independent research, analyze findings in high speed networks.

#### **UNIT I HIGH SPEED NETWORKS 9**

Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture, ATM logical Connection, ATM Cell – ATM Service Categories – AAL.High Speed LAN's: Fast Ethernet, Gigabit Ethernet, Fibre Channel – Wireless LAN's: applications, requirements – Architecture of 802.11

#### **UNIT II CONGESTION AND TRAFFIC MANAGEMENT 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.

#### **UNIT III TCP AND ATM CONGESTION CONTROL 12**

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 IV INTEGRATED AND DIFFERENTIATED SERVICES 8**

PRIST

86



**17150E73BP- BIO INFORMATICS****AIM:**

To impart knowledge, on basic techniques of Bioinformatics.

**OBJECTIVE:**

- To learnt about Sequencing Alignment and Dynamic Programming.
- To gain knowledge about various secondary ,ternary structures .
- To have ability to design drugs.
- To understand Evolutionary Trees and Phylogeny.

**UNIT I****9**

Introduction to molecular biology – the genetic material – gene structure – proteinstructure – chemical bonds – molecular biology tools – genomic information content.

**UNIT II****9**

Data searches – simple alignments – gaps – scoring matrices – dynamic programming –global and local alignments – database searches – multiple sequence alignmentsPatterns for substitutions – estimating substitution numbers – evolutionary rates –molecular clocks – evolution in organelles.

**UNIT III****9**

Phylogenetics – history and advantages – phylogenetic trees – distance matrix methods– maximum likelihood approaches – multiple sequence alignments – Parsimony –ancestral sequences – strategies for faster searches – consensus trees – treeconfidence – comparison of phylogenetic methods – molecular phylogenies.

**UNIT IV****9**

Genomics – prokaryotic genomes: prokaryotic gene structure – GC content – genedensity – eukaryotic genomes: gene structure – open reading frames – GC content –gene expression – transposition – repeated elements – gene density.

**UNIT V****9**

Amino acids – polypeptide composition – secondary structure – tertiary and quaternarystructure – algorithms for modeling protein folding – structure prediction – predictingRNA secondary structuresProteomics – protein classification – experimental techniques – inhibitors and drugdesign – ligand screening – NMR structures – empirical methods and predictiontechniques – post-translational modification prediction.

**TOTAL: 45 hrs****TEXT BOOK:**

1. D. E. Krane and M. L. Raymer, “Fundamental concepts of Bioinformatics”, Pearson

PRIST

88

**REFERENCES:**

1. Arthur M. Lesk, "Introduction to Bioinformatics", Second Edition, Oxford University Press, 2005.
2. T. K. Attwood, D. J. Parry-Smith, and S. Phukan, "Introduction to Bioinformatics", Pearson Education, 1999.
3. Vittal R. Srinivas, "Bioinformatics – A Modern Approach", Prentice-Hall of India Pvt. Ltd., 2005.

## 17150E73CP- 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 1 SOFTWARE MANAGEMENT 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 - Team Effectiveness - Automation through Software Environments - Achieving Required Quality. Modern Software Management -Transitioning to an Iterative Process

### **UNIT 2 SOFTWARE MANAGEMENT PROCESS FRAMEWORK 9**

Life-Cycle Phases - Engineering and Production Stages - Inception Phase - Elaboration Phase - Construction Phase -Transition Phase. Artifacts of the Process - Artifact Sets - Management Set - Engineering Sets - Artifact Evolution overthe 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.

### **UNIT 3 SOFTWARE MANAGEMENT DISCIPLINES 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 - Quality Indicators - . Pragmatic Software Metrics -Metrics Automation.

### **UNIT 4 PROJECT PROFILES 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 - Modern Process Transitions.

**UNIT 5 PROJECT EXECUTION AND CLOSURE 9**

Review Process – Planning - Overview and Preparation - Group Review Meeting - Rework and Follow-up – Guidelines for Reviews in Projects - Analysis and Control Guidelines – Case Studies. Project Monitoring and Control – Project Tracking - Activities Tracking - Defect Tracking - Issues Tracking - Status Reports - Milestone Analysis. Defect Analysis and Prevention - Process Monitoring and Audit. Project Closure – Analysis - Analysis Report.

**TOTAL 45hrs**

**TEXT BOOKS:**

1. Walker Royce, “*Software Project Management: A Unified Framework*”, Pearson, 2000
2. Pankaj Jalote, “*Software Project Management in Practice*”, Pearson, 2002.

**REFERENCES:**

1. Joel Henry, “*Software Project Management: A Real-World Guide to Success*”. Pearson, 2004.
2. Kathy Schwalbe, “*Information Technology Project Management*”, Course Technology, 2005

## 17150E73DP-DIGITAL IMAGE PROCESSING

### AIM:

The purpose of this course is to introduce the basic concept and methodologies for digital image processing.

### OBJECTIVES :

- To understand the fundamentals of image processing.
- To learn about the various transforms used in image processing.
- To introduce for enhancing the quality of images
- To gain knowledge about the various techniques of image enhancement, reconstruction, compression and segmentation.

### **UNIT 1 DIGITAL IMAGE FUNDAMENTALS 9**

Introduction-Elements of Digital Image Processing system- Visual perception and properties of human eye-image representation-A simple image model-Some basic relationship between pixels-Image geometry.

### **UNIT 2 IMAGE TRANSFORMS 9**

Introduction to Fourier Transform and DFT – Properties of 2D Fourier Transform–FFT–Separable Image Transforms -Walsh – Hadamard – Discrete Cosine Transform, Haar, –KL transforms.

### **UNIT 3 IMAGE ENHANCEMENT 9**

Image Enhancement b-Histogram Modeling-equalization and modification. Image smoothing-Image Sharpening-Spatial Filtering-Homomorphic Filtering for image enhancement.

### **UNIT 4 IMAGE RESTORATION 9**

Model of Image Degradation/restoration process –Inverse filtering -Least mean square(wiener) filtering – Constrained least mean square restoration – Singular value decomposition-Recursive filtering.

### **UNIT 5 IMAGE COMPRESSION AND SEGMENTATION 9**

Fundamentals -Image compression models- Lossless compression: Variable length coding-LZW coding. Lossy Compression: Transform coding-Wavelet coding. Image Segmentation: Detection of discontinuities-Edge linking and boundary detection-thresholding-Region oriented segmentation and Texture.

**TOTAL 45 hrs**

### TEXT BOOKS:

PRIST

92

1. Rafael C Gonzalez, Richard E Woods, “Digital Image Processing”- 2nd Edition, Pearson Education 2003.

2. A.K. Jain, “Fundamentals of Digital Image Processing”. Pearson education.

**REFERENCES :**

1. William K Pratt, “Digital Image Processing”, John Willey (2001).

2. Millman Sonka, Vaclav hlavac, Roger Boyle, Broos/colic, “Image Processing Analysis and Machine Vision” – Thompson learning, 1999.

3. S. Chanda, Dutta Magumdar – “Digital Image Processing and Applications”, Prentice Hall of India, 2000.



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**DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING**

**PROGRAM HANDBOOK**

**M.Tech**  
**COMPUTER SCIENCE AND ENGINEERING**  
**[FULL TIME]**

# COURSE STRUCTURE

## SEMESTER - I

Semester. no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
I	19248S11A	Higher Mathematics	3	1	0	4
I	19250C12	Modern Operating System	4	0	0	4
I	19250C13	Parallel and High Performance Computing	4	0	0	4
I	19250C14	Adhoc and Sensor Network	4	0	0	4
I	19250C15	Advanced Data Structures and Algorithms	4	1	0	4
I	19250E16_	Elective - I	3	0	0	3
<b>Practical</b>						
I	19250L17	Advanced Web Technologies Lab	0	0	3	3
<b>Research Skill Development(RSD) Courses</b>						
I	19250CRS	Research Led Seminar	0	0	0	1
<b>Total no of Credit</b>					<b>27</b>	

## SEMESTER - II

Semester. no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
II	19250C21	Middleware Technologies	3	1	0	4
II	19250C22	Object Oriented Software Engineering	4	0	0	4
II	19250C23	Digital Image Processing	4	0	0	4
II	19250E24_	Elective II	3	0	0	3
II	19250E25_	Elective – III	3	0	0	3
<b>Practical</b>						
II	19250L26	.NET Technologies Lab	0	0	3	3
II	192TECWR	Technical Writing /Seminars	0	0	3	3
<b>Research Skill Development(RSD) Courses</b>						
II	19250CRM	Research Methodology	3	0	0	3
II	19250CBR	Participation in Bounded Research	2	0	0	2
<b>Total no of Credit</b>					<b>29</b>	

### SEMESTER - III

Semester. no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
III	19250C31	Software Project Management	4	0	0	4
III	19250E32_	Elective-IV	4	0	0	3
III	19250E33_	Elective-V	4	0	0	3
III	19250E34_	Elective-VI	4	0	0	3
III	19250P35	Project Work- Phase I	-	-	10	10
<b>Research Skill Development(RSD) Courses</b>						
III	19250CSR	Design/Socio Technical Project	0	0	0	6
<b>Total no of Credit</b>						<b>29</b>

### SEMESTER - IV

Semester no.	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
IV	19250P41	Project Work- Phase II	-	-	15	15
<b>Total no of Credit</b>						<b>15</b>

## LIST OF ELECTIVES

### SEMESTER - I - ELECTIVE - I

Semester no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
I	19250E16A	Multimedia Systems	3	0	0	3
I	19250E16B	Genetic Algorithms	3	0	0	3
I	19250E16C	Software Metrics	3	0	0	3

### SEMESTER - II - ELECTIVE - II

Semester no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
II	19250E24A	Advanced Distributed Computing	3	0	0	3
II	19250E24B	Data Warehousing & Data Mining	3	0	0	3
II	19250E24C	Artificial Neural Networks	3	0	0	3

### SEMESTER - II - ELECTIVE - III

Semester no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
II	19250E25A	Service Oriented Architecture	3	0	0	3
II	19250E25B	High Speed Networks	3	0	0	3
II	19250E25C	Embedded Systems	3	0	0	3



**SEMESTER - III - ELECTIVE – IV**

Semester no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
III	19250E32A	Cloud Computing	3	0	0	3
III	19250E32B	Information Security	3	0	0	3
III	19250E32C	Soft Computing	3	0	0	3

**SEMESTER - III - ELECTIVE – V**

Semester no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
III	19250E33A	Advanced Database Technology	3	0	0	3
III	19250E33B	Mobile Communication and Computing	3	0	0	3
III	19250E33C	Green Computing	3	0	0	3

**SEMESTER - III - ELECTIVE – VI**

Semester no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
III	19250E34A	Software Quality Assurance	3	0	0	3
III	19250E34B	Bio-Informatics	3	0	0	3
III	19250E34C	Wireless Application Protocols	3	0	0	3

# 248S11A – HIGER MATHAMETICS

LT 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 –  $a = (\text{mod } m)$  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<sub>0</sub> – Context Sensitive-Context-Free- Regular Grammars-Ambiguity.

## UNIT V LATTICE 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.

**CSE/Semester - I**

# 19250H12 - 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 - virtualization - 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 , 3<sup>rd</sup> Edition , 2009

*CSE/Semester - I*

**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.

***CSE/Semester - I***

# 19250H13 - PARALLEL AND HIGH PERFORMANCE COMPUTING

LTPC 40 0

4

## AIM:

The main objective of this paper is to make the students to know the need of Parallel Computing.

## OBJECTIVES:

- To understand the models and parameters used.
- To understand the Matrix Algorithms and Design Issues.

### Unit I : Introduction : 9

Need for Parallel Computing - Scope of Parallel Computing - Issues in Parallel Computing - Parallel Processing Concepts (Overview) - Levels of parallelism (instruction, transaction, task, thread, memory, function) - Models (SIMD, MIMD, SIMT, SPMD, Dataflow Models, Demand-driven Computation etc) -Architectures.

### Unit II : Models of Parallel Computing : 9

Taxonomy of Parallel Architectures -Dynamic Interconnection Networks - Static Interconnection Networks - Message Transfer - Reduction, Parallel Prefix - GPU thread model.

### Unit III : Performance Modelling : 9

Metrics – Granularity – Scalability – Overhead – Isoefficiency.

### Unit IV : Matrix Algorithms : 9

Matrix Partitioning - Matrix Transposition - Matrix Vector Multiply - Matrix Multiply - CUDA, vector add, matrix multiply, sequence alignment - Linear Equations - LU(P) Decomposition

### Unit V : Fundamental Design Issues in Parallel Computing 9

Synchronization – Scheduling - Job Allocation -Job Partitioning - Dependency Analysis - Mapping Parallel Algorithms onto Parallel Architectures - Performance Analysis of Parallel Algorithms

Total : 45 hrs

*CSE/Semester - I*

**TEXTBOOK:**

**Introduction to Parallel Computing, 2<sup>nd</sup> Edition- AnanthGrama, Anshul Gupta, George Karypis, Vipin Kumar. The Addison Wesley Publishing Company, ISBN 0-201-64865-2.**

**REFERENCES :**

**“Highly Parallel Computing”, by George S. Almasi and Alan Gottlieb**

1. “Advanced Computer Architecture: Parallelism, Scalability, Programmability”, by Kai Hwang, McGraw Hill 1993.
2. ”Parallel Computer Architecture: A hardware/Software Approach”, by David Culler Jaswinder Pal Singh, Morgan Kaufmann, 1999.
3. “Scalable Parallel Computing”, by Kai Hwang, McGraw Hill 1998.
4. “Principles and Practices on Interconnection Networks”, by William James Dally and Brian Towles, Morgan Kauffman 2004.
5. GPU Gems 3 --- by Hubert Nguyen (Chapter 29 to Chapter 41)

***CSE/Semester – I***

# 19250H14 -ADHOCAND SENSOR NETWORK

L T P C

40 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.Toth, “Ad Hoc Mobile Wireless Networks”, Pearson Education, 2002.
4. Thomas Krag and SebastinBuettrich, “Wireless Mesh Networking”, O’Reilly Publishers, 2007.

**CSE/Semester - I**

# 19250H15 - 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 to Randomized 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.

**CSE/Semester - I**



# 19250L17 -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.

**CSE/Semester - II**

# 19250H21 - MIDDLEWARE TECHNOLOGIES

LTPC

31 0

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## 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

**CSE/Semester - II**

## **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

***CSE/Semester - II***



**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.



**REFERENCES:**

1. Gonzalez.R.C& Woods. R.E., Digital Image Processing, 2<sup>nd</sup>Edition, Pearson Education, 2002.
2. Anil Jain.K, Fundamentals of Digital image Processing, Prentice Hall of India, 1989.
3. Sid Ahmed, Image Processing, McGraw Hill, New York, 1995.

***CSE/Semester - II***

**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.



# 19250CRM - RESEARCH METHODOLOGY

L T P C  
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## 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.

*CSE/Semester - II*

### **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.

***CSE/Semester - III***

## 19250H31 - SOFTWARE PROJECT MANAGEMENT

LTPC  
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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 Gopalswamy, “Managing Global Projects”, Tata McGraw Hill, 2001.
2. Bob Hughes, Mikecoterrell, “Software Project Management”, 3rd Edition, Tata cGraw Hill, 2004.

**CSE/Elective –I/Semester - I**

**SEMESTER - I - ELECTIVE – I**  
**19250E16A - 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 III Multimedia 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 IV Multimedia 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.

**CSE/Elective –I/Semester - I**

# 19250E16B- GENETIC ALGORITHMS

LTPC

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 :** A brief 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 & other reordering 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

**CSE/Elective -I/Semester - I**

**REFERENCE BOOKS:**

1. Melanie Mitchell, "An introduction to genetic algorithms", Prentice Hall India, 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

***CSE/Elective -I/Semester - I***

# 19250E16C - SOFTWARE METRICS

**L T P C**

**4 0 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 – 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

***CSE/Elective –II/Semester - II***

# 19250E24A - ADVANCED DISTRIBUTED COMPUTING

LTPC 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

*CSE/Elective –II/Semester - II*



**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**

***CSE/Elective –II/Semester - II***

# 19250E24B- DATA WAREHOUSING & DATA MINING

L T P C 40 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.

***CSE/Elective -II/Semester - II***

# 19250E24C- ARTIFICIAL NEURAL NETWORKS

L T P C

40 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

**CSE/Elective –III/Semester - II**

## 19250E25A- 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.

**CSE/Elective –III/Semester - II**

# 19250E25B - HIGH SPEED NETWORKS

L T P C  
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## 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

*CSE/Elective –III/Semester – II*

**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 Aparcar, "MPLS and VPN architecture", Cisco Press, Volume 1 and 2, 2003

***CSE/Elective –III/Semester – II***

# 19250E25C- EMBEDDED SYSTEMS

L T P C  
40 0  
4

## 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 – IIRTS.

## 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.

*CSE/Elective –III/Semester - II*



**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.

# 19250E32A - CLOUD COMPUTING

L T P C

40 0

4

**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 AntonopoulosSpringer, 2012
4. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010

**CSE/Elective –IV/Semester – III**

## 19250E32B - INFORMATION SECURITY

L T P C

40 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 become aware of various standards in this area.
- To know the technological aspects of Information Security.

**UNIT-I**

9

An overview of Computer Security, Access Control Matrix, Security Policies, Confidentiality Polices, Integrity policies and Hybrid Policies

**UNIT-II**

9

Cryptography- Key Management- Session and Interchange and generation, Cryptography Key Infrastructure, Storing and revoking Keys, Digital Signature, Cipher Techniques

**UNIT-III**

9

Systems: Design Principle, Representing Identity, Access Control Mechanisms, Information flow and Confinement Problems

**UNIT-IV**

9

Malicious logic, Vulnerability Analysis, Auditing and Intrusion Detection

**UNIT-V**

9

Network Security, System Security, User Security and Program Security.

**Total:45hrs**

**TEXT BOOK:**

Matt Bishop, "Computer Security arts and science" 2<sup>nd</sup> edition, Pearson Education

**REFERENCE BOOK:**

1. Mark Merkow, James Breithaupt, " Information Security: Principles and Practices", 1<sup>st</sup> edition, Pearson Education.
2. Whitman, "Principles of Information Security", 2<sup>nd</sup> edition, Pearson Education
3. William Stallings, " Cryptography an d Network Security: Principles and Practices", 3<sup>rd</sup> edition, Pearson Education.
4. Charles P Pfleeger and Shari Lawrence Pfleeger, "Security in Computing", 3<sup>rd</sup> edition

**CSE/Elective -IV/Semester - III**

## 19250E32C- SOFT COMPUTING

**L T P C**

**40 0**

**4**

### **AIM:**

To understand the concepts of Artificial Intelligence , ANN , Genetic Algorithms and Fuzzy systems and its applications.

### **OBJECTIVES:**

- 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.

***CSE/Elective –IV/Semester – III***

**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.

***CSE/Elective –V/Semester – III***

# 19250E33A -ADVANCED DATABASE TECHNOLOGY

LTPC 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 structures 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 = 45hrs

*CSE/Elective – V/Semester – III*

**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.

***CSE/Elective –V/Semester – III***

**AIM:**

To understand the mobile computing and mobile application development.

**OBJECTIVES:**

- Learning the basics of Wireless voice and data communications technologies.
- Enhancing working knowledge on various telephone and satellite networks.
- studying the working principles of wireless LAN and its standards.
- Studying various wireless operating systems.

**UNIT-I**

9

**Introduction : Evolution of Mobile Computing – Important terminologies - Mobile computing functions – Mobile computing Devices – Networks: Wireline, Wireless , Adhoc - Comparison of wired and wireless mechanism - Various types of wireless communication technologies used in Mobiles, Antennas - Architecture : Architecture of Mobile Computing – 3- Tier Architecture – Presentation ( Tier-1), Application ( Tier -2), Data ( Tier – 3).**

**UNIT-II:**

9

**Mobile computing through Telephony: Evolution through telephony – Multiple Access Procedures: FDMA, TDMA, CDMA, SDMA – features – Satellite Communication System : Communicating through satellite – Low orbit satellite – Medium orbit satellite – Geo stationary Satellite – Satellite phones**

**UNIT-III**

9

**Wireless LAN: Introduction - Definition – Applications of WLAN – Infrared versus Radio transmission – Features of WI-FI and WI-MAX - Roaming Issues.**

**UNIT-IV**

9

**Mobile Transport Layer: Traditional TCP - Congestion control - Slow start - Fast retransmit & fast recovery - Transmission / time out freezing - Selective retransmission – Indirect TCP – Snooping TCP – Mobile TCP**

**UNIT-V**

9

**Wireless Application languages and operating systems - Understanding of Wireless Application languages - XML, JAVA, J2ME, JAVA CARD - Understanding of Mobile operating system - Palm OS, Windows CE , Android**

**Total :45hrs**

**CSE/Elective –V/Semester – III**



**REFERENCES:**

1. Mobile Computing - Raj Kamal OXFORD Second Edition -2012
2. Wireless Communication and Networks - William Stallings PHI , New Delhi 1st edition.
3. Wireless Communications and Networks – 3 G and Beyond ITI SahaMisra TMGH, New Delhi Third reprint 2011
4. Wireless and Mobile Networks Concepts and protocols -  
Dr.SunilkumarS.Manvi&MahabaleshwarS.Kakkasageri - Wiley Publisher First Edition
5. Mobile Computing - Dr.N.N. Jani, KamaljitI.Lakhtara, dr.AshishN.Jani, Neeta KanabarS.Chand and Co,- New Delhi Reprint 2011
6. Mobile Computing Theory and Practice - Kumkum Gay Pearson Education 2010
7. Mobile Computing for Beginneris - RakshaShendeShroff Publishers and Distributors - First Edition -Feb 2012.

***CSE/Elective –V/Semester – III***

## 19250E33C - GREEN COMPUTING

LTPC  
400  
4

**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), McGraw Hill
3. The Greening of IT-How Companies Can Make a Difference for the Environment by John Lamb.

**CSE/Elective –VI/Semester – III**

# 19250E34A - SOFTWARE QUALITY ASSURANCE

L T P C  
40 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 – 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 – ad hoc 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. Daniel Galin, Software quality assurance – from theory to implementation, Pearson education, 2009.
2. Aditya Mathur, Foundations of software testing, Pearson Education, 2008.
3. Srinivasan Desikan and Gopalaswamy Ramesh, Software testing – principles and practices , Pearson education, 2006.
4. Ron Patton, Software Testing , second edition, Pearson education, 2009.

**CSE/Elective – VI/Semester – III**

# 19250E34B - BIO-INFORMATICS

LTPC  
400  
4

**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.

**CSE/Elective –VI/Semester – III**

# 19250E34C - WIRELESS APPLICATION PROTOCOLS

LTPC 40 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. Sandeepsinghal , JariAlwinen., -The Wireless Application Protocol: Writing Applications for the Mobile Internet - Addison Wesley Publications - 2000 .

**CSE/Elective –VI/Semester – III**

## 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-related suggests that one way of achieving this is to 'exploit further the link between teaching 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

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 .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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**PRIST UNIVERSITY  
VALLAM, THANJAVUR.**

**DEPARTMENT OF  
COMPUTER SCIENCE & ENGINEERING**

**PROGRAM HANDBOOK**

**M.Tech  
COMPUTER SCIENCE AND ENGINEERING  
[PART TIME]**

**[REGULATION 2019]  
[for candidates admitted to M.Tech CSE program from June 2019 onwards]**

# COURSE STRUCTURE

## SEMESTER – I

Semester. no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
I	19248S11AP	Higher Mathematics	3	1	0	4
I	19250H12P	Adhoc & Sensor Networks	4	0	0	4
I	19250H13P	Advanced Data Structures	4	0	0	4
<b>Practical</b>						
I	19250L14P	Advanced Web Technologies Lab	-	-	3	3
<b>Research Skill Development(RSD) Courses</b>						
I	<b>19250HRSP</b>	<b>Research Led Seminar</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>
<b>Total no of Credits</b>					<b>16</b>	

## SEMESTER – II

Semester. no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
II	19250H21P	Middleware Technologies	3	1	0	4
II	19250H22P	Digital Image Processing	4	0	0	4
II	19250E23_P	Elective I	4	0	0	4
<b>Practical</b>						
II	19250L24P	.NET Technologies Lab	-	-	3	3
II	192TECWRP	Technical Writing /Seminars	-	-	3	3
<b>Research Skill Development(RSD) Courses</b>						
II	<b>19250CRMP</b>	<b>Research Methodology</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
II	<b>19250CBRP</b>	<b>Participation in Bounded Research</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
<b>Total no of Credits</b>					<b>23</b>	

### SEMESTER – III

Semester.no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
III	19250H31P	Modern Operating System	4	0	0	4
III	19250E32P	Parallel and High Performance Computing	4	0	0	4
III	19250E33_P	Elective-II	4	0	0	4
<b>Research Skill Development(RSD) Courses</b>						
III	19250CSRP	Design/Socio Technical Project	0	0	4	4
<b>Total no of Credits</b>					<b>16</b>	

### SEMESTER – IV

Semester no.	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
IV	19250H41P	Object Oriented Software Engineering	4	0	0	4
IV	19250H42P	Software Project Management	4	0	0	4
IV	19250E43_P	Elective-V	4	0	0	4
IV	19250P44P	Project Work- Phase I	-	-	6	6
<b>Total no of Credits</b>					<b>18</b>	

## **SEMESTER – V**

Semester no.	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
V	19250E51_P	Elective-IV	4	0	0	4
V	19250E52_P	Elective-V	4	0	0	4
V	19250E53_P	Elective-VI	4	0	0	4
<b>Total no of Credits</b>						<b>12</b>

## **SEMESTER – VI**

Semester no.	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
VI	19250P61P	Project Work- Phase II	0	0	12	12
<b>Total no of Credits</b>						<b>12</b>

## LIST OF ELECTIVES

### SEMESTER – II ELECTIVE – I

Semester no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
II	19250E23AP	Advanced Distributed Computing	4	0	0	4
II	19250E23BP	Data Warehousing & Data Mining	4	0	0	4
II	19250E23CP	Artificial Neural Networks	4	0	0	4

### SEMESTER – III ELECTIVE – II

Semester no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
III	19250E33AP	Multimedia Systems	4	0	0	4
III	19250E33BP	Genetic Algorithms	4	0	0	4
III	19250E33CP	Software Metrics	4	0	0	4

### SEMESTER – IV - ELECTIVE – III

Semester no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
II	19250E43AP	Service Oriented Architecture	4	0	0	4
II	19250E43BP	High Speed Networks	4	0	0	4
II	19250E43CP	Embedded Systems	4	0	0	4

### SEMESTER – V - ELECTIVE – IV

Semester no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
III	19250E51AP	Cloud Computing	4	0	0	4
III	19250E51BP	Information Security	4	0	0	4
III	19250E51CP	Soft Computing	4	0	0	4

### SEMESTER – V - ELECTIVE – V

Semester no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
III	19250E52AP	Advanced Database Technology	4	0	0	4
III	19250E52BP	Mobile Communication Computing	4	0	0	4
III	19250E52CP	Green Computing	4	0	0	4

### SEMESTER – V - ELECTIVE – VI

Semester no	Subject Code	Subject Title	Periods per Week			C
			L	T	P	
III	19250E53AP	Software Quality Assurance	4	0	0	4
III	19250E53BP	Bio-Informatics	4	0	0	4
III	19250E53CP	Wireless Application Protocols	4	0	0	4

## CREDITS DISTRIBUTION

Semester	Theory Courses		Elective Courses		Practical Courses		Courses on *RSD		Project	Total Credit
	Nos	Credit	Nos	Credit	Nos	Credit	Nos	Credit	Credit	
I	3	12	-	-	1	03	1	01	-	16
II	2	08	1	04	2	06	2	05	-	23
III	2	08	1	04	-	-	1	04	-	16
IV	2	08	1	04	-	-	-	-	06	18
V	-	-	3	12	-	-	-	-	-	12
VI	-	-	-	-	-	-	-	-	12	12
<b>Total Credits</b>										<b>97</b>

\*RSD-Research Skill Development

<b>TOTAL CREDITS</b>	
Semester – I	<b>16</b>
Semester – II	<b>23</b>
Semester – III	<b>16</b>
Semester – IV	<b>18</b>
Semester – V	<b>12</b>
Semester – VI	<b>12</b>
<b>TOTAL</b>	<b>97</b>



# 17248S11AP - 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 –  $a \equiv (mod\ m)$  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<sub>0</sub> – Context Sensitive-Context-Free-Regular Grammars-Ambiguity.

## UNIT V LATTICE 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.

**CSE/Semester - I**

# 17250H12P - 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 - virtualization - 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 , 3<sup>rd</sup> 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.

**17250H13P - PARALLEL AND HIGH PERFORMANCE  
COMPUTING**

**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 Parallel Computing.

**OBJECTIVES:**

- To understand the models and parameters used.
- To understand the Matrix Algorithms and Design Issues.

**Unit I : Introduction : 9**

Need for Parallel Computing - Scope of Parallel Computing - Issues in Parallel Computing - Parallel Processing Concepts (Overview) - Levels of parallelism (instruction, transaction, task, thread, memory, function) - Models (SIMD, MIMD, SIMT, SPMD, Dataflow Models, Demand-driven Computation etc) -Architectures.

**Unit II : Models of Parallel Computing : 9**

Taxonomy of Parallel Architectures -Dynamic Interconnection Networks - Static Interconnection Networks - Message Transfer - Reduction, Parallel Prefix - GPU thread model.

**Unit III : Performance Modelling : 9**

Metrics – Granularity – Scalability – Overhead – Isoefficiency.

**Unit IV : Matrix Algorithms : 9**

Matrix Partitioning - Matrix Transposition - Matrix Vector Multiply - Matrix Multiply - CUDA, vector add, matrix multiply, sequence alignment - Linear Equations - LU(P) Decomposition

**Unit V : Fundamental Design Issues in Parallel Computing 9**

Synchronization – Scheduling - Job Allocation -Job Partitioning - Dependency Analysis - Mapping Parallel Algorithms onto Parallel Architectures - Performance Analysis of Parallel Algorithms

**Total : 45 hrs**

**TEXTBOOK:**

Introduction to Parallel Computing, 2<sup>nd</sup> Edition- AnanthGrama, Anshul Gupta, George Karypis, Vipin Kumar. The Addison Wesley Publishing Company, ISBN 0-201-64865-2.

**REFERENCES :**

“Highly Parallel Computing”, by George S. Almasi and Alan Gottlieb

1. “Advanced Computer Architecture: Parallelism, Scalability, Programmability”, by Kai Hwang, McGraw Hill 1993.
2. ”Parallel Computer Architecture: A hardware/Software Approach”, by David Culler Jaswinder Pal Singh, Morgan Kaufmann, 1999.
3. “Scalable Parallel Computing”, by Kai Hwang, McGraw Hill 1998.
4. “Principles and Practices on Interconnection Networks”, by William James Dally and Brian Towles, Morgan Kauffman 2004.
5. GPU Gems 3 --- by Hubert Nguyen (Chapter 29 to Chapter 41)

## 17250H14P – 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.

# 17250H15 - 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 to Randomized 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.

**17250L17 -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.



## 17250H21 - 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-CORBA Client 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

## 17250H22 - OBJECT ORIENTED SOFTWARE ENGINEERING

L T P C  
4 0 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 – Object Oriented 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 “Fundamentals of Software Engineering”Prentice Hall of India 2002.
4. Fairley, “Software Engineering Concepts”, Mc.Graw Hill 1985.



**REFERENCES:**

1. Gonzalez.R.C& Woods. R.E., Digital Image Processing, 2<sup>nd</sup>Edition, Pearson Education, 2002.
2. Anil Jain.K, Fundamentals of Digital image Processing, Prentice Hall of India, 1989.
3. Sid Ahmed, Image Processing, McGraw Hill, New York, 1995.

**17250L26 - .NET TECHNOLOGIES LAB**

**L T P C**  
**0 0 3 3**

**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.

## 17250CRM - RESEARCH METHODOLOGY

L T P C  
3 0 0 3

### 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.

## 17250H31 - SOFTWARE PROJECT MANAGEMENT

L T P C  
4 0 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 Gopalswamy, “Managing Global Projects”, Tata McGraw Hill, 2001.
2. Bob Hughes, Mikecoterrell, “Software Project Management”, 3rd Edition, Tata cGraw Hill, 2004.

**SEMESTER – I - ELECTIVE – I**  
**17250E16A - MULTIMEDIA SYSTEMS**

**L T P C**  
**4 0 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 III Multimedia 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 IV Multimedia 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.

**17250E16B- GENETIC ALGORITHMS**

**L T P C**  
**4 0 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 :** A brief 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 & other reordering 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

***CSE/Elective -I/Semester - I***

**REFERENCE BOOKS:**

1. Melanie Mitchell, “An introduction to genetic algorithms”, Prentice Hall India, 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

## **17250E16C - SOFTWARE METRICS**

**L T P C**  
**4 0 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 – 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

**17250E24A - ADVANCED DISTRIBUTED COMPUTING**

**L T P C**  
**4 0 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**  
***CSE/Elective -II/Semester - II***

**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



## 17250E24B- 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 – 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 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.

## 17250E24C- 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 Feed forward 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

## **17250E25A- 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 as 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 coordination – 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.

## 17250E25B - 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 Aparcar, "MPLS and VPN architecture", Cisco Press, Volume 1 and 2, 2003

## 17250E25C- EMBEDDED SYSTEMS

L T P C  
4 0 0 4

### 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 – IIRTS.

### 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.

## **17250E32A - CLOUD COMPUTING**

**L T P C**  
**4 0 0 4**

**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: 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

## 17250E32B - INFORMATION SECURITY

L T P C  
4 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 become aware of various standards in this area.
- To know the technological aspects of Information Security.

**UNIT-I**

9

An overview of Computer Security, Access Control Matrix, Security Policies, Confidentiality Policies, Integrity policies and Hybrid Policies

**UNIT-II**

9

Cryptography- Key Management- Session and Interchange and generation, Cryptography Key Infrastructure, Storing and revoking Keys, Digital Signature, Cipher Techniques

**UNIT-III**

9

Systems: Design Principle, Representing Identity, Access Control Mechanisms, Information flow and Confinement Problems

**UNIT-IV**

9

Malicious logic, Vulnerability Analysis, Auditing and Intrusion Detection

**UNIT-V**

9

Network Security, System Security, User Security and Program Security.

**Total:45hrs**

**TEXT BOOK:**

Matt Bishop, "Computer Security arts and science" 2<sup>nd</sup> edition, Pearson Education

**REFERENCE BOOK:**

1. Mark Merkow, James Breithaupt, "Information Security: Principles and Practices", 1<sup>st</sup> edition, Pearson Education.
2. Whitman, "Principles of Information Security", 2<sup>nd</sup> edition, Pearson Education
3. William Stallings, "Cryptography and Network Security: Principles and Practices", 3<sup>rd</sup> edition, Pearson Education.
4. Charles P Pfleeger and Shari Lawrence Pfleeger, "Security in Computing", 3<sup>rd</sup> edition

## **17250E32C - SOFT COMPUTING**

**L T P C**  
**4 0 0 4**

### **AIM:**

To understand the concepts of Artificial Intelligence , ANN , Genetic Algorithms and Fuzzy systems and its applications.

### **OBJECTIVES:**

- 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.

## 17250E33A – 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 structures 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.



**17250E33B - MOBILE COMMUNICATION AND COMPUTING**

**L T P C**  
**4 0 0 4**

**AIM:**

To understand the mobile computing and mobile application development.

**OBJECTIVES:**

- Learning the basics of Wireless voice and data communications technologies.
- Enhancing working knowledge on various telephone and satellite networks.
- studying the working principles of wireless LAN and its standards.
- Studying various wireless operating systems.

**UNIT-I**

**9**

**Introduction** : Evolution of Mobile Computing – Important terminologies - Mobile computing functions – Mobile computing Devices – Networks: Wireline, Wireless , Adhoc - Comparison of wired and wireless mechanism - Various types of wireless communication technologies used in Mobiles, Antennas - **Architecture** : Architecture of Mobile Computing – 3- Tier Architecture – Presentation ( Tier-1), Application ( Tier -2), Data ( Tier – 3).

**UNIT-II:**

**9**

**Mobile computing through Telephony:** Evolution through telephony – Multiple Access Procedures: FDMA, TDMA, CDMA, SDMA – features – Satellite Communication System : Communicating through satellite – Low orbit satellite – Medium orbit satellite – Geo stationary Satellite – Satellite phones

**UNIT-III**

**9**

**Wireless LAN:** Introduction - Definition – Applications of WLAN – Infrared versus Radio transmission – Features of WI-FI and WI-MAX - Roaming Issues.

**UNIT-IV**

**9**

**Mobile Transport Layer:** Traditional TCP - Congestion control - Slow start - Fast retransmit & fast recovery - Transmission / time out freezing - Selective retransmission – Indirect TCP – Snooping TCP – Mobile TCP

**UNIT-V**

**9**

**Wireless Application languages and operating systems** - Understanding of Wireless Application languages - XML, JAVA, J2ME, JAVA CARD - Understanding of Mobile operating system - Palm OS, Windows CE , Android

**Total :45hrs**

49

**REFERENCES:**

1. Mobile Computing - Raj Kamal OXFORD Second Edition -2012
2. Wireless Communication and Networks - William Stallings PHI , New Delhi 1st edition.
3. Wireless Communications and Networks – 3 G and Beyond ITI SahaMisra TMGH, New Delhi Third reprint 2011
4. Wireless and Mobile Networks Concepts and protocols - Dr.Sunilkumar S.Manvi & Mahabaleshwar S.Kakkasageri - Wiley Publisher First Edition
5. Mobile Computing - Dr.N.N. Jani, Kamaljit I.Lakhtara, dr.Ashish N.Jani, Neeta Kanabar S.Chand and Co,- New Delhi Reprint 2011
6. Mobile Computing Theory and Practice - Kumkum Gay Pearson Education 2010
7. Mobile Computing for Beginneris - Raksha Shende Shroff Publishers and Distributors - First Edition -Feb 2012.

**17250E33C - GREEN COMPUTING**

**L T P C**  
**4 0 0 4**

**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.

## 17250E34A - 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 – 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. Daniel Galin, Software quality assurance – from theory to implementation, Pearson education, 2009.
2. Aditya Mathur, Foundations of software testing, Pearson Education, 2008.
3. Srinivasan Desikan and Gopaldaswamy Ramesh, Software testing – principles and practices , Pearson education, 2006.
4. Ron Patton, Software Testing , second edition, Pearson education, 2007.

**17250E34B - BIO-INFORMATICS**

**L T P C**  
**4 0 0 4**

**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.

# 17250E34C - 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 for the Mobile Internet - Addison Wesley Publications - 2000 .

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

**Mapping of Courses to Crosscutting Issues**

**2020R**

<b>Programme Name &amp;Code</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Gender Sensitization</b>	<b>Professional Ethics</b>	<b>Environment and Sustainability</b>	<b>Human Values</b>
B.Tech - 20UGCSEFT	20149L18	Physics and Chemistry Laboratory	–	–	–	–
B.Tech - 20UGCSEFT	201VEA19	Value Education Engineering	–	–	–	–
B.Tech - 20UGCSEFT	20147S21	Technical English	–	–	–	–
B.Tech - 20UGCSEFT	20148S22	Engineering Mathematics–II	–	–	–	–
B.Tech - 20UGCSEFT	20149S23A	Physics for Information Science	–	–	–	–
B.Tech - 20UGCSEFT	20149S24A	Environmental Science And Engineering	–	–	✓	–



B.Tech - 20UGCSEFT	20153S25A	Basic Electrical, Electronics And Measurement Engineering	-	-	-	-
B.Tech - 20UGCSEFT	20150S26A	Programming in C	-	-	-	-
B.Tech - 20UGCSEFT	20154L27	Engineering Practices Lab	-	-	-	-
B.Tech - 20UGCSEFT	20150L28A	C Programming Lab	-	-	-	-
B.Tech - 20UGCSEFT	201ICA29	Fundamentals of Indian constitution and Economy	-	-	-	-
B.Tech - 20UGCSEFT	20148S31	Discrete Mathematics	-	-	-	-
B.Tech - 20UGCSEFT	20150S32	Digital Principles and System Design	-	-	-	-
B.Tech - 20UGCSEFT	20150C33	Data Structures	-	-	-	-
B.Tech - 20UGCSEFT	20150C34	Object Oriented Programming	-	-	-	-
B.Tech - 20UGCSEFT	20150S35	Communication Engineering	-	-	-	-
B.Tech - 20UGCSEFT	20150L36	Data Structures Laboratory	-	-	-	-
B.Tech - 20UGCSEFT	20150L37	Object Oriented Programming Laboratory	-	-	-	-

B.Tech - 20UGCSEFT	20150L38	Digital Systems Laboratory	-	-	-	-
B.Tech - 20UGCSEFT	20150L39	Interpersonal Skills/Listening &Speaking	-	-	-	-
B.Tech - 20UGCSEFT	20148S41A	Probability and Queuing Theory	-	-	-	-
B.Tech - 20UGCSEFT	20150C42	Computer Architecture	-	-	-	-
B.Tech - 20UGCSEFT	20150C43	Database Management Systems	-	-	-	-
B.Tech - 20UGCSEFT	20150C44	Design and Analysis of Algorithms	-	-	-	-
B.Tech - 20UGCSEFT	20150C45	Operating Systems	-	-	-	-
B.Tech - 20UGCSEFT	20150C46	Software Engineering	-	-	-	-
B.Tech - 20UGCSEFT	20150L47	Database Management Systems Laboratory	-	-	-	-
B.Tech - 20UGCSEFT	20150L48	Operating Systems Laboratory	-	-	-	-
B.Tech - 20UGCSEFT	20150L49	Advanced Reading and Writing	-	-	-	-
B.Tech - 20UGCSEFT	19150CRS	Research Led Seminar	-	-	-	-
B.Tech - 20UGCSEFT	20148S51A	Algebra and Number Theory	-	-	-	-

B.Tech - 20UGCSEFT	20150C52	Computer Networks	-	-	-	-
B.Tech - 20UGCSEFT	20150C53	Microprocessors and Microcontrollers	-	-	-	-
B.Tech - 20UGCSEFT	201__OE54	Open Elective –I	-	-	-	-
B.Tech - 20UGCSEFT	20150C55	Theory of Computation	-	-	-	-
B.Tech - 20UGCSEFT	20150C56	Object Oriented Analysis and Design	-	-	-	-
B.Tech - 20UGCSEFT	20150L57	Microprocessors and Microcontrollers Laboratory	-	-	-	-
B.Tech - 20UGCSEFT	20150L58	Object Oriented Analysis and Design Laboratory	-	-	-	-
B.Tech - 20UGCSEFT	20150L59	Networks Laboratory	-	-	-	-
B.Tech - 20UGCSEFT	20150CRM	Research Methodology	-	-	-	-
B.Tech - 20UGCSEFT	20150C61	Internet Programming	-	-	-	-
B.Tech - 20UGCSEFT	20150C62	Artificial Intelligence	-	-	-	-
B.Tech - 20UGCSEFT	20150C63	Mobile Computing	-	-	-	-
B.Tech - 20UGCSEFT	20150C64	Compiler Design	-	-	-	-

B.Tech - 20UGCSEFT	20150C65	Distributed Systems	-	-	-	-
B.Tech - 20UGCSEFT	20150E66	Elective-I	-	-	-	-
B.Tech - 20UGCSEFT	20150L61	Internet Programming Laboratory	-	-	-	-
B.Tech - 20UGCSEFT	20150L62	Mobile Application Development Laboratory	-	-	-	-
B.Tech - 20UGCSEFT	20150L63	Mini Project	-	-	-	-
B.Tech - 20UGCSEFT	20150L64	Professional Communication	-	✓	-	-
B.Tech - 20UGCSEFT	20150CBR	Participation in Bounded Research	-	-	-	-
B.Tech - 20UGCSEFT	20150S71	Principles of Management	-	-	-	✓
B.Tech - 20UGCSEFT	20150C72	Cryptography and Network Security	-	-	-	-
B.Tech - 20UGCSEFT	20150C73	Cloud Computing	-	-	-	-
B.Tech - 20UGCSEFT	201__OE74_	Open Elective-II	-	-	-	-
B.Tech - 20UGCSEFT	20150E75	Elective-II	-	-	-	-

B.Tech - 20UGCSEFT	20150E76	Elective–III	–	–	–	–
B.Tech - 20UGCSEFT	20150L77	Cloud Computing Laboratory	–	–	–	–
B.Tech - 20UGCSEFT	20150L78	Security Laboratory	–	–	–	–
B.Tech - 20UGCSEFT	20150CSR	Design / Socio- Technical Project	–	–	–	–
B.Tech - 20UGCSEFT	20150E81 —	Elective–IV	–	–	–	–
B.Tech - 20UGCSEFT	20150E82 —	Elective–V	–	–	–	–
B.Tech - 20UGCSEFT	20150P83	Project Work	–	–	–	–
B.Tech - 20UGCSEFT	20150PEE	Program Exit Examination	–	–	–	–
B.Tech - 20UGCSEFT	20150E66A	Artificial Intelligence	–	–	–	–
B.Tech - 20UGCSEFT	20150E66B	Software Testing	–	–	–	–
B.Tech - 20UGCSEFT	20150E66C	Digital Image Processing	–	–	–	–
B.Tech - 20UGCSEFT	20150E66D	System Software	–	–	–	–

B.Tech - 20UGCSEFT	20150E66E	System Modelling & Simulation	-	-	-	-
B.Tech - 20UGCSEFT	20150E75A	Network Tools & Techniques	-	-	-	-
B.Tech - 20UGCSEFT	20150E75B	Python Programming with Web Frameworks	-	-	-	-
B.Tech - 20UGCSEFT	20150E75C	Software Project Management	-	-	-	✓
B.Tech - 20UGCSEFT	20150E75D	Linux Programming	-	-	-	-
B.Tech - 20UGCSEFT	20150E75E	System Software	-	-	-	-
B.Tech - 20UGCSEFT	20150E76A	Green Computing	-	-	-	-
B.Tech - 20UGCSEFT	20150E76B	Data Warehousing & Data Mining	-	-	-	-
B.Tech - 20UGCSEFT	20150E76C	C# and .Net Programming	-	-	-	-
B.Tech - 20UGCSEFT	20150E76D	Domain-centric Security	-	-	-	-
B.Tech - 20UGCSEFT	20150E76E	Network Administration & Management Tools	-	-	-	-
B.Tech - 20UGCSEFT	20150E81A	Digital Image Processing	-	-	-	-

B.Tech - 20UGCSEFT	20150E81B	Social Network Analysis	-	-	-	-
B.Tech - 20UGCSEFT	20150E81C	Information Security	-	-	-	-
B.Tech - 20UGCSEFT	20150E81D	Cyber Forensics	-	-	-	-
B.Tech - 20UGCSEFT	20150E81E	Soft Computing	-	-	-	-
B.Tech - 20UGCSEFT	20150E82A	Information Retrieval Techniques	-	-	-	-
B.Tech - 20UGCSEFT	20150E82B	Natural Language Processing	-	-	-	-
B.Tech - 20UGCSEFT	21149S13	Engineering Physics	-	-	-	-
B.Tech - 20UGCSEFT	21149S14	Engineering Chemistry	-	-	-	-
B.Tech - 20UGCSEFT	21150S15	Problem Solving And Python Programming	-	-	-	-

### 1.3.1 SUPPORTING DOCUMENTS

Courses which address the Gender Sensitization, Human Values, Professional Ethics, Environment and sustainability.

## SCHOOL OF ENGINEERING AND TECHNOLOGY

### DEPARTMENT OF CIVIL ENGINEERING

### PROGRAM HAND BOOK

Gender Sensitization and Human Values	
Professional Ethics	..
Human Values	
Environment and sustainability	
Professional Ethics & Human Values	



**COURSE STRUCTURE**  
**B.TECH FT CIVIL R2019**

**I - VIII SEMESTERS CURRICULUM AND SYLLABI**

**B.TECH (FT) CIVIL**

**[REGULATION 2019]**

**SEMESTER I**

Sl.No	Course Code	Course Title	Periods			Credit
			Per Week			
			L	T	P	
<b>THEORY</b>						
1	19147S11	Communicative English	4	0	0	4
2	19148S12	Engineering Mathematics – I	3	2	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
<b>PRACTICALS</b>						
7	19150L17	Problem Solving and Python Programming Laboratory	0	0	3	2
8	19149L18	Physics and Chemistry Laboratory	0	0	3	2
9	191VEA19	Value Education				-
<b>TOTAL</b>						25

**SEMESTER II**

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	19147S21	Technical English (All Branches)	4	0	0	4
2.	19148S22A	Engineering Mathematics II (All Branches)	4	0	0	4
3.	19149S23D	Physics for Civil Engineering	3	0	0	3
4.	19149S24A	Environmental Science And Engineering	3	0	0	3
5.	19153S25E	Basic Electrical And Electronics Engineering	3	0	0	3
6.	19154S26D	Engineering Mechanics	3	2	0	4
<b>PRACTICALS</b>						
7.	19154L27	Engineering Practices Laboratory	0	0	3	2

8.	19155L28E	Computer Aided Building Drawing Lab	0	0	3	2
9.	191ICA29	Fundamentals of Indian Constitution and Economy	0	0	0	-
<b>TOTAL</b>			<b>20</b>	<b>2</b>	<b>6</b>	<b>25</b>

### SEMESTER III

S. No	Sub. Code	Name of the Subject	L	T	P	C
<b>THEORY</b>						
1	19148S31C	Transforms and Partial Differential Equations	4	0	0	4
2	19155C32	Engineering Geology	3	2	0	4
3	19155C33	Construction Materials	4	0	0	4
4	19155C34	Strength of Materials -I	3	0	0	3
5	19155C35	Fluid Mechanics	3	2	0	4
6	19155C36	Surveying	4	0	0	3
<b>PRACTICALS</b>						
7	19155L37	Surveying Laboratory	0	0	3	2
8	19155L38	Construction Materials Laboratory	0	0	3	2
9	19155L39	Interpersonal Skills / Listening and Speaking	0	0	2	1
<b>TOTAL</b>						<b>27</b>

### SEMESTER IV

S. No	Sub. Code	Name of the Subject	L	T	P	C
<b>THEORY</b>						
1	19148S41C	Numerical Methods	4	0	0	4
2	19155C42	Construction Techniques and Practices	3	2	0	4
3	19155C43	Strength of Materials II	4	0	0	4
4	19155C44	Applied Hydraulic Engineering	3	0	0	3
5	19155C45	Concrete Technology	3	2	0	4
6	19155C46	Soil Mechanics	3	0	0	3

<b>PRACTICALS</b>						
7	19155L47	Strength of Materials Lab	0	0	3	2
8	19155L48	Hydraulic Engineering Lab	0	0	3	2
9	19155L49	Advanced Reading & Writing	0	0	2	1
10	19155CRS	Research Led Seminar	0	0	2	1
<b>TOTAL</b>						<b>28</b>

### SEMESTER – V

<b>S. No</b>	<b>Sub. Code</b>	<b>Name of the Subject</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>THEORY</b>						
1	19155C51	Design of Reinforced Cement Concrete Elements	4	0	0	4
2	19155C52	Structural Analysis I	3	2	0	4
3	19155C53	Water Supply Engineering	3	0	0	3
4	19155FE54	Open Elective I	3	0	0	3
5	19155E55	Elective I	3	0	0	3
6	19155C56	Foundation Engineering	3	0	0	3
<b>PRACTICALS</b>						
7	19155L57	Soil Mechanics Lab	0	0	3	2
8	19155L58	Water and Waste Water Analysis Lab	0	0	3	2
9	19155L59	Survey Camp	0	0	2	2
10	19155CRM	Research Methodology	0	0	2	3
<b>TOTAL</b>						<b>29</b>

### SEMESTER – VI

<b>S. No</b>	<b>Sub. Code</b>	<b>Name of the Subject</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>THEORY</b>						
1	19155C61	Design of Steel Structural Elements	3	0	0	3
2	19155C62	Structural Analysis II	3	2	0	4
3	19155C63	Irrigation Engineering	3	0	0	3

4	19155C64	Highway Engineering	3	2	0	4
5	19155C65	Waste Water Engineering	3	0	0	3
6	19155E66	Elective II	3	0	0	3
<b>PRACTICALS</b>						
7	19155L67	Highway Engineering Laboratory	0	0	3	2
8	19155L68	Irrigation and Environmental Engineering Drawing	0	0	3	2
9	19155L69	Professional Communication	0	0	2	2
10	19155CBR	Participation in Bounded Research	0	0	2	2
TOTAL						28

### SEMESTER – VII

S. No	Sub. Code	Name of the Subject	L	T	P	C
<b>THEORY</b>						
1	19155C71	Estimation , Costing & Valuation Engineering	4	0	0	4
2	19155C72	Railways, Airports, Docks And Harbour Engineering	3	2	0	4
3	19155C73	Structural Design and drawing	3	2	0	4
4	19155FE74	Open Elective II	4	0	0	3
5	19155E75	Elective III	4	0	0	3
<b>PRACTICALS</b>						
6	19155L76	Creative and Innovation project (activity based –subject related)	0	0	4	2
7	19155L77	Industrial Training ( 4 Weeks during VI th Sem Summar)	0	0	0	2
8	19155L78	Technical Seminar	0	0	2	1
9	19155CSR	Design Project / Socio Technical Project(Participated Scaffolded Research )	0	0	4	4
TOTAL						27

### SEMESTER – VIII

S. No	Sub. Code	Name of the Subject	L	T	P	C
1	19155E81	Elective IV	3	0	0	3
2	19155E82	Elective V	3	0	0	3
3	19155PW83	Project Work	0	0	30	15
4	19155PEE	Program Exit Exam				2
TOTAL						23

**LIST OF ELECTIVES****SEMESTER – V****ELECTIVE I**

S. No	Sub. Code	Name of the Subject	L	T	P	C
1	19155E55A	Digital Cadastre	3	0	0	3
2	19155E55B	Advanced Surveying	3	0	0	3
3	19155E55C	Geographic Information System	3	0	0	3
4	19155E55D	Geo informatics Applications for Civil Engineers	3	0	0	3

**SEMESTER – VI****ELECTIVE II**

S. No	Sub. Code	Name of the Subject	L	T	P	C
1	19155E66A	Ground Improvement Techniques	3	0	0	3
2	19155E66B	Introduction to soil dynamics and machine foundation	3	0	0	3
3	19155E66C	Rock Engineering	3	0	0	3
4	19155E66D	Urban planning and development	3	0	0	3

**SEMESTER – VII****ELECTIVE III**

S. No	Sub. Code	Name of the Subject	L	T	P	C
1	19155E75A	Traffic engineering and management	3	0	0	3
2	19155E75B	Design of Prestressed concrete structures	3	0	0	3
3	19155E75C	Construction planning and scheduling	3	0	0	3
4	19155E75D	Municipal solid waste management	3	0	0	3

**SEMESTER – VIII****ELECTIVE IV**

S. No	Sub. Code	Name of the Subject	L	T	P	C
1	19155E81A	Coastal Engineering	3	0	0	3
2	19155E81B	Integrated water resources management	3	0	0	3
3	19155E81C	Groundwater engineering	3	0	0	3
4	19155E81D	Hydrology and water resources engineering	3	0	0	3

### ELECTIVE V

S. No	Sub. Code	Name of the Subject	L	T	P	C
1	19155E82A	Maintenance, repair and rehabilitation of structures	3	0	0	3
2	19155E82B	Structural dynamics and earthquake engineering	3	0	0	3
3	19155E82C	Prefabricated structures	3	0	0	3
4	19155E82D	Bridge engineering	3	0	0	3

### OPEN ELECTIVE-I

<b>1</b>	<b>19150FE54A</b>	<b>Database Management Systems (CSE)</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
2	19150FE54B	Cloud Computing (CSE)	3	0	0	3
3	19152FE54A	Basic Of Bio Medical Instrumentation (ECE)	3	0	0	3
4	19152FE54B	Sensor and Transducers (ECE)	3	0	0	3
5	19153FE54A	Industrial Nano Technology (EEE)	3	0	0	3
<b>6</b>	<b>19153FE54A</b>	<b>Energy Conservation and Management (EEE)</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
7	19154FE54A	Renewable Energy Sources (MECH)	3	0	0	3
8	19154FE54B	Automotive Systems (MECH)	3	0	0	3



**OPEN ELECTIVE-II**

<b>1</b>	19150FE74A	Introduction to C Programming (CSE)	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>2</b>	19150FE74B	Data Structures & Algorithms (CSE)	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>3</b>	19152FE74A	Robotics (ECE)	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>4</b>	19152FE74B	Electronic Devices (ECE)	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>5</b>	19153FE74A	Basic Circuit Theory (EEE)	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>6</b>	19153FE74B	Introduction to Renewable Energy Systems (EEE)	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>7</b>	19154FE74A	Industrial Safety (MECH)	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>8</b>	19154FE74B	Testing of Materials (MECH)	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**COURSE STRUCTURE**  
**B.TECH PT CIVIL R2019**

**SEMESTER – I**

S. No	Sub. Code	Name of the Subject	L	T	P	C
1	19148S11P	Transforms & Partial Differential Equations	3	1	0	4
2	19155C12P	Mechanics of Solids	3	1	0	4
3	19155C13P	Fluid Mechanics I	3	1	0	4
4	19155C14P	Surveying	3	1	0	4
5	19155C15P	Irrigation Engineering	3	0	0	3
TOTAL						19

**SEMESTER – II**

S. No	Sub. Code	Name of the Subject	L	T	P	C
1	19148S21P	Numerical Methods	3	1	0	4
2	19155C22P	Strength of Materials	3	1	0	4
3	19155C23P	Fluid Mechanics II	3	1	0	4
4	19155C24P	Concrete Technology	3	1	0	4
5	19155C25P	Soil Mechanics	3	0	0	3
TOTAL						19

**SEMESTER – III**

S. No	Sub. Code	Name of the Subject	L	T	P	C
1	19148S31P	Probability & Statistics	3	1	0	4
2	19155C32P	Design of Reinforced Concrete Structures-I	3	1	0	4
3	19155C33P	Structural Analysis I	3	1	0	4
4	19155C34P	Construction Materials And Practice	3	0	0	3
5	19155L35P	Soil Mechanics laboratory	0	0	3	2
TOTAL						17

**SEMESTER – IV**

S. No	Sub. Code	Name of the Subject	L	T	P	C
1	19155C41P	Design of Reinforced Concrete Structures-II	3	1	0	4
2	19155C42P	Structural Analysis II	3	1	0	4
3	19155C43P	Environmental Engineering	3	1	0	4
4	19155E44-P	Hard Core Elective I	3	1	0	4
5	19155L45P	Environmental Engineering Lab	0	0	3	2
TOTAL						18

**SEMESTER – V**

S. No	Sub. Code	Name of the Subject	L	T	P	C
1	19155C51P	Design of Steel Structures	3	1	0	4
2	19155C52P	Foundation Engineering	3	1	0	4
3	19155C53P	Industrial Waste Management	3	1	0	4
4	19155E54-P	Hard Core Elective II	3	1	0	4
5	19155L55P	Computer Aided Building Drawing Laboratory	0	0	3	2
						18

**SEMESTER – VI**

S. No	Sub. Code	Name of the Subject	L	T	P	C
1	19155C61P	Estimation & Cost Evaluation	3	1	0	4
2	19155C62P	Ground Water Hydrology	3	1	0	4
3	19155C63P	Construction Project Management	3	1	0	4
4	19155E64-P	Hard Core Elective III	3	1	0	4
5	19155L65P	Concrete & Transportation Engineering Laboratory	0	0	3	2
TOTAL						18

## SEMESTER – VII

S. No	Sub. Code	Name of the Subject	L	T	P	C
1	19160S71P	Total Quality Management	3	0	0	3
2	19155C72P	Housing, Planning & Management	3	1	0	4
3	19155C73P	Repair And Rehabilitation of Structures	3	1	0	4
4	19155E74-P	Hard Core Elective IV	3	0	0	3
5	19155P75P	Project Work	-	-	12	6
TOTAL						20

### LIST OF ELECTIVES

#### HARD CORE ELECTIVE I

S. No	Sub. Code	Name of the Subject	L	T	P	C
1	19155E44AP	Hydrology	3	1	0	4
2	19155E44BP	Water Resource Engineering	3	1	0	4
3	19155E44CP	Building Technology	3	1	0	4
4	19155E44DP	Contract Laws And Regulations	3	1	0	4

#### HARD CORE ELECTIVE II

S. No	Sub. Code	Name of the Subject	L	T	P	C
1	19155E54AP	Computer Aided Analysis And Design	3	1	0	4
2	19155E54BP	Transportation Engineering	3	1	0	4
3	19155E54CP	Geology	3	1	0	4
4	19155E54DP	Highway Engineering	3	1	0	4

### HARD CORE ELECTIVE III

S. No	Sub. Code	Name of the Subject	L	T	P	C
1	19155E64AP	Remote Sensing And GIS	3	1	0	4
2	19155E64BP	Railway Engineering	3	1	0	4
3	19155E64CP	Airport & Harbours	3	1	0	4
4	19155E64DP	Electronic Surveying	3	1	0	4

### HARD CORE ELECTIVE IV

S. No	Sub. Code	Name of the Subject	L	T	P	C
1	19155E74AP	Air Pollution Management	3	0	0	3
2	19155E74BP	Pre Fabricated Structures	3	0	0	3
3	19155E74CP	Bridge Structures	3	0	0	3
4	19155E74DP	Pre stressed Concrete Structures	3	0	0	3

**COURSE STRUCTURE**  
**M.TECH FT STRUCTURAL R2019**



**SEMESTER – I**

S. No	Subject Code	Name of the Subject	L	T	P	C
1	19248S11E	Advanced Engineering Mathematics	3	1	0	4
2	19255H12	Quality Control & Assurance in Construction	3	0	0	3
3	19255H13	Theory of Plasticity and Elasticity	3	1	0	4
4	19255H14	Structural Dynamics	3	1	0	4
5	19255H15	Maintenance and Rehabilitation of Structures	3	1	0	4
6	19255E16(A-C)	Hard Core Elective I	3	1	0	4
7	19255CRS	Research Led Seminar	4	0	0	1
8	19255L18	Core Practical (Computer Programming Lab)	0	0	3	3
TOTAL						27

**SEMESTER – II**

S. No	Subject Code	Name of the Subject	L	T	P	C
1	19255H21	Management Information System	3	0	0	3
2	19255H22	Finite Element Analysis	3	1	0	4
3	19255H23	Advanced Concrete Structural Design	3	1	0	4
4	19255E24(A-C)	Hard Core Elective –II	3	0	0	3
5	19255E25(A-C)	Hard Core Elective –III	3	1	0	4
6	19255CRM	Research Methodology	4	0	0	3
7	19255CBR	Participation in Bounded Research	1	0	0	2
8	19255L28	Core practical (Software Lab – Finite Element Analysis- ANSYS)	0	0	3	3
9	192TECWR	Technical writing / Seminars	0	0	3	3
TOTAL						29

**SEMESTER – III**

<b>S. No</b>	<b>Subject Code</b>	<b>Name of the Subject</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1	19255H31	Advanced Steel Structures	3	1	0	4
2	19255E32(A-C)	Hard Core Elective IV	3	1	0	4
3	19255E33(A-C)	Hard Core Elective V	3	1	0	4
4	19255E34(A-C)	Hard Core Elective VI	3	1	0	4
5	19255CSR	Design Project / Socio Technical Project	4	0	0	4
6	19255P36	Project Work Phase-I	0	0	9	9
TOTAL						29

**SEMESTER – IV**

<b>S. No</b>	<b>Subject Code</b>	<b>Name of the Subject</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1	19255P41	Project Work Phase-II	0	0	15	15
TOTAL						15

**LIST OF ELECTIVES**

**SEMESTER I**

**Hard Core Elective-I**

<b>S. No</b>	<b>Subject Code</b>	<b>Name of the Subject</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1	19255E16A	Prestressed Concrete Design	3	1	0	4
2	19255E16B	High Rise Structures	3	1	0	4
3	19255E16C	Computer Aided Structural Design	3	1	0	4

**SEMESTER II**

**Hard Core Elective - II**

<b>S. No</b>	<b>Subject Code</b>	<b>Name of the Subject</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1	19255E24 A	Failure Analysis of Structures	3	1	0	4
2	19255E24 B	Advanced Concrete Technology	3	0	0	3
3	19255E24 C	Steel, Concrete Composite Structures	3	1	0	4

**Hard Core Elective - III**

<b>S. No</b>	<b>Subject Code</b>	<b>Name of the Subject</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1	19255E25A	Optimization in Structural Design	3	1	0	4
2	19255E25B	Design of Industrial Structures	3	1	0	4
3	19255E25 C	Elements of Earthquake Engineering	3	1	0	4

**SEMESTER III**

**Hard Core Elective-IV**

<b>S. No</b>	<b>Subject Code</b>	<b>Name of the Subject</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1	19255E32A	ExperimentalStressAnalysis	3	1	0	4
2	19255E32B	Soil Structure Interaction	3	1	0	4
3	19255E32C	Aseismic Design of Structures	3	1	0	4

**Hard Core Elective – V**

<b>S. No</b>	<b>Subject Code</b>	<b>Name of the Subject</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1	19255E33A	Prefabricated Structures	3	1	0	4
2	19255E33B	Disaster Resistant Structures	3	1	0	4
3	19255E33C	Nonlinear Analysis of Structures	3	1	0	4

**Hard Core Elective – VI**

<b>S. No</b>	<b>Subject Code</b>	<b>Name of the Subject</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1	19255E34A	Offshore Structures	3	1	0	4
2	19255E34B	Stability of Structures	3	1	0	4
3	19255E34C	Mechanics of Composite Materials	3	1	0	4

**COURSE STRUCTURE**  
**M.TECH PT STRUCTURAL R2019**

### **SEMESTER-I**

S.No	Sub.Code	Name of the Subject	L	T	P	C
1	19248S11EP	Advanced Engineering Mathematics	3	1	0	4
2	19255C12P	Quality Control & Assurance in Construction	3	1	0	4
3	19255C13P	Theory of Plasticity and Elasticity	3	1	0	4
4	19255L14P	Computer Programming Lab	0	0	3	3
5	19255CRSP	Research Led Seminar	4	0	0	1
TOTAL						16

### **SEMESTER-II**

S.No	Sub.Code	Name of the Subject	L	T	P	C
1	19255C21P	Management Information System	3	1	0	4
2	19255C22P	Finite Element Analysis	3	1	0	4
3	19255E23-P	Elective I-(ACT)	3	1	0	4
4	19255L24P	Software Lab- ANSYS	0	0	3	3
5	192TECWRP	Technical Writing/Seminars	0	0	3	3
6	19255CRMP	Research Methodology	4	0	0	3
7	19255CBRP	Participation in Bounded Research	1	0	0	2
TOTAL						23

### **SEMESTER-III**

S.No	Sub.Code	Name of the Subject	L	T	P	C
1	19255C31P	Structural Dynamics	3	1	0	4
2	19255C32P	Maintenance and Rehabilitation of Structures	3	1	0	4
3	19255E33-P	Elective II	3	1	0	4
TOTAL						16

### **SEMESTER-IV**

S.No	Sub.Code	Name of the Subject	L	T	P	C
1	19255C41P	Advanced Concrete Structural design	3	1	0	4
2	19255C42P	Advanced Steel Structures	3	1	0	4
3	19255E43-P	Elective III	3	1	0	4
4	19255P44P	Project Work Phase I	0	0	6	6
5	19255CSRSP	Design/Socio-Technical Project	4	0	0	4
Total Credits						18

**SEMESTER- V**

S.No	Sub.Code	Name ofthe Subject	L	T	P	C
1	19255E51-P	ElectiveIV	3	1	0	4
2	19255E52-P	ElectiveV	3	1	0	4
3	19255E53-P	ElectiveVI	3	1	0	4
TOTAL						12

**SEMESTER- VI**

S.No	Sub.Code	Name ofthe Subject	L	T	P	C
1	19255P61P	ProjectWorkPhaseII	0	0	12	12
TotalCredits						12

**LIST OF ELECTIVES**

**SEMESTER II**

**Elective-I**

S.No	Sub.Code	Name ofthe Subject	L	T	P	C
1	19255E23AP	Failure Analysis ofStructures	3	1	0	4
2	19255E23BP	AdvancedConcreteTechnology	3	1	0	4
3	19255E23CP	Steel,ConcreteCompositeStructures	3	1	0	4

**SEMESTER III**

**Elective- II**

S.No	Sub.Code	Name ofthe Subject	L	T	P	C
1	19255E33AP	PrestressedConcreteDesign	3	1	0	4
2	19255E33BP	HighRise Structures	3	1	0	4
3	19255E33CP	Computer AidedStructuralDesign	3	1	0	4

**SEMESTERIV**

**Elective-III**

S.No	Sub.Code	Name ofthe Subject	L	T	P	C
1	19255E43AP	OptimizationInStructuralDesign	3	1	0	4
2	19255E43BP	Design OfIndustrialStructures	3	1	0	4
3	19255E43CP	ElementsOfEarthquakeEngineering	3	1	0	4

**SEMESTERV**

**Elective-IV**

S.No	Sub.Code	Name ofthe Subject	L	T	P	C
1	19255E51AP	ExperimentalStressAnalysis	3	1	0	4
2	19255E51BP	SoilStructureInteraction	3	1	0	4
3	19255E51CP	AseismicDesignOfStructures	3	1	0	4

**Elective-V**

<b>S.No</b>	<b>Sub.Code</b>	<b>Name oftheSubject</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1	19255E52AP	PrefabricatedStructures	3	1	0	4
2	19255E52BP	DisasterResistantStructures	3	1	0	4
3	19255E52CP	NonlinearAnalysisofStructures	3	1	0	4

**Elective-VI**

<b>S.No</b>	<b>Sub.Code</b>	<b>Name ofthe Subject</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1	19255E53AP	OffshoreStructures	3	1	0	4
2	19255E53BP	StabilityOfStructures	3	1	0	4
3	19255E53CP	MechanicsOfCompositeMaterials	3	1	0	4



**DEPARTMENT OF CIVIL ENGINEERING**  
**Mapping of Courses to Cross Cutting Issues**  
**B.Tech – Civil Engineering FT (R-2019)**

Programme Name & Code	Course Code	Title of the Course	CrossCuttingIssues							
			Gender Sensitization and Human Values	Professional Ethics and Human Values	Environment and Sustainability and Human Values	Human Values	Professional Ethics	Environment and Sustainability	Professional Ethics, Human Values and Environment and Sustainability	Gender Sensitization
B.Tech-19UGCVLFT	19147S11	Communicative English					✓			
B.Tech-19UGCVLFT	19148S12	Engineering Mathematics – I					✓			
B.Tech-19UGCVLFT	19149S13	Engineering Physics								
B.Tech-19UGCVLFT	19149S14	Engineering Chemistry								
B.Tech-19UGCVLFT	19154S15	Engineering Graphics								
B.Tech-19UGCVLFT	19150S16	Problem Solving and Python Programming								
B.Tech-19UGCVLFT	19147S21	Technical English (All Branches )					✓			
B.Tech-19UGCVLFT	19148S22A	Engineering Mathematics II (All Branches )					✓			
B.Tech-19UGCVLFT	19149S23D	Physics for Civil Engineering								

B.Tech-19UGCVLFT	19149S24A	Environmental Science And Engineering						✓		
B.Tech-19UGCVLFT	19153S25E	Basic Electrical And Electronics Engineering								
B.Tech-19UGCVLFT	19154S26D	Engineering Mechanics								
B.Tech-19UGCVLFT	19148S31C	Transforms and Partial Differential Equations					✓			
B.Tech-19UGCVLFT	19155C32	Engineering Geology								
B.Tech-19UGCVLFT	19155C33	Construction Materials								
B.Tech-19UGCVLFT	19155C34	Strength of Materials -I								
B.Tech-19UGCVLFT	19155C35	Fluid Mechanics								
B.Tech-19UGCVLFT	19155C36	Surveying								
B.Tech-19UGCVLFT	19148S41C	Numerical Methods					✓			
B.Tech-19UGCVLFT	19155C42	Construction Techniques and Practices								
B.Tech-19UGCVLFT	19155C43	Strength of Materials II								
B.Tech-19UGCVLFT	19155C44	Applied Hydraulic Engineering								
B.Tech-19UGCVLFT	19155C45	Concrete Technology								
B.Tech-19UGCVLFT	19155C46	Soil Mechanics								
B.Tech-19UGCVLFT	19155C51	Design of Reinforced Cement Concrete Elements								
B.Tech-19UGCVLFT	19155C52	Structural Analysis I								
B.Tech-19UGCVLFT	19155C53	Water Supply Engineering						✓		
B.Tech-	19150FE54A	Database					✓			

19UGCVLFT		Management Systems (CSE)								
B.Tech-19UGCVLFT	19150FE54B	Cloud Computing (CSE)								
B.Tech-19UGCVLFT	19152FE54A	Basic Of Bio Medical Instrumentation (ECE)								
B.Tech-19UGCVLFT	19152FE54B	Sensor and Transducers (ECE)								
B.Tech-19UGCVLFT	19153FE54A	Industrial Nano Technology (EEE)								
B.Tech-19UGCVLFT	19153FE54A	Energy Conservation and Management (EEE)					✓			
B.Tech-19UGCVLFT	19154FE54A	Renewable Energy Sources (MECH)								
B.Tech-19UGCVLFT	19154FE54B	Automotive Systems (MECH)								
B.Tech-19UGCVLFT	19155E55A	Digital Cadastre								
B.Tech-19UGCVLFT	19155E55B	Advanced Surveying								
B.Tech-19UGCVLFT	19155E55C	Geographic Information System								
B.Tech-19UGCVLFT	19155E55D	Geo informatics Applications for Civil Engineers								
B.Tech-19UGCVLFT	19155C56	Foundation Engineering								
B.Tech-19UGCVLFT	19155C61	Design of Steel Structural Elements								
B.Tech-19UGCVLFT	19155C62	Structural Analysis II								
B.Tech-19UGCVLFT	19155C63	Irrigation Engineering								
B.Tech-19UGCVLFT	19155C64	Highway Engineering						✓		
B.Tech-	19155C65	Waste Water								

19UGCVLFT		Engineering								
B.Tech-19UGCVLFT	19155E66A	Ground Improvement Techniques								
B.Tech-19UGCVLFT	19155E66B	Introduction to soil dynamics and machine foundation								
B.Tech-19UGCVLFT	19155E66C	Rock Engineering								
B.Tech-19UGCVLFT	19155E66D	Urban planning and development								
B.Tech-19UGCVLFT	19155C71	Estimation , Costing & Valuation Engineering								
B.Tech-19UGCVLFT	19155C72	Railways, Airports, Docks And Harbour Engineering								
B.Tech-19UGCVLFT	19155C73	Structural Design and drawing								
B.Tech-19UGCVLFT	19150FE74A	Introduction to C Programming (CSE)								
B.Tech-19UGCVLFT	19150FE74B	Data Structures & Algorithms (CSE)								
B.Tech-19UGCVLFT	19152FE74A	Robotics (ECE)								
B.Tech-19UGCVLFT	19152FE74B	Electronic Devices (ECE)								
B.Tech-19UGCVLFT	19153FE74A	Basic Circuit Theory (EEE)								
B.Tech-19UGCVLFT	19153FE74B	Introduction to Renewable Energy Systems (EEE)								
B.Tech-19UGCVLFT	19154FE74A	Industrial Safety (MECH)								
B.Tech-19UGCVLFT	19154FE74B	Testing of Materials (MECH)					✓			
B.Tech-	19155E75A	Traffic								

19UGCVLFT		engineering and management								
B.Tech-19UGCVLFT	19155E75B	Design of Prestressed concrete structures								
B.Tech-19UGCVLFT	19155E75C	Construction planning and scheduling					✓			
B.Tech-19UGCVLFT	19155E75D	Municipal solid waste management								
B.Tech-19UGCVLFT	19155E81A	Coastal Engineering								
B.Tech-19UGCVLFT	19155E81B	Integrated water resources management						✓		
B.Tech-19UGCVLFT	19155E81C	Groundwater engineering						✓		
B.Tech-19UGCVLFT	19155E81D	Hydrology and water resources engineering						✓		
B.Tech-19UGCVLFT	19155E82A	Maintenance, repair and rehabilitation of structures								
B.Tech-19UGCVLFT	19155E82B	Structural dynamics and earthquake engineering								
B.Tech-19UGCVLFT	19155E82C	Prefabricated structures								
B.Tech-19UGCVLFT	19155E82D	Bridge engineering								



**DEPARTMENT OF CIVIL ENGINEERING**  
**Mapping of Courses to Cross Cutting Issues**  
**B.Tech – Civil Engineering PT (R-2019)**

Programme Name & Code	Course Code	Title of the Course	CrossCuttingIssues							
			Gender Sensitization And Human Values	Professional Ethics And Human Values	Environment and Sustainability and Human Values	Human Val ues	Professional Ethics	Environment and Sustainability	Professional Ethics, Human Values and Environment And Sustainability	Gender Sensitization
B.Tech-19UGCVLPT	19148S11P	Transforms & Partial Differential Equations					✓			
B.Tech-19UGCVLPT	19155C12P	Mechanics of Solids								
B.Tech-19UGCVLPT	19155C13P	Fluid Mechanics I								
B.Tech-19UGCVLPT	19155C14P	Surveying								
B.Tech-19UGCVLPT	19155C15P	Irrigation Engineering								
B.Tech-19UGCVLPT	19148S21P	Numerical Methods					✓			
B.Tech-19UGCVLPT	19155C22P	Strength of Materials								

B.Tech-19UGCVLPT	19155C23P	Fluid Mechanics II								
B.Tech-19UGCVLPT	19155C24P	Concrete Technology								
B.Tech-19UGCVLPT	19155C25P	Soil Mechanics								
B.Tech-19UGCVLPT	19148S31P	Probability & Statistics					✓			
B.Tech-19UGCVLPT	19155C32P	Design of Reinforced Concrete Structures-I								
B.Tech-19UGCVLPT	19155C33P	Structural Analysis I								
B.Tech-19UGCVLPT	19155C34P	Construction Materials And Practice								
B.Tech-19UGCVLPT	19155C41P	Design of Reinforced Concrete Structures-II								
B.Tech-19UGCVLPT	19155C42P	Structural Analysis II								
B.Tech-19UGCVLPT	19155C43P	Environmental Engineering						✓		
B.Tech-19UGCVLPT	19155E44AP	Hydrology						✓		
B.Tech-19UGCVLPT	19155E44BP	Water Resource Engineering						✓		
B.Tech-19UGCVLPT	19155E44CP	Building Technology								
B.Tech-19UGCVLPT	19155E44DP	Contract Laws And Regulations								
B.Tech-19UGCVLPT	19155C51P	Design of Steel Structures								
B.Tech-19UGCVLPT	19155C52P	Foundation Engineering								
B.Tech-19UGCVLPT	19155C53P	Industrial Waste Management					✓			
B.Tech-19UGCVLPT	19155E54AP	Computer Aided Analysis And Design								
B.Tech-19UGCVLPT	19155E54BP	Transportation Engineering								



B.Tech-19UGCVLPT	19155E54CP	Geology								
B.Tech-19UGCVLPT	19155E54DP	Highway Engineering								
B.Tech-19UGCVLPT	19155C61P	Estimation & Cost Evaluation								
B.Tech-19UGCVLPT	19155C62P	Ground Water Hydrology					✓			
B.Tech-19UGCVLPT	19155C63P	Construction Project Management					✓			
B.Tech-19UGCVLPT	19155E64AP	Remote Sensing And GIS								
B.Tech-19UGCVLPT	19155E64BP	Railway Engineering								
B.Tech-19UGCVLPT	19155E64CP	Airport & Harbours								
B.Tech-19UGCVLPT	19155E64DP	Electronic Surveying								
B.Tech-19UGCVLPT	19160S71P	Total Quality Management					✓			
B.Tech-19UGCVLPT	19155C72P	Housing, Planning & Management					✓			
B.Tech-19UGCVLPT	19155C73P	Repair And Rehabilitation of Structures								
B.Tech-19UGCVLPT	19155E74AP	Air Pollution Management					✓			
B.Tech-19UGCVLPT	19155E74BP	Pre Fabricated Structures								
B.Tech-19UGCVLPT	19155E74CP	Bridge Structures								
B.Tech-19UGCVLPT	19155E74DP	Pre stressed Concrete Structures								



**DEPARTMENT OF CIVIL ENGINEERING**  
**Mapping of Courses to Cross Cutting Issues**  
**M.Tech – Structural Engineering PT (R-2019)**

Programme Name & Code	Course Code	Title of the Course	CrossCuttingIssues							
			Gender Sensitization And Human Values	Professional Ethics And Human Values	Environment and Sustainability and Human Values	Human Values	Professional Ethics	Environment and Sustainability	Professional Ethics, Human Values and Environment And Sustainability	Gender Sensitization
M.Tech-19PGSTEPT	19248S11EP	AdvancedEngineeringMathematics					✓			
M.Tech-19PGSTEPT	19255C12P	QualityControl&AssuranceinConstruction								
M.Tech-19PGSTEPT	19255C13P	TheoryofPlasticityandElasticity								
M.Tech-19PGSTEPT	19255CRSP	ResearchLedSeminar								
M.Tech-19PGSTEPT	19255C21P	ManagementInformationSystem					✓			
M.Tech-19PGSTEPT	19255C22P	FiniteElementAnalysis								
M.Tech-19PGSTEPT	19255E23AP	Failure Analysis								

		ofStructures								
M.Tech-19PGSTEPT	19255E23BP	AdvancedConcreteTechnology								
M.Tech-19PGSTEPT	19255E23CP	Steel,ConcreteCompositeStructures								
M.Tech-19PGSTEPT	192TECW RP	TechnicalWriting/Seminars								
M.Tech-19PGSTEPT	19255CRMP	ResearchMethodology								
M.Tech-19PGSTEPT	19255CBRP	ParticipationinBoundedResearch								
M.Tech-19PGSTEPT	19255C31P	StructuralDynamics								
M.Tech-19PGSTEPT	19255C32P	MaintenanceandRehabilitationofStructures								
M.Tech-19PGSTEPT	19255E33AP	PrestressedConcreteDesign								
M.Tech-19PGSTEPT	19255E33BP	HighRiseStructures								
M.Tech-19PGSTEPT	19255E33CP	ComputerAidedStructuralDesign								
M.Tech-19PGSTEPT	19255C41P	AdvancedConcreteStructuraldesign								
M.Tech-19PGSTEPT	19255C42P	AdvancedSteelStructures								
M.Tech-19PGSTEPT	19255E43AP	OptimizationInStructuralDesign								
M.Tech-19PGSTEPT	19255E43BP	DesignOfIndustrialStructures								
M.Tech-19PGSTEPT	19255E43CP	ElementsOfEarthquakeEngineering								

M.Tech-19PGSTEPT	19255P44P	ProjectWorkPhaseI								
M.Tech-19PGSTEPT	19255CSR	Design/Socio-TechnicalProject								
M.Tech-19PGSTEPT	19255E51AP	ExperimentalStressAnalysis								
M.Tech-19PGSTEPT	19255E51BP	SoilStructureInteraction								
M.Tech-19PGSTEPT	19255E51CP	AseismicDesignOfStructures								
M.Tech-19PGSTEPT	19255E52AP	PrefabricatedStructures								
M.Tech-19PGSTEPT	19255E52BP	DisasterResistantStructures								
M.Tech-19PGSTEPT	19255E52CP	NonlinearAnalysisofStructures								
M.Tech-19PGSTEPT	19255E53AP	OffshoreStructures								
M.Tech-19PGSTEPT	19255E53BP	StabilityOfStructures								
M.Tech-19PGSTEPT	19255E53CP	MechanicsOfCompositeMaterials								
M.Tech-19PGSTEPT	19255P61P	ProjectWorkPhaseII								



**DEPARTMENT OF CIVIL ENGINEERING**  
**Mapping of Courses to Cross Cutting Issues**  
**M.Tech – Structural Engineering FT (R-2019)**

Programme Name & Code	Course Code	Title of the Course	CrossCuttingIssues							
			Gender Sensitization And Human Values	Professional Ethics And Human Values	Environment and Sustainability and Human Values	Human Values	Professional Ethics	Environment and Sustainability	Professional Ethics, Human Values and Environment And Sustainability	Gender Sensitization
M.Tech-19PGSTEFT	19248S11E	Advanced Engineering Mathematics					✓			
M.Tech-19PGSTEFT	19255H12	Quality Control & Assurance in Construction								
M.Tech-19PGSTEFT	19255H13	Theory of Plasticity and Elasticity								
M.Tech-19PGSTEFT	19255H14	Structural Dynamics								
M.Tech-19PGSTEFT	19255H15	Maintenance and Rehabilitation of Structures								
M.Tech-19PGSTEFT	19255E16A	Prestressed Concrete Design								
M.Tech-19PGSTEFT	19255E16B	High Rise Structures								

M.Tech-19PGSTEFT	19255E16C	Computer Aided Structural Design								
M.Tech-19PGSTEFT	19255CRS	Research Led Seminar								
M.Tech-19PGSTEFT	19255H21	Management Information System					✓			
M.Tech-19PGSTEFT	19255H22	Finite Element Analysis								
M.Tech-19PGSTEFT	19255H23	Advanced Concrete Structural Design								
M.Tech-19PGSTEFT	19255E24 A	Failure Analysis of Structures								
M.Tech-19PGSTEFT	19255E24 B	Advanced Concrete Technology								
M.Tech-19PGSTEFT	19255E24 C	Steel, Concrete Composite Structures								
M.Tech-19PGSTEFT	19255E25A	Optimization in Structural Design								
M.Tech-19PGSTEFT	19255E25B	Design of Industrial Structures								
M.Tech-19PGSTEFT	19255E25 C	Elements of Earthquake Engineering								
M.Tech-19PGSTEFT	19255CRM	Research Methodology								
M.Tech-19PGSTEFT	19255CBR	Participation in Bounded Research								
M.Tech-19PGSTEFT	192TECWR	Technical writing / Seminars								
M.Tech-19PGSTEFT	19255H31	Advanced Steel Structures								
M.Tech-19PGSTEFT	19255E32A	Experimental Stress Analysis								
M.Tech-19PGSTEFT	19255E32B	Soil Structure Interaction								



M.Tech-19PGSTEFT	19255E32C	Aseismic Design of Structures								
M.Tech-19PGSTEFT	19255E33A	Prefabricated Structures								
M.Tech-19PGSTEFT	19255E33B	Disaster Resistant Structures								
M.Tech-19PGSTEFT	19255E33C	Nonlinear Analysis of Structures								
M.Tech-19PGSTEFT	19255E34A	Offshore Structures								
M.Tech-19PGSTEFT	19255E34B	Stability of Structures								
M.Tech-19PGSTEFT	19255E34C	Mechanics of Composite Materials								
M.Tech-19PGSTEFT	19255CSR	Design Project / Socio Technical Project								
M.Tech-19PGSTEFT	19255P41	Project Work Phase-II								





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

**SCHOOL OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF  
MECHANICAL ENGINEERING**

**PROGRAM HANDBOOK**

**B.Tech – FULL TIME**

**[Regulation 2020]**

## COURSE STRUCTURE

### B.E. MECHANICAL ENGINEERING

#### REGULATIONS – 2020

#### CHOICE BASED CREDIT SYSTEM

#### PROGRAMME EDUCATIONAL OBJECTIVES:

Bachelor of Mechanical Engineering curriculum is designed to impart Knowledge, Skill and Attitude on the graduates to

1. Have a successful career in Mechanical Engineering and allied industries.
2. Have expertise in the areas of Design, Thermal, Materials and Manufacturing.
3. Contribute towards technological development through academic research and industrial practices.
4. Practice their profession with good communication, leadership, ethics and social responsibility.
5. Graduates will adapt to evolving technologies through life-long learning.

#### 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 industrial problems.
- B. **Problem analysis:** Identify, formulates, and solve complex engineering problems. with high degree of competence.
- C. **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.
- D. **Design/development of solutions:** Design solutions for mechanical engineering problems and design components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- E. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering use modern tools, software and equipment to analyze multidisciplinary.
- 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	PROGRAMME 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	3	2	3	1	2	2	2	2
4	3	3	2	3	3	2	3	2	1	2	2	2	2
5	3	3	3	3	3	3	3	2	2	2	2	2	2

1-Reasonable: 2- Significant: 3- Strong

*Gender Sensitization and Human Values
*Human Values
*Professional Ethics
*Environment and Sustainability
*Professional Ethics& Human Values

## I - VIII SEMESTER CURRICULUM AND SYLLABI

B.TECH (FT) MECHANICAL [Regulation 2020]

### SEMESTER I

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
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 and Python Programming	3	0	0	3
<b>PRACTICAL</b>						
7.	20150L17	Problem Solving and Python Programming Laboratory	0	0	4	2
8.	20149L18	Physics and Chemistry Laboratory	0	0	4	2
9.	201AGIT	Induction Training Programme				2
<b>TOTAL</b>			<b>19</b>	<b>0</b>	<b>12</b>	<b>27</b>

## SEMESTER II

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	20147S21	Technical English ( All Branches )	4	0	0	4
2.	20148S22	Engineering Mathematics II (All Branches )	4	0	0	4
3	20149S23C	Material Science ( MECH )	3	0	0	3
4.	20149S24A	Environmental Science And Engineering (CSE, EEE, MECH, CIVIL)	3	0	0	3
5.	20153S25D	Basic Electrical, Electronics And Instrumentation Engineering (MECH)	3	0	0	3
6.	20154S26D	Engineering Mechanics ( MECH,CIVIL )	3	2	0	4
<b>PRACTICAL</b>						
7.	20154L27	Engineering Practices Lab (All Branches)	0	0	4	2
8.	20153L28D	Basic Electrical, Electronics and Instrumentation Engineering Lab (Mech)	0	0	4	2
9.	201AGIC	Indian Constitution				2
10	201ASBE	Basic Behavioral Etiquette				2
<b>TOTAL</b>			<b>20</b>	<b>2</b>	<b>8</b>	<b>29</b>

### SEMESTER III

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	20148C31C	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	4	0	0	4
5.	20154C35	Electrical Drives and Controls	3	2	0	4
<b>PRACTICAL</b>						
6.	20154L36	Production Technology Laboratory - I	0	0	4	2
7.	20154L37	Computer Aided Machine Drawing	0	0	4	2
8.	20154L38	Electrical Engineering Laboratory	0	0	4	2
9.	20154L39	Interpersonal Skills / Listening & Speaking	0	0	2	1
10	201AGGS	Introduction to Gender studies				2
<b>TOTAL</b>			<b>17</b>	<b>4</b>	<b>14</b>	<b>29</b>



**SEMESTER IV**

<b>S.NO.</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>THEORY</b>						
1.	20148C41D	Statistics and Numerical Methods	3	2	0	4
2.	20154C42	Theory of Machines-I	3	2	0	4
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	2	0	4
6.	20154C46	Thermal Engineering- I	3	2	0	4
<b>PRACTICAL</b>						
7.	20154L47	Production Technology Laboratory - II	0	0	4	2
8.	20154L48	Strength of Materials and Fluid Mechanics and Machinery Laboratory	0	0	4	2
9.	20154L49	Advanced Reading and Writing	0	0	2	1
10	201AGCE	Community Engagement				2
11	201ASTT	Technical, General Aptitude and Skill set Development				2
<b>TOTAL</b>			<b>19</b>	<b>0</b>	<b>10</b>	<b>31</b>

### SEMESTER V

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	20154C51	Thermal Engineering- II	3	2	0	4
2.	20154C52	Design of Machine Elements	3	2	0	4
3.	20154C53	Metrology and Measurements	4	0	0	4
4.	2015-OE54- <u>  </u>	Open Elective I	3	0	0	3
5.	20154C55	Theory of Machines-II	3	2	0	4
<b>PRACTICAL</b>						
6.	20154L56	Theory of Machines Laboratory	0	0	4	2
7.	20154L57	Thermal Engineering Laboratory	0	0	4	2
8.	20154L58	Metrology and Measurements Laboratory	0	0	4	2
09	201AGIE	Innovation and Entrepreneurship				2
<b>TOTAL</b>			<b>16</b>	<b>6</b>	<b>12</b>	<b>27</b>

### SEMESTER VI

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1	20154C61	Design of Transmission Systems	3	2	0	4
2	20154C62	Computer Aided Design And Manufacturing	3	2	0	4
3	20154C63	Heat and Mass Transfer	3	2	0	4
4	20154C64	Finite Element Analysis	3	2	0	4
5	20154C65	Hydraulics And Pneumatics	3	0	0	3
6	20154E66- <u>  </u>	Elective - I	3	0	0	3
<b>PRACTICAL</b>						
6	20154L67	CAD / CAM Laboratory	0	0	4	2
7	20154L68	Design and Fabrication Project	0	0	4	2
8	20154L69	Professional Communication	0	0	2	1
9	201ASTT	Technical Training				2
<b>TOTAL</b>			<b>18</b>	<b>8</b>	<b>10</b>	<b>29</b>

### SEMESTER VII

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	20154C71	Power Plant Engineering	4	0	0	4
2.	20154C72	Process Planning and Cost Estimation	3	2	0	4
3.	20154C73	Mechatronics	4	0	0	4
4.	2015-OE74__	Open ElectiveII	3	0	0	3
5.	20154E75-	Elective II	3	0	0	3
6.	20154E76-_	Elective III	3	0	0	3
<b>PRACTICAL</b>						
7.	20154L77	Simulation and Analysis Laboratory	0	0	4	2
8.	20154L78	Mechatronics Laboratory	0	0	4	2
9.	20154L79	Technical Seminar	0	0	2	1
<b>TOTAL</b>			<b>20</b>	<b>2</b>	<b>6</b>	<b>26</b>

### SEMESTER VIII

S.No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	20154C81	Principles of Management	3	0	0	3
2.	20154E82-_	Elective– IV	3	0	0	3
<b>PRACTICAL</b>						
3.	20154PW83	Project Work	0	0	20	15
4.	201AGPE	Professional Ethics and Human Values				2
5.	201ASIM	Interview Skills Training and Mock Test				2
.6	20154PEE	Programme Exit Examination				2
<b>TOTAL</b>			<b>6</b>	<b>0</b>	<b>20</b>	<b>27</b>

**ELECTIVE – I ( VI SEMESTER)**

<b>S.NO.</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1.	20154E66A	Automobile Engineering	3	0	0	3
2.	20154E66B	Safety in Engineering industries	3	0	0	3
3.	20154E66C	Gas Dynamics and Jet Propulsion	3	0	0	3
4.	20154E66D	Fundamentals of Nano Science	3	0	0	3

**ELECTIVE – II ( VII SEMESTER)**

	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>1.</b>	20154E75A	Renewable Sources of Energy	3	0	0	3
<b>2.</b>	20154E75B	Nonconventional Machining Processes	3	0	0	3
<b>3.</b>	20154E75C	Operations Research	3	0	0	3
<b>4.</b>	<b>20154E75D</b>	<b>Total Quality Management</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**ELECTIVE – III ( VII SEMESTER)**

<b>SI. No</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1.	20154E76A	Robotics	3	0	0	3
2.	20154E76B	Design of Jigs, Fixtures and Press Tools	3	0	0	3
3.	20154E76C	General Aspects of Energy Management and Energy audit	3	0	0	3
4.	20154E76D	Composite Materials	3	0	0	3

**ELECTIVE – IV ( VIII SEMESTER)**

<b>Sl. No</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1.	20154E82A	Production Planning and Control	3	0	0	3
2.	20154E82B	Computer Integrated Manufacturing Systems	3	0	0	3
3.	20154E82C	Energy Efficiency in Thermal Utilities	3	0	0	3
4.	20154E82D	Vibration and Noise Control	3	0	0	3

**OPEN ELECTIVE– I**

<b>Sl. No</b>	<b>DEPT</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1.	CSE	20150FE54A	Data Base management systems	3	0	0	3
2.		20150FE54B	Cloud computing	3	0	0	3
3.	ECE	20152FE54A	Basics Of Bio Medical Instrumentation	3	0	0	3
4.		20152FE54B	Sensors And Transducers	3	0	0	3
5.	EEE	20153FE54A	Industrial Nano Technology	3	0	0	3
6.		20153FE54B	Energy Conservation and Management	3	0	0	3
7.	MECH	20154FE54A	Renewable energy sources	3	0	0	3
8.		20154OE54B	Automotive Systems	3	0	0	3
9.	CIVIL	20155FE54A	Air Pollution And Control Engineering	3	0	0	3
10.		20155FE54B	Geographic Information Systems	3	0	0	3

**OPEN ELECTIVE- II**

<b>Sl. No</b>	<b>DEPT</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1	CSE	20150FE74A	Introduction to C programming	3	0	0	3
2.		20150FE74B	Data structures and algorithms	3	0	0	3
3.	ECE	20152FE74A	Robotics	3	0	0	3
4.		20152FE74B	Electronic devices	3	0	0	3
5.	EEE	20153FE74A	Basic circuit theory	3	0	0	3
6.		20153FE74B	Introduction to renewable energy systems	3	0	0	3
7.	MECH	20154FE74A	Industrial safety	3	0	0	3
8.		20154FE74B	Testing of materials	3	0	0	3
9.	CIVIL	20155FE74A	Green building design	3	0	0	3
10.		20155FE74B	Waste water treatment	3	0	0	3

### CGPA CREDITS

Semester	Core	Elective	Free elective	Practical	Seminar/Exit exam	Audi	Project	Total
I	21	-	-	04	-	2	-	27
II	21	-	-	04	-	4	-	29
III	20	-	-	07	-	2	-	29
IV	22	-	-	05	-	4	-	31
V	16	-	03	06	-	2	-	27
VI	19	03	-	05	-	2	-	29
VII	12	06	03	04	1	-	-	26
VIII	03	03	-	-	2	4	15	27
<b>TOTAL</b>								<b>225</b>

### NON-CGPA CREDITS

Semester	Add on course	Total
I	01	<b>01</b>
II	01	<b>01</b>
III	-	-
IV	-	-
V	-	-
VI	-	-
VII	-	-
VIII	-	-
Co curricular Activities	In-plant Training , Industrial Visit , Seminars & Conferences	<b>03</b>
<b>TOTAL NON-CGPA CREDITS</b>		<b>05</b>

<b>TOTAL CREDITS</b>	
CGPA CREDITS	<b>225</b>
NON-CGPA CREDITS	<b>05</b>
<b>TOTAL</b>	<b>230</b>

20147S11

COMMUNICATIVE ENGLISH

L	T	P	C
4	0	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

**TOTAL: 60 PERIODS**



**OUTCOMES:**

At the end of the course, learners will be able to:

- Read articles of a general kind in magazines and newspapers.
- Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.
- Comprehend conversations and short talks delivered in English
- Write short essays of a general kind and personal letters and emails in English.

**TEXT BOOKS:**

1. Board of Editors. Using English A Course book for Undergraduate Engineers and Technologists. Orient BlackSwan Limited, Hyderabad: 2015
2. Richards, C. Jack. Interchange Students' Book-2 New Delhi: CUP, 2015.

**REFERENCES**

- 1 Bailey, Stephen. Academic Writing: A practical guide for students. New York: 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, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011
- 5 Dutt P. Kiranmai and Rajeevan Geeta. Basic Communication Skills, Foundation Books: 2013



**TEXT BOOKS :**

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43<sup>rd</sup> Edition, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7<sup>th</sup> 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, 10<sup>th</sup> Edition, 2016.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3<sup>rd</sup> 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", 12<sup>th</sup> Edition, Pearson India, 2016.

20149S13

**ENGINEERING PHYSICS**

**L T P C**  
**3 0 0 3**

**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 conduction 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.

**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<sub>2</sub>-O<sub>2</sub> fuel cell.

**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.

**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: 30+60 = 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. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50<sup>th</sup> 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. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2<sup>nd</sup> 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

**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.

**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.

**TEXT BOOKS:**

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2<sup>nd</sup> 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. John V Guttag, "Introduction to Computation and Programming Using Python", Revised and 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. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd.,, 2015.
4. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 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 to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013.

**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

**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 : 45 PERIODS**

20149L18

**PHYSICS AND CHEMISTRY LABORATORY**  
(Common to all branches of B.E. / B.Tech Programme)

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**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)**

- Determination of rigidity modulus – Torsion pendulum
- Determination of Young's modulus by non-uniform bending method
- (a) Determination of wavelength, and particle size using Laser  
(b) Determination of acceptance angle in an optical fiber.
- Determination of thermal conductivity of a bad conductor – Lee's Disc method.
- Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
- Determination of wavelength of mercury spectrum – spectrometer grating
- Determination of band gap of a semiconductor
- Determination of thickness of a thin wire – Air wedge method

**TOTAL: 23 PERIODS**

**OUTCOMES:**

Upon completion of the course, the students will be able to

- 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 viscometry.
- Estimation of HCl using  $\text{Na}_2\text{CO}_3$  as primary standard and Determination of alkalinity in water sample.
  - Determination of total, temporary & permanent hardness of water by EDTA method.
  - Determination of DO content of water sample by Winkler's method.
  - Determination of chloride content of water sample by argentometric method.
  - Estimation of copper content of the given solution by Iodometry.
  - Determination of strength of given hydrochloric acid using pH meter.
  - Determination of strength of acids in a mixture of acids using conductivity meter.
  - Estimation of iron content of the given solution using potentiometer.
  - Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
  - Estimation of sodium and potassium present in water using flame photometer.
  - Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
  - Pseudo first order kinetics-ester hydrolysis.
  - 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: 22 PERIODS**

**TEXTBOOKS:**

1. Vogel's Textbook of Quantitative Chemical Analysis (8<sup>TH</sup> edition, 2014)

20147S21

**TECHNICAL ENGLISH**

**L T P C**  
**4 0 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- newspapers- Writing- purpose statements – extended definitions – issue- writing instructions – checklists-recommendations-Vocabulary Development- technical vocabulary Language Development –subject verb agreement - compound words.

**READING AND STUDY SKILLS 12**

**UNIT II**

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 charts, graphs- Vocabulary Development-vocabulary used 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/ talks 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 Black swan, Hyderabad: 2016
2. Sudharshana.N.P and Saveetha. C. English for Technical Communication. Cambridge University Press: New Delhi, 2016.

## **REFERENCES**

1. Raman, Meenakshi and Sharma, Sangeetha- Technical Communication Principles and Practice.Oxford University Press: New Delhi,2014.
2. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad,2015
3. Booth-L. Diana, Project Work, Oxford University Press, Oxford: 2014.
4. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007
5. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges. Cengage Learning, USA: 2007



**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**

Eigen values and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigen values 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 by functions  $w = z + c, cz, 1/z, z^2$ - 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.

**TOTAL: 60 PERIODS****OUTCOMES :**

After successfully completing the course, the student will have a good understanding of the following topics and their applications:

- Eigen values 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, 43<sup>rd</sup> Edition, 2014.
2. Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10<sup>th</sup> 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, 7<sup>th</sup> Edition, 2009.
2. Jain R.K. and Iyengar S.R.K., " Advanced Engineering Mathematics ", Narosa Publications, New Delhi , 3<sup>rd</sup> 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, 4<sup>th</sup> Edition, New Delhi, 2014.
5. Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6<sup>th</sup> Edition, New Delhi, 2012.

	<b>MATERIALS SCIENCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>20149S23C</b>	(Common to courses offered in Faculty of Mechanical Engineering Except B.E. Materials Science and Engineering )	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To introduce the essential principles of materials science for mechanical and related engineering applications.

**UNIT I PHASE DIAGRAMS 9**

Solid solutions - Hume Rothery's rules – the phase rule - single component system - one-component system of iron - binary phase diagrams - isomorphous systems - the tie-line rule - the lever rule - application to isomorphous system - eutectic phase diagram - peritectic phase diagram - other invariant reactions – free energy composition curves for binary systems - microstructural change during cooling.

**UNIT II FERROUS ALLOYS 9**

The iron-carbon equilibrium diagram - phases, invariant reactions - microstructure of slowly cooled steels - eutectoid steel, hypo and hypereutectoid steels - effect of alloying elements on the Fe-C system - diffusion in solids - Fick's laws - phase transformations - T-T-T-diagram for eutectoid steel – pearlitic, bainitic and martensitic transformations - tempering of martensite – steels – stainless steels – cast irons.

**UNIT III MECHANICAL PROPERTIES 9**

Tensile test - plastic deformation mechanisms - slip and twinning - role of dislocations in slip - strengthening methods - strain hardening - refinement of the grain size - solid solution strengthening - precipitation hardening - creep resistance - creep curves - mechanisms of creep - creep-resistant materials - fracture - the Griffith criterion - critical stress intensity factor and its determination - fatigue failure - fatigue tests - methods of increasing fatigue life - hardness - Rockwell and Brinell hardness - Knoop and Vickers microhardness.

**UNIT IV MAGNETIC, DIELECTRIC AND SUPERCONDUCTING MATERIALS 9**

Ferromagnetism – domain theory – types of energy – hysteresis – hard and soft magnetic materials – ferrites - dielectric materials – types of polarization – Langevin-Debye equation – frequency effects on polarization - dielectric breakdown – insulating materials – Ferroelectric materials - superconducting materials and their properties.

**UNIT V NEW MATERIALS 9**

Ceramics – types and applications – composites: classification, role of matrix and reinforcement, processing of fiber reinforced plastics – metallic glasses: types , glass forming ability of alloys, melt spinning process, applications - shape memory alloys: phases, shape memory effect, pseudoelastic effect, NiTi alloy, applications – nanomaterials: preparation (bottom up and top down approaches), properties and applications – carbon nanotubes: types.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

Upon completion of this course,

- the students will have knowledge on the various phase diagrams and their applications
- the students will acquire knowledge on Fe-Fe<sub>3</sub>C phase diagram, various microstructures and alloys
- the students will get knowledge on mechanical properties of materials and their measurement
- the students will gain knowledge on magnetic, dielectric and superconducting properties of materials
- the students will understand the basics of ceramics, composites and nanomaterials.

**TEXT BOOKS:**

1. Balasubramaniam, R. "Callister's Materials Science and Engineering". Wiley India Pvt. Ltd., 2014.
2. Raghavan, V. "Physical Metallurgy: Principles and Practice". PHI Learning, 2015.
3. Raghavan, V. "Materials Science and Engineering : A First course". PHI Learning, 2015.

**REFERENCES**

1. Askeland, D. "Materials Science and Engineering". Brooks/Cole, 2010.
2. Smith, W.F., Hashemi, J. & Prakash, R. "Materials Science and Engineering". Tata McGraw Hill Education Pvt. Ltd., 2014.
3. Wahab, M.A. "Solid State Physics: Structure and Properties of Materials". Narosa Publishing House, 2009.

**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****17**

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****11**

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****13**

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**

**10**

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**

**9**

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: 60 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', 2<sup>nd</sup> 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. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.
4. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.

**OBJECTIVES:**

To impart knowledge on

- Electric circuit laws, single and three phase circuits and wiring
- Working principles of Electrical Machines
- Working principle of Various electronic devices and measuring instruments

**UNIT I ELECTRICAL CIRCUITS 9**

Basic circuit components -, Ohms Law - Kirchoff's Law – Instantaneous Power – Inductors - Capacitors – Independent and Dependent Sources - steady state solution of DC circuits - Nodal analysis, Mesh analysis- Thevinin's Theorem, Norton's Theorem, Maximum Power transfer theorem- Linearity and Superposition Theorem.

**UNIT II AC CIRCUITS 9**

Introduction to AC circuits – waveforms and RMS value – power and power factor, single phase and three-phase balanced circuits – Three phase loads - housing wiring, industrial wiring, materials of wiring

**UNIT III ELECTRICAL MACHINES 9**

Principles of operation and characteristics of ; DC machines, Transformers (single and three phase ) ,Synchronous machines , three phase and single phase induction motors.

**UNIT IV ELECTRONIC DEVICES & CIRCUITS 9**

Types of Materials – Silicon & Germanium- N type and P type materials – PN Junction –Forward and Reverse Bias –Semiconductor Diodes –Bipolar Junction Transistor – Characteristics – Field Effect Transistors – Transistor Biasing –Introduction to operational Amplifier –Inverting Amplifier –Non Inverting Amplifier –DAC – ADC .

**UNIT V MEASUREMENTS & INSTRUMENTATION 9**

Introduction to transducers - Classification of Transducers: Resistive, Inductive, Capacitive, Thermoelectric, piezoelectric, photoelectric, Hall effect and Mechanical - ,Classification of instruments  
- Types of indicating Instruments - multimeters –Oscilloscopes- – three-phase power measurements – instrument transformers (CT and PT )

**TOTAL : 45 PERIODS**

**OUTCOMES:**

Ability to

- Understand electric circuits and working principles of electrical machines
- Understand the concepts of various electronic devices
- Choose appropriate instruments for electrical measurement for a specific application

**TEXT BOOKS**

1. Leonard S Bobrow, “Foundations of Electrical Engineering”, Oxford University Press, 2013
2. D P Kothari and I.J Nagarath, ”Electrical Machines “Basic Electrical and Electronics Engineering”, McGraw Hill Education(India) Private Limited, Third Reprint ,2016
3. Thereja .B.L., “Fundamentals of Electrical Engineering and Electronics”, S. Chand & Co. Ltd., 2008

## **REFERENCES**

2. Del Toro, "Electrical Engineering Fundamentals", Pearson Education, New Delhi, 2007
3. John Bird, "Electrical Circuit Theory and Technology", Elsevier, First Indian Edition, 2006
4. Allan S Moris, "Measurement and Instrumentation Principles", Elsevier, First Indian Edition, 2006
5. Rajendra Prasad, "Fundamentals of Electrical Engineering", Prentice Hall of India, 2006
6. A.E.Fitzgerald, David E Higginbotham and Arvin Gabel, "Basic Electrical Engineering", McGraw Hill Education(India) Private Limited, 2009
7. N K De, Dipu Sarkar, "Basic Electrical Engineering", Universities Press (India)Private Limited 2016



**OBJECTIVES:**

- To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.

**UNIT I      STATICS OF PARTICLES****9+6**

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces – Vectorial representation of forces – Vector operations of forces -additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility .

**UNIT II      EQUILIBRIUM OF RIGID BODIES****9+6**

Free body diagram – Types of supports – Action and reaction forces – stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

**UNIT III      PROPERTIES OF SURFACES AND SOLIDS****9+6**

Centroids and centre of mass – Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula – Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia – mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.

**UNIT IV      DYNAMICS OF PARTICLES****9+6**

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion - Newton's laws of motion – Work Energy Equation– Impulse and Momentum – Impact of elastic bodies.

**UNIT V      FRICTION AND RIGID BODY DYNAMICS****9+6**

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

**TOTAL : 45+30=75 PERIODS****OUTCOMES:**

On successful completion of this course, the student will be able to

- illustrate the vectorial and scalar representation of forces and moments
- analyse the rigid body in equilibrium
- evaluate the properties of surfaces and solids
- calculate dynamic forces exerted in rigid body
- determine the friction and the effects by the laws of friction

**TEXT BOOKS:**

1. Beer, F.P and Johnston Jr. E.R., “Vector Mechanics for Engineers (In SI Units): Statics and Dynamics”, 8<sup>th</sup> Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).
2. Vela Murali, “Engineering Mechanics”, Oxford University Press (2010)

**REFERENCES:**

1. Bhavikatti, S.S and Rajashekarappa, K.G., “Engineering Mechanics”, New Age International (P) Limited Publishers, 1998.
2. Hibbeler, R.C and Ashok Gupta, “Engineering Mechanics: Statics and Dynamics”, 11<sup>th</sup> Edition, Pearson Education 2010.
3. Irving H. Shames and Krishna Mohana Rao. G., “Engineering Mechanics – Statics and Dynamics”, 4<sup>th</sup> Edition, Pearson Education 2006.
4. Meriam J.L. and Kraige L.G., “ Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2”, Third Edition, John Wiley & Sons,1993.
5. Rajasekaran S and Sankarasubramanian G., “Engineering Mechanics Statics and Dynamics”, 3<sup>rd</sup> Edition, Vikas Publishing House Pvt. Ltd., 2005.

**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**

17

**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**

16

**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** **14**
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** **13**
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.

**TOTAL: 60 PERIODS**

### **OUTCOMES:**

On successful completion of this course, the student will be able to

- 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.

### **LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

#### **1. CIVIL**

- |   |          |
|---|----------|
| 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   |

### **2. 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 |         |

**OBJECTIVE:**

- To train the students in performing various tests on electrical drives, sensors and circuits.

**LIST OF EXPERIMENTS:**

1. Load test on separately excited DC generator
2. Load test on Single phase Transformer
3. Load test on Induction motor
4. Verification of Circuit Laws
5. Verification of Circuit Theorems
6. Measurement of three phase power
7. Load test on DC shunt motor.
8. Diode based application circuits
9. Transistor based application circuits
10. Study of CRO and measurement of AC signals
11. Characteristics of LVDT
12. Calibration of Rotometer
13. RTD and Thermistor

**Minimum of 10 Experiments to be carried out :-**

**TOTAL: 60 PERIODS**

**OUTCOMES:**

- Ability to determine the speed characteristic of different electrical machines
- Ability to design simple circuits involving diodes and transistors
- Ability to use operational amplifiers

**1. LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S.No.	NAME OF THE EQUIPMENT	Qty.
1	D. C. Motor Generator Set	2
2	D.C. Shunt Motor	2
3	Single Phase Transformer	2
4	Single Phase Induction Motor	2
5	Ammeter A.C and D.C	20
6	Voltmeters A.C and D.C	20
7.	Watt meters LPF and UPF	4
8.	Resistors & Breadboards	-
9.	Cathode Ray Oscilloscopes	4
10.	Dual Regulated power supplies	6
11.	A.C. Signal Generators	4
12.	Transistors (BJT, JFET)	-

**Aim:**

- To understand the salient features of the Indian Constitution

**Objectives:**

- To make the students understand about the Democratic Rule and Parliamentary 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.

**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.

**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, Unionparliament 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 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.

**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.

**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", 43<sup>rd</sup> 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.Vi<sup>49</sup>swanathan Publishers Pvt. Ltd, Chennai, 1998.



**REFERENCES :**

1. B.V Ramana., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
2. Erwin Kreyszig, "Advanced Engineering Mathematics ", 10<sup>th</sup> Edition, John Wiley, India, 2016.
3. G. James, "Advanced Modern Engineering Mathematics", 3<sup>rd</sup> Edition, Pearson Education, 2007.
4. L.C Andrews, L.C and Shivamoggi, B, "Integral Transforms for Engineers" SPIE Press, 1999.
5. N.P. Bali. and Manish Goyal, "A Textbook of Engineering Mathematics", 9<sup>th</sup> Edition, Laxmi Publications Pvt. Ltd, 2014.
6. R.C. Wylie, and Barrett, L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

**OBJECTIVE:**

- To familiarize the students to understand the fundamentals of thermodynamics and to perform thermal analysis on their behavior and performance.

(Use of Standard and approved Steam Table, Mollier Chart, Compressibility Chart and Psychrometric Chart permitted)

**UNIT I BASIC CONCEPTS AND FIRST LAW****9+6**

Basic concepts - concept of continuum, comparison of microscopic and macroscopic approach. Path and point functions. Intensive and extensive, total and specific quantities. System and their types. Thermodynamic Equilibrium State, path and process. Quasi-static, reversible and irreversible processes. Heat and work transfer, definition and comparison, sign convention. Displacement work and other modes of work .P-V diagram. Zeroth law of thermodynamics – concept of temperature and thermal equilibrium– relationship between temperature scales –new temperature scales. First law of thermodynamics –application to closed and open systems – steady and unsteady flow processes.

**UNIT II SECOND LAW AND AVAILABILITY ANALYSIS****9+6**

Heat Reservoir, source and sink. Heat Engine, Refrigerator, Heat pump. Statements of second law and its corollaries. Carnot cycle Reversed Carnot cycle, Performance. Clausius inequality. Concept of entropy, T-s diagram, Tds Equations, entropy change for - pure substance, ideal gases - different processes, principle of increase in entropy. Applications of II Law. High and low grade energy. Available and non-available energy of a source and finite body. Energy and irreversibility. Expressions for the energy of a closed system and open systems. Energy balance and entropy generation. Irreversibility. I and II law Efficiency.

**UNIT III PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE****9+6**

Formation of steam and its thermodynamic properties, p-v, p-T, T-v, T-s, h-s diagrams. p-v-T surface. Use of Steam Table and Mollier Chart. Determination of dryness fraction. Application of I and II law for pure substances. Ideal and actual Rankine cycles, Cycle Improvement Methods - Reheat and Regenerative cycles, Economiser, preheater, Binary and Combined cycles.

**UNIT IV IDEAL AND REAL GASES, THERMODYNAMIC RELATIONS****9+6**

Properties of Ideal gas- Ideal and real gas comparison- Equations of state for ideal and real gases- Reduced properties. Compressibility factor-.Principle of Corresponding states. -Generalised Compressibility Chart and its use-. Maxwell relations, Tds Equations, Difference and ratio of heat capacities, Energy equation, Joule-Thomson Coefficient, Clausius Clapeyron equation, Phase Change Processes. Simple Calculations.

**UNIT V GAS MIXTURES AND PSYCHROMETRY****9+6**

Mole and Mass fraction, Dalton's and Amagat's Law. Properties of gas mixture – Molar mass, gas constant, density, change in internal energy, enthalpy, entropy and Gibbs function. Psychrometric properties, Psychrometric charts. Property calculations of air vapour mixtures by using chart and expressions. Psychrometric process – adiabatic saturation, sensible heating and cooling, humidification, dehumidification, evaporative cooling and adiabatic mixing. Simple Applications

**TOTAL : 75 PERIODS**

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Apply the first law of thermodynamics for simple open and closed systems under steady and unsteady conditions.
- CO2 Apply second law of thermodynamics to open and closed systems and calculate entropy and availability.
- CO3 Apply Rankine cycle to steam power plant and compare few cycle improvement methods
- CO4 Derive simple thermodynamic relations of ideal and real gases
- CO5 Calculate the properties of gas mixtures and moist air and its use in psychometric processes

**TEXT BOOKS :**

1. R.K.Rajput, "A Text Book Of Engineering Thermodynamics ",Fifth Edition,2017.
2. Yunus a. Cengel & michael a. Boles, "Thermodynamics", 8th edition 2015.

**REFERENCES:**

1. Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.
2. Borgnakke & Sonntag, "Fundamental of Thermodynamics", 8th Edition , 2016.
3. Chattopadhyay, P, "Engineering Thermodynamics", Oxford University Press, 2016.
4. Michael J. Moran, Howard N. Shapiro, "Fundamentals of Engineering Thermodynamics", 8th Edition.
5. Nag.P.K., "Engineering Thermodynamics", 5<sup>th</sup> Edition, Tata McGraw-Hill, New Delhi, 2013.

**OBJECTIVES**

- The properties of fluids and concept of control volume are studied
- The applications of the conservation laws to flow through pipes are studied.
- To understand the importance of dimensional analysis
- To understand the importance of various types of flow in pumps.
- To understand the importance of various types of flow in turbines.

**UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS 12**

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation.

**UNIT II FLOW THROUGH CIRCULAR CONDUITS 12**

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli- Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor- Moody diagram- commercial pipes- minor losses – Flow through pipes in series and parallel.

**UNIT III DIMENSIONAL ANALYSIS 12**

Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.

**UNIT IV PUMPS 12**

Impact of jets - Euler's equation - Theory of roto-dynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle  
- work done by the impeller - performance curves - Reciprocating pump- working principle – Rotary pumps –classification.

**UNIT V TURBINES 12**

Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner – draft tube. Specific speed - unit quantities – performance curves for turbines – governing of turbines.

**TOTAL: 60 PERIODS****OUTCOMES:**

Upon completion of this course, the students will be able to

- Apply mathematical knowledge to predict the properties and characteristics of a fluid.
- Can analyse and calculate major and minor losses associated with pipe flow in piping networks.
- Can mathematically predict the nature of physical quantities
- Can critically analyse the performance of pumps
- Can critically analyse the performance of turbines.

**TEXT BOOK:**

1. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi

**REFERENCES:**

1. Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011
2. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House(p) Ltd., New Delhi 2016
3. Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, "Fluid Mechanics and Machinery", 2011.
4. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2010

**OBJECTIVE:**

- To introduce the concepts of basic manufacturing processes and fabrication techniques, such as metal casting, metal joining, metal forming and manufacture of plastic components.

**UNIT I METAL CASTING PROCESSES 12**

Sand Casting : Sand Mould – Type of patterns - Pattern Materials – Pattern allowances –Moulding sand Properties and testing – Cores –Types and applications – Moulding machines– Types and applications; Melting furnaces : Blast and Cupola Furnaces; Principle of special casting processes : Shell - investment – Ceramic mould – Pressure die casting - Centrifugal Casting - CO<sub>2</sub> process – Stir casting; Defects in Sand casting

**UNIT II JOINING PROCESSES 12**

Operating principle, basic equipment, merits and applications of: Fusion welding processes: Gas welding - Types – Flame characteristics; Manual metal arc welding – Gas Tungsten arc welding - Gas metal arc welding – Submerged arc welding – Electro slag welding; Operating principle and applications of: Resistance welding - Plasma arc welding – Thermit welding – Electron beam welding – Friction welding and Friction Stir Welding; Brazing and soldering; Weld defects: types, causes and cure.

**UNIT III METAL FORMING PROCESSES 12**

Hot working and cold working of metals – Forging processes – Open, impression and closed die forging – 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.

**UNIT IV SHEET METAL PROCESSES 12**

Sheet metal characteristics – 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 pulse forming, peen forming, Super plastic forming – Micro forming

**UNIT V MANUFACTURE OF PLASTIC COMPONENTS 12**

Types and characteristics of plastics – Moulding of thermoplastics – working principles and typical applications – injection moulding – Plunger and screw machines – Compression moulding, Transfer Moulding – Typical industrial applications – introduction to blow moulding –Rotational moulding – Film blowing – Extrusion – Thermoforming – Bonding of Thermoplastics.

**TOTAL: 60 PERIODS****OUTCOMES:**

- CO1 Explain different metal casting processes, associated defects, merits and demerits  
 CO2 Compare different metal joining processes.  
 CO3 Summarize various hot working and cold working methods of metals.  
 CO4 Explain various sheet metal making processes.  
 CO5 Distinguish various methods of manufacturing plastic components.

**TEXT BOOKS:**

- Hajra Choudhary S.K and Hajra Choudhury. AK., "Elements of workshop Technology", volume I and II, Media promoters and Publishers Private Limited, Mumbai, 2008
- Kalpakjian. S, "Manufacturing Engineering and Technology", Pearson Education India Edition, 2013

**REFERENCES:**

1. Gowri P. Hariharan, A.Suresh Babu, "Manufacturing Technology I", Pearson Education, 2008
2. Paul Degarma E, Black J.T and Ronald A. Kosher, "Materials and Processes, in Manufacturing" Eight Edition, Prentice – Hall of India, 1997.
3. Rao, P.N. "Manufacturing Technology Foundry, Forming and Welding", 4<sup>th</sup> Edition, TMH-2013
4. Roy. A. Lindberg, "Processes and Materials of Manufacture", PHI / Pearson education, 2006
5. Sharma, P.C., "A Text book of production Technology", S.Chand and Co. Ltd., 2014.

**OBJECTIVES:**

- To understand the basic concepts of different types of electrical machines and their performance.
- To study the different methods of starting D.C motors and induction motors.
- To study the conventional and solid-state drives

**UNIT I INTRODUCTION****9+6**

Basic Elements – Types of Electric 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 II DRIVE MOTOR CHARACTERISTICS****9+6**

Mechanical characteristics – Speed-Torque characteristics of various types of load and drive motors – Braking of Electrical motors – DC motors: Shunt, series and compound - single phase and three phase induction motors.

**UNIT III STARTING METHODS****9+6**

Types of D.C Motor starters – Typical control circuits for shunt and series motors – Three phase squirrel cage and slip ring induction motors.

**UNIT IV CONVENTIONAL AND SOLID STATE SPEED CONTROL OF D.C. DRIVES****9+6**

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+6**

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

**TOTAL: 75 PERIODS****OUTCOME:**

- Upon Completion of this subject, the students can able to explain different types of electrical machines and their performance

**TEXT BOOKS:**

1. Nagrath .I.J. & Kothari .D.P, “Electrical Machines”, Tata McGraw-Hill, 2006
2. Vedam Subrahmaniam, “Electric Drives (Concepts and Applications)”, Tata McGraw-Hill, 2010

**REFERENCES:**

1. Partab. H., “Art and Science and Utilisation of Electrical Energy”, Dhanpat Rai and Sons, 2017
2. Pillai.S.K “A First Course on Electric Drives”, Wiley Eastern Limited, 2012
3. Singh. M.D., K.B.Khanchandani, “Power Electronics”, Tata McGraw-Hill, 2006.



**OBJECTIVE:**

- To Study and practice the various operations that can be performed in lathe, shaper, drilling, milling machines etc. and to equip with the practical knowledge required in the core industries.

**LIST OF EXPERIMENTS**

Machining and Machining time estimations for:

- Taper Turning
  - External Thread cutting
  - Internal Thread Cutting
  - Eccentric Turning
  - Knurling
  - Square Head Shaping
  - Hexagonal Head Shaping
- 
- Fabrication of simple structural shapes using Gas Metal Arc Welding
  - Joining of plates and pipes using Gas Metal Arc Welding/ Arc Welding /Submerged arc welding
  - Preparation of green sand moulds
  - Manufacturing of simple sheet metal components using shearing and bending operations.
  - Manufacturing of sheet metal components using metal spinning on a lathe

**TOTAL: 60 PERIODS****OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Demonstrate the safety precautions exercised in the mechanical workshop.  
 CO2 Make the workpiece as per given shape and size using Lathe.  
 CO3 Join two metals using arc welding.  
 CO4 Use sheet metal fabrication tools and make simple tray and funnel.  
 CO5 Use different moulding tools, patterns and prepare sand moulds.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S. NO.	NAME OF THE EQUIPMENT	Qty.
1	Centre Lathes	7 Nos.
2	Horizontal Milling Machine	1 No
3	Vertical Milling Machine	1 No
4	Shaper	1 No.
5	Arc welding transformer with cables and holders	2 Nos
6	Oxygen and acetylene gas cylinders, blow pipe and other welding outfit	1 No
7	Moulding table, Moulding equipments	2 Nos
8	Sheet metal forming tools and equipments	2 Nos.

**OBJECTIVES:**

- To make the students understand and interpret drawings of machine components
- To prepare assembly drawings both manually and using standard CAD packages
- To familiarize the students with Indian Standards on drawing practices and standard components
- To gain practical experience in handling 2D drafting and 3D modeling software systems.

**UNIT I DRAWING STANDARDS & FITS AND TOLERANCES 17**

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 – Specification of Fits – Preparation of production drawings and reading of part and assembly drawings, basic principles of geometric dimensioning & tolerancing.

**UNIT II INTRODUCTION TO 2D DRAFTING 18**

- Drawing, Editing, Dimensioning, Layering, Hatching, Block, Array, Detailing, Detailed drawing.
- Bearings - Bush bearing, Plummer block
- Valves – Safety and non-return valves.

**UNIT III 3D GEOMETRIC MODELING AND ASSEMBLY 25**

Sketcher - Datum planes – Protrusion – Holes - Part modeling – Extrusion – Revolve – Sweep – Loft – Blend – Fillet - Pattern – Chamfer - Round - Mirror – Section - Assembly

- Couplings – Flange, Universal, Oldham's, Muff, Gear couplings
- Joints – Knuckle, Gib & cotter, strap, sleeve & cotter joints
- Engine parts – Piston, connecting rod, cross-head (vertical and horizontal), stuffing box, multi-plate clutch
- Miscellaneous machine components – Screw jack, machine vice, tail stock, chuck, vane and gear pump

**TOTAL: 60 PERIODS**

**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 / 3D CAD software

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

CO1 Follow the drawing standards, Fits and Tolerances

CO2 Re-create part drawings, sectional views and assembly drawings as per standards

**TEXT BOOK:**

1. Gopalakrishna K.R., "Machine Drawing", 22nd Edition, Subhas Stores Books Corner, Bangalore, 2013

**REFERENCES:**

1. N. D. Bhatt and V.M. Panchal, "Machine Drawing", 48th Edition, Charotar Publishers, 2013
2. Junnarkar, N.D., "Machine Drawing", 1st Edition, Pearson Education, 2004
3. N. Siddeshwar, P. Kanniah, V.V.S. Sastri, "Machine Drawing", published by Tata Mc GrawHill, 2006
4. S. Trymbaka Murthy, "A Text Book of Computer Aided Machine Drawing", CBS Publishers, New Delhi, 2007

**OBJECTIVE:**

- To validate the principles studied in theory by performing experiments in the laboratory

**LIST OF EXPERIMENTS**

1. Load test on DC Shunt & DC Series motor
2. O.C.C & Load characteristics of DC Shunt and DC Series 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. Study of DC & AC Starters

**TOTAL: 60 PERIODS****OUTCOME:**

- Ability to perform speed characteristic of different electrical machine

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

<b>S.No.</b>	<b>NAME OF THE EQUIPMENT</b>	<b>Qty.</b>
1	DC Shunt motor	2
2	DC Series motor	1
3	DC shunt motor-DC Shunt Generator set	1
4	DC Shunt motor-DC Series Generator set	1
5	Single phase transformer	2
6	Three phase alternator	2
7	Three phase synchronous motor	1
8	Three phase Squirrel cage Induction motor	1
9	Three phase Slip ring Induction motor	1

20154L39

**INTERPERSONAL SKILLS/LISTENING & SPEAKING**

**L T P C**

**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 Mamta Bhatnagar. 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.

**COURSE OUTLINE****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****Feminist Theory**

Liberal, Marxist, Socialist, Radical, Psychoanalytic, postmodernist, eco-feminist.

**Unit-III****Women's Movements: Global, National and Local**

Rise of Feminism in Europe and America.

Women's Movement in India.

**Unit-IV****Gender and Language**

Linguistic Forms and Gender.

Gender and narratives.

**Unit-V****Gender and Representation**

Advertising and popular visual media.

Gender and Representation in Alternative Media.

Gender and social media.

**TOTAL : 30 PERIODS**

**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.
- 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+6**

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 II DESIGN OF EXPERIMENTS****9+6**

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+6**

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 - Eigen values of a matrix by Power method and Jacobi's method for symmetric matrices.

**UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION****9+6**

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.

**UNIT V NUMERICAL SOLUTION OF 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.

**TOTAL : 45+30= 75 PERIODS****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 of agriculture.
- Appreciate the numerical techniques of interpolation in various intervals and 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

**TEXT BOOKS :**

1. Grewal. B.S. and Grewal. J.S., "Numerical Methods in Engineering and Science ", 10<sup>th</sup> Edition, Khanna Publishers, New Delhi, 2015.
2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8<sup>th</sup> Edition, 2015.

**REFERENCES :**

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9<sup>th</sup> Edition, Cengage Learning, 2016.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8<sup>th</sup> Edition, 2014.
3. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 2006.
4. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on 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", 8<sup>th</sup> Edition, Pearson Education, Asia, 2007.

<b>20154C42</b>	<b>THEORY OF MACHINES-I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>2</b>	<b>0</b>	<b>4</b>

**OBJECTIVES:**

- To understand the basic components and layout of linkages in the assembly of a system machine.
- To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
- To understand the motion resulting from a specified set of linkages, design few linkage mechanisms and cam mechanisms for specified output motions.
- To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machine components.

**UNIT I BASICS OF MECHANISMS 9+6**

Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, Mobility – Kutzbach criterion, Gruebler’s criterion – Grashof’s Law – Kinematic inversions of four-bar chain and slider crank chains – Limit positions – Mechanical advantage – Transmission Angle – Description of some common mechanisms – Quick return mechanisms, Straight line generators, Universal Joint – rocker mechanisms.

**UNIT II KINEMATICS OF LINKAGE MECHANISMS 9+6**

Displacement, velocity and acceleration analysis of simple mechanisms – Graphical method– Velocity and acceleration polygons – Velocity analysis using instantaneous centres – kinematic analysis of simple mechanisms – Coincident points – Coriolis component of Acceleration – Introduction to linkage synthesis problem.

**UNIT III KINEMATICS OF CAM MECHANISMS 9+6**

Classification of cams and followers – Terminology and definitions – Displacement diagrams – Uniform velocity, parabolic, simple harmonic and cycloidal motions – Derivatives of follower motions – Layout of plate cam profiles – Specified contour cams – Circular arc and tangent cams – Pressure angle and undercutting – sizing of cams.

**UNIT IV GEARS AND GEAR TRAINS 9+6**

Law of toothed gearing – Involute and cycloidal tooth profiles –Spur Gear terminology and definitions –Gear tooth action – contact ratio – Interference and undercutting. Helical, Bevel, Worm, Rack and Pinion gears [Basics only]. Gear trains – Speed ratio, train value – Parallel axis gear trains – Epicyclic Gear Trains.

**UNIT V FRICTION IN MACHINE ELEMENTS 9+6**

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Bearings and lubrication – Friction clutches – Belt and rope drives – Friction in brakes- Band and Block brakes.

**TOTAL: 45+30 = 75 PERIODS**

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Discuss the basics of mechanism
- CO2 Calculate velocity and acceleration in simple mechanisms
- CO3 Develop CAM profiles
- CO4 Solve problems on gears and gear trains
- CO5 Examine friction in machine elements

**TEXT BOOKS:**

1. F.B. Sayyad, "Kinematics of Machinery", MacMillan Publishers Pvt Ltd., Tech-max Educational resources, 2011.
2. Rattan, S.S, "Theory of Machines", 4<sup>th</sup> Edition, Tata McGraw-Hill, 2014.
3. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", 4 Edition, Oxford University Press, 2014.

**REFERENCES:**

1. Allen S. Hall Jr., "Kinematics and Linkage Design", Prentice Hall, 1961
2. Cleghorn. W. L, "Mechanisms of Machines", Oxford University Press, 2014
3. Ghosh. A and Mallick, A.K., "Theory of Mechanisms and Machines", 3<sup>rd</sup> Edition Affiliated East-West Pvt. Ltd., New Delhi, 2006.
4. John Hannah and Stephens R.C., "Mechanics of Machines", Viva Low-Prices Student Edition, 1999.
5. Thomas Bevan, "Theory of Machines", 3rd Edition, CBS Publishers and Distributors, 2005.

**OBJECTIVES:**

- To understand the concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching.
- To understand the basic concepts of Computer Numerical Control (CNC) of machine tools and CNC Programming

**UNIT I THEORY OF METAL CUTTING 9**

Mechanics of chip formation, single point cutting tool, forces in machining, Types of chip, cutting tools– nomenclature, orthogonal 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, machining time and power estimation. Capstan and turret lathes- tool layout – automatic lathes: semi automatic – single spindle : Swiss type, automatic screw type – multi spindle:

**UNIT III SHAPER, MILLING AND GEAR CUTTING MACHINES 9**

Shaper - Types of operations. Drilling ,reaming, boring, Tapping. Milling operations-types of milling cutter. Gear cutting – forming and generation principle and construction of gear milling ,hobbing and gear shaping processes –finishing of gears.

**UNIT IV ABRASIVE PROCESS AND BROACHING 9**

Abrasive processes: grinding wheel – specifications and selection, types of grinding process– cylindrical grinding, surface grinding, centreless grinding and internal grinding- Typical applications  
– concepts of surface integrity, broaching machines: broach construction – push, pull, surface and continuous broaching machines

**UNIT V CNC MACHINING 9**

Numerical Control (NC) machine tools – CNC types, constructional details, special features, machining centre, part programming fundamentals CNC – manual part programming – micromachining – wafer machining.

**TOTAL : 45 PERIODS****OUTCOMES:****Upon the completion of this course the students will be able to**

- CO1 Explain the mechanism of material removal processes.  
CO2 Describe the constructional and operational features of centre lathe and other special purpose lathes.  
CO3 Describe the constructional and operational features of shaper, planner, milling, drilling, sawing and broaching machines.  
CO4 Explain the types of grinding and other super finishing processes apart from gear manufacturing processes.  
CO5 Summarize numerical control of machine tools and write a part program.

**TEXT BOOKS:**

1. Hajra Choudhury, "Elements of Workshop Technology", Vol.II., Media Promoters 2014

2. Rao. P.N “Manufacturing Technology - Metal Cutting and Machine Tools”, 3<sup>rd</sup> Edition, Tata McGraw-Hill, New Delhi, 2013.

**REFERENCES:**

1. Richerd R Kibbe, John E. Neely, Roland O. Merges and Warren J.White “Machine Tool Practices”, Prentice Hall of India, 1998
2. Geoffrey Boothroyd, "Fundamentals of Metal Machining and Machine Tools", Mc Graw Hill, 1984
3. HMT, "Production Technology", Tata McGraw Hill, 1998.
4. Roy. A.Lindberg, “Process and Materials of Manufacture,” Fourth Edition, PHI/Pearson Education 2006.

**OBJECTIVE:**

- To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications.

**UNIT I ALLOYS AND PHASE DIAGRAMS 9**

Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectic, eutectoid, peritectic, and peritectoid reactions, Iron – carbon 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 – normalising, hardening and Tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram CCR – Hardenability, Jominy end quench test - Austempering, martempering – case hardening, carburizing, Nitriding, cyaniding, carbonitriding – Flame and Induction hardening – Vacuum and Plasma hardening. .

**UNIT III FERROUS AND NON-FERROUS METALS 9**

Effect of alloying additions on steel-  $\alpha$  and  $\beta$  stabilisers– stainless and tool steels – HSLA, Maraging steels – Cast Iron - Grey, white, malleable, spheroidal – alloy cast irons, Copper and copper alloys – Brass, Bronze and Cupronickel – Aluminium and Al-Cu – precipitation strengthening treatment – Bearing alloys, Mg-alloys, Ni-based super alloys and Titanium alloys.

**UNIT IV NON-METALLIC MATERIALS 9**

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of various thermosetting and thermoplastic polymers (PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE, Polymers – Urea and Phenol formaldehydes)- Engineering Ceramics – Properties and applications of  $Al_2O_3$ , SiC,  $Si_3N_4$ , PSZ and SIALON –Composites- Classifications- Metal Matrix and FRP - Applications of Composites.

**UNIT V MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS 9**

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

**TOTAL: 45 PERIODS****OUTCOMES**

**Upon the completion of this course the students will be able to**

- CO1 Explain alloys and phase diagram, Iron-iron carbon diagram and steel classification.  
 CO2 Explain isothermal transformation, continuous cooling diagrams and different heat treatment processes.  
 CO3 Clarify the effect of alloying elements on ferrous and non-ferrous metals  
 CO4 Summarize the properties and applications of non metallic materials.  
 CO5 Explain the testing of mechanical properties. .

**TEXT BOOKS:**

- Avner, S.H., "Introduction to Physical Metallurgy", McGraw Hill Book Company, 1997.
- Williams D Callister, "Material Science and Engineering" Wiley India Pvt Ltd, Revised Indian Edition 2014

**REFERENCES:**

1. Kenneth G. Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of India Private Limited, 2010.
2. Raghavan.V, "Materials Science and Engineering", Prentice Hall of India Pvt. Ltd., 2015.
3. U.C. Jindal : Material Science and Metallurgy, "Engineering Materials and Metallurgy", First Edition, Dorling Kindersley, 2012
4. Upadhyay. G.S. and Anish Upadhyay, "Materials Science and Engineering", Viva Books Pvt. Ltd., New Delhi, 2006.

20154C45

**STRENGTH OF MATERIALS FOR  
MECHANICAL ENGINEERS**

L	T	P	C
3	2	0	4

**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 determinate beams 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+6**

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric 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+6**

Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending – bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.

**UNIT III TORSION 9+6**

Torsion formulation stresses and deformation in circular and hollow shafts – Stepped shafts – Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

**UNIT IV DEFLECTION OF BEAMS 9+6**

Double Integration method – Macaulay's method – Area moment method for computation of slopes and deflections in beams – Conjugate beam and strain energy – Maxwell's reciprocal theorems.

**UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS 9+6**

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders – spherical shells subjected to internal pressure – Deformation in spherical shells – Lamé's theorem.

**TOTAL: 45+30 = 75 PERIODS**

**OUTCOMES**

Students will be able to

- Understand the concepts of stress and strain in simple and compound bars, the importance of principal stresses and principal planes.
- Understand the load transferring mechanism in beams and stress distribution due to shearing force and bending moment.
- Apply basic equation of simple torsion in designing of shafts and helical spring
- Calculate the slope and deflection in beams using different methods.
- Analyze and design thin and thick shells for the applied internal and external pressures.

**TEXT BOOKS:**

1. Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2016
2. Jindal U.C., "Strength of Materials", Asia Books Pvt. Ltd., New Delhi, 2009



**REFERENCES:**

1. Egor. P.Popov "Engineering Mechanics of Solids" Prentice Hall of India, New Delhi, 2002
2. Ferdinand P. Beer, Russell Johnson, J.r. and John J. Dewole "Mechanics of Materials", Tata McGraw Hill Publishing 'co. Ltd., New Delhi, 2005.
3. Hibbeler, R.C., "Mechanics of Materials", Pearson Education, Low Price Edition, 2013
4. Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series, 2010.

**OBJECTIVES:**

- To integrate the concepts, laws and methodologies from the first course in thermodynamics into analysis of cyclic processes
- To apply the thermodynamic concepts into various thermal application like IC engines, Steam.
- Turbines, Compressors and Refrigeration and Air conditioning systems

(Use of standard refrigerant property data book, Steam Tables, Mollier diagram and Psychrometric chart permitted)

**UNIT I GAS AND STEAM POWER CYCLES 9+6**

Air Standard Cycles - Otto, Diesel, Dual, Brayton – Cycle Analysis, Performance and Comparison – Rankine, reheat and regenerative cycle.

**UNIT II RECIPROCATING AIR COMPRESSOR 9+6**

Classification and comparison, working principle, work of compression - with and without clearance, Volumetric efficiency, Isothermal efficiency and Isentropic efficiency. Multistage air compressor with Intercooling. Working principle and comparison of Rotary compressors with reciprocating air compressors.

**UNIT III INTERNAL COMBUSTION ENGINES AND COMBUSTION 9+6**

IC engine – Classification, working, components and their functions. Ideal and actual : Valve and port timing diagrams, p-v diagrams- two stroke & four stroke, and SI & CI engines – comparison. Geometric, operating, and performance comparison of SI and CI engines. Desirable properties and qualities of fuels. Air-fuel ratio calculation – lean and rich mixtures. Combustion in SI & CI Engines – Knocking – phenomena and control.

**UNIT IV INTERNAL COMBUSTION ENGINE PERFORMANCE AND SYSTEMS 9+6**

Performance parameters and calculations. Morse and Heat Balance tests. Multipoint Fuel Injection system and Common Rail Direct Injection systems. Ignition systems – Magneto, Battery and Electronic. Lubrication and Cooling systems. Concepts of Supercharging and Turbocharging – Emission Norms.

**UNIT V GAS TURBINES 9+6**

Gas turbine cycle analysis – open and closed cycle. Performance and its improvement – Regenerative, Intercooled, Reheated cycles and their combinations. Materials for Turbines.

**TOTAL:45 +30=75PERIODS**

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Apply thermodynamic concepts to different air standard cycles and solve problems.
- CO2 Solve problems in single stage and multistage air compressors
- CO3 Explain the functioning and features of IC engines, components and auxiliaries.
- CO4 Calculate performance parameters of IC Engines.
- CO5 Explain the flow in Gas turbines and solve problems.

**TEXT BOOKS:**

1. Kothandaraman.C.P., Domkundwar. S,Domkundwar. A.V., “A course in thermal Engineering”, Fifth Edition, ”Dhanpat Rai & sons , 2016
2. Rajput. R. K., “Thermal Engineering” S.Chand Publishers, 2017

**REFERENCES:**

1. Arora.C.P, "Refrigeration and Air Conditioning ," Tata McGraw-Hill Publishers 2008
2. Ganesan V.." Internal Combustion Engines" , Third Edition, Tata Mcgraw-Hill 2012
3. Ramalingam. K.K., "Thermal Engineering", SCITECH Publications (India) Pvt. Ltd., 2009.
4. Rudramoorthy, R, "Thermal Engineering ",Tata McGraw-Hill, New Delhi,2003
5. Sarkar, B.K,"Thermal Engineering" Tata McGraw-Hill Publishers, 2007

**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. Helical Gear Cutting in milling machine
4. Gear generation in hobbing machine
5. Gear generation in gear shaping machine
6. Plain Surface grinding
7. Cylindrical grinding
8. Tool angle grinding with tool and Cutter Grinder
9. Measurement of cutting forces in Milling / Turning Process
10. 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	Cylindrical 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 4 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

**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



# 201AGCE

# Community Engagement

L T P C  
0 0 0 2

**a) 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

**b) Learning 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

**c) Credit**

2 credit, 30 hours, at least 50% in field, compulsory for all students

**d) Contents**

Divided into four Modules, field immersion is part of each Unit

Course Structure: 2 Credits Course (1 Credit for Classroom and Tutorials and 1 Credit for Field Engagement)

S. No.	Module Title	Module Content	Assignment	Teaching/ Learning Methodology	No. of Classes
1	Appreciation of Rural Society	Rurallifestyle, 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	Prepare a map (physical, visual or digital) of the village you visited and write an essay about inter-family relations in that village.	Classroom discussions Field visit** Assignment Map	2 4 2

2	<i>Understanding rural economy &amp; livelihood</i>	Agriculture, farming, landownership, water management, animal husbandry, non-farm livelihoods and artisans, rural entrepreneurs, rural markets	Describe your analysis of rural household economy, its challenges and possible pathways to address them	Field visit** Group discussions in class Assignment	3 4 1
3	<i>Rural Institutions</i>	Traditional rural organisations, Self-help Groups, Panchayati raj institutions (Gram Sabha, Gram Panchayat, Standing Committees), local civil society, local administration	How effectively are Panchayati raj institutions functioning in the village? What would you suggest to improve their effectiveness? Present a case study (written or audio-visual)	Classroom Field visit** Group presentation of assignment	2 4 2
4	<i>Rural Development Programmes</i>	History of rural development in India, current national programmes: Sarva Shiksha Abhiyan, Beti Bachao, Beti Padhao, Ayushman Bharat, Swatchh Bharat, PM Awaas Yojana, Skill India, Gram Panchayat Decentralised Planning, NRLM, MNREGA, etc.	Describe the benefits received and challenges faced in the delivery of one of these programmes in the rural community; give suggestions about improving implementation of the programme for the rural poor.	Classroom Each student selects one program for field visit** Written assignment	2 4 2

20154C51

**THERMAL ENGINEERING – II**

L	T	P	C
3	2	0	4

**OBJECTIVES:**

- To apply the thermodynamic concepts for Nozzles, Boilers, Turbines, and Refrigeration & Air Conditioning Systems.
- To understand the concept of utilising residual heat in thermal systems.

**UNIT I STEAM NOZZLE 9**

Types and Shapes of nozzles, Flow of steam through nozzles, Critical pressure ratio, Variation of mass flow rate with pressure ratio. Effect of friction. Metastable flow.

**UNIT II BOILERS 9**

Types and comparison. Mountings and Accessories. Fuels - Solid, Liquid and Gas. Performance calculations, Boiler trial.

**UNIT III STEAM TURBINES 9**

Types, Impulse and reaction principles, Velocity diagrams, Work done and efficiency – optimal operating conditions. Multi-staging, compounding and governing.

**UNIT IV COGENERATION AND RESIDUAL HEAT RECOVERY 9**

Cogeneration Principles, Cycle Analysis, Applications, Source and utilisation of residual heat. Heat pipes, Heat pumps, Recuperative and Regenerative heat exchangers. Economic Aspects.

**UNIT V REFRIGERATION AND AIR – CONDITIONING 9**

Vapour compression refrigeration cycle, Effect of Superheat and Sub-cooling, Performance calculations, Working principle of air cycle, vapour absorption system, and Thermoelectric refrigeration. Air conditioning systems, concept of RSHF, GSHF and ESHF, Cooling load calculations. Cooling towers – concept and types.

**TOTAL:45 PERIODS**

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Solve problems in Steam Nozzle
- CO2 Explain the functioning and features of different types of Boilers and auxiliaries and calculate performance parameters.
- CO3 Explain the flow in steam turbines, draw velocity diagrams for steam turbines and solve problems.
- CO4 Summarize the concept of Cogeneration, Working features of Heat pumps and Heat Exchangers
- CO5 Solve problems using refrigerant table / charts and psychrometric charts

**TEXT BOOKS:**

1. Kothandaraman, C.P., Domkundwar .S and Domkundwar A.V.,”A course in Thermal

Engineering”, Dhanpat Rai & Sons, 2016.

2. Mahesh. M. Rathore, “Thermal Engineering”, 1<sup>st</sup>

**REFERENCES:**

1. Arora .C.P., “Refrigeration and Air Conditioning”, Tata Mc Graw Hill, 2008
2. Ballaney. P.L ." Thermal Engineering”, Khanna publishers, 24th Edition 2012
3. Charles H Butler : Cogeneration” McGraw Hill, 1984.
4. Donald Q. Kern, “ Process Heat Transfer”, Tata Mc Graw Hill, 2001.

Sydney Reiter “Industrial and Commercial Heat Recovery Systems” Van Nostrand Reinholds, 1985.

20154C51

**THERMAL ENGINEERING – II**

L	T	P	C
3	2	0	4

**OBJECTIVES:**

- To apply the thermodynamic concepts for Nozzles, Boilers, Turbines, and Refrigeration & Air Conditioning Systems.
- To understand the concept of utilising residual heat in thermal systems.

**UNIT I STEAM NOZZLE**

**9+6**

Types and Shapes of nozzles, Flow of steam through nozzles, Critical pressure ratio, Variation of mass flow rate with pressure ratio. Effect of friction. Metastable flow.

**UNIT II BOILERS**

**9+6**

Types and comparison. Mountings and Accessories. Fuels - Solid, Liquid and Gas. Performance calculations, Boiler trial.

**UNIT III STEAM TURBINES**

**9+6**

Types, Impulse and reaction principles, Velocity diagrams, Work done and efficiency – optimal operating conditions. Multi-staging, compounding and governing.

**UNIT IV COGENERATION AND RESIDUAL HEAT RECOVERY**

**9+6**

Cogeneration Principles, Cycle Analysis, Applications, Source and utilisation of residual heat. Heat pipes, Heat pumps, Recuperative and Regenerative heat exchangers. Economic Aspects.

**UNIT V REFRIGERATION AND AIR – CONDITIONING**

**9+6**

Vapour compression refrigeration cycle, Effect of Superheat and Sub-cooling, Performance calculations, Working principle of air cycle, vapour absorption system, and Thermoelectric refrigeration. Air conditioning systems, concept of RSHF, GSHF and ESHF, Cooling load calculations. Cooling towers – concept and types.

**TOTAL: 45+30=75 PERIODS**

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Solve problems in Steam Nozzle
- CO2 Explain the functioning and features of different types of Boilers and auxiliaries and calculate performance parameters.
- CO3 Explain the flow in steam turbines, draw velocity diagrams for steam turbines and solve problems.
- CO4 Summarize the concept of Cogeneration, Working features of Heat pumps and Heat exchangers
- CO5 Solve problems using refrigerant table / charts and psychrometric charts

**REFERENCES:**

5. Arora .C.P., “Refrigeration and Air Conditioning”, Tata Mc Graw Hill, 2008
6. Ballaney. P.L ." Thermal Engineering”, Khanna publishers, 24th Edition 2012
7. Charles H Butler : Cogeneration” McGraw Hill, 1984.
8. Donald Q. Kern, “ Process Heat Transfer”, Tata Mc Graw Hill, 2001.
9. Sydney Reiter “Industrial and Commercial Heat Recovery Systems” Van Nostrand Reinholds, 1985.

**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 fasteners - 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”, 4<sup>th</sup> 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),
  2. 2010 Ansel Ugural, "Mechanical An Integral Approach", 1<sup>st</sup> Edition, Tata McGraw-Hill Book Design 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.
- Robert C. Juvinall and Kurt M . Marshek, "Fundamentals of Machine Design", Edition, Wiley, 4<sup>th</sup> 2005



**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", 5<sup>th</sup> edition, Cengage Learning EMEA,1990.
4. Donald Peckman, "Industrial Instrumentation", Wiley Eastern, 2004.
5. Raghavendra ,Krishnamurthy "Engineering Metrology & Measurements", Oxford Univ. Press, 2013.

**OBJECTIVES:**

- To understand the force-motion relationship in components subjected to external forces and analysis of standard mechanisms.
- To understand the undesirable effects of unbalances resulting from prescribed motions in mechanism.
- To understand the effect of Dynamics of undesirable vibrations.
- To understand the principles in mechanisms used for speed control and stability control.

**UNIT I FORCE ANALYSIS****9+6**

Dynamic force analysis – Inertia force and Inertia torque– D Alembert's principle –Dynamic Analysis in reciprocating engines – Gas forces – Inertia effect of connecting rod– Bearing loads – Crank shaft torque – Turning moment diagrams –Fly Wheels – Flywheels of punching presses– Dynamics of Cam- follower mechanism.

**UNIT II BALANCING****9+6**

Static and dynamic balancing – Balancing of rotating masses – Balancing a single cylinder engine – Balancing of Multi-cylinder inline, V-engines – Partial balancing in engines – Balancing of linkages – Balancing machines-Field balancing of discs and rotors.

**UNIT III FREE VIBRATION****9+6**

Basic features of vibratory systems – Degrees of freedom – single degree of freedom – Free vibration– Equations of motion – Natural frequency – Types of Damping – Damped vibration– Torsional vibration of shaft – Critical speeds of shafts – Torsional vibration – Two and three rotor torsional systems.

**UNIT IV FORCED VIBRATION****9+6**

Response of one degree freedom systems to periodic forcing – Harmonic disturbances – Disturbance caused by unbalance – Support motion –transmissibility – Vibration isolation vibration measurement.

**UNIT V MECHANISM FOR CONTROL****9+6**

Governors – Types – Centrifugal governors – Gravity controlled and spring controlled centrifugal governors – Characteristics – Effect of friction – Controlling force curves. Gyroscopes –Gyroscopic forces and torques – Gyroscopic stabilization – Gyroscopic effects in Automobiles, ships and airplanes.

**TOTAL : 45+30=75 PERIODS****OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Calculate static and dynamic forces of mechanisms.
- CO2 Calculate the balancing masses and their locations of reciprocating and rotating masses.
- CO3 Compute the frequency of free vibration.
- CO4 Compute the frequency of forced vibration and damping coefficient.
- CO5 Calculate the speed and lift of the governor and estimate the gyroscopic effect on automobiles, ships and airplanes.

**TEXT BOOKS:**

1. F. B. Sayyad, "Dynamics of Machinery", McMillan Publishers India Ltd., Tech-Max Educational resources, 2011.
2. Rattan, S.S, "Theory of Machines", 4<sup>th</sup> Edition, Tata McGraw-Hill, 2014.
3. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", 4<sup>th</sup> Edition, Oxford University Press, 2014.

**REFERENCES:**

1. Cleghorn. W. L, "Mechanisms of Machines", Oxford University Press, 2014
2. Ghosh. A and Mallick, A.K., "Theory of Mechanisms and Machines", 3<sup>rd</sup> Edition Affiliated East-West Pvt. Ltd., New Delhi, 2006.
3. Khurmi, R.S., "Theory of Machines", 14<sup>th</sup> Edition, S Chand Publications, 2005.
4. Rao.J.S. and Dukupati.R.V. "Mechanisms and Machine Theory", Wiley-Eastern Ltd., New Delhi, 1992.
5. Robert L. Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill, 2009.
6. V.Ramamurthi, "Mechanics of Machines", Narosa Publishing House, 2002.

**OBJECTIVES:**

- To supplement the principles learnt in kinematics and Dynamics of Machinery.
- To understand how certain measuring devices are used for dynamic testing.

**LIST OF EXPERIMENTS**

1. a) Study of gear parameters.  
b) Experimental study of velocity ratios of simple, compound, Epicyclic and differential gear trains.
2. a) Kinematics of Four Bar, Slider Crank, Crank Rocker, Double crank, Double rocker, Oscillating cylinder Mechanisms.  
b) Kinematics of single and double universal joints.
3. a) Determination of Mass moment of inertia of Fly wheel and Axle system.  
b) Determination of Mass Moment of Inertia of axisymmetric bodies using Turn Table apparatus. c) Determination of Mass Moment of Inertia using bifilar suspension and compound pendulum.
4. Motorized gyroscope – Study of gyroscopic effect and couple.
5. Governor - Determination of range sensitivity, effort etc., for Watts, Porter, Proell, and Hartnell Governors.
6. Cams – Cam profile drawing, Motion curves and study of jump phenomenon
7. a) Single degree of freedom Spring Mass System – Determination of natural Frequency and verification of Laws of springs – Damping coefficient determination. b) Multi degree freedom suspension system – Determination of influence coefficient.
8. a) Determination of torsional natural frequency of single and Double Rotor systems.- Undamped and Damped Natural frequencies.  
b) Vibration Absorber – Tuned vibration absorber.
9. Vibration of Equivalent Spring mass system – undamped and damped vibration.
10. Whirling of shafts – Determination of critical speeds of shafts with concentrated loads.
11. a) Balancing of rotating masses. (b) Balancing of reciprocating masses.
12. a) Transverse vibration of Free-Free beam – with and without concentrated masses. b) Forced Vibration of Cantilever beam – Mode shapes and natural frequencies.  
c) Determination of transmissibility ratio using vibrating table.

**TOTAL : 60 PERIODS****OUTCOMES****Upon the completion of this course the students will be able to**

- CO1 Explain gear parameters, kinematics of mechanisms, gyroscopic effect and working of lab equipments.
- CO2 Determine mass moment of inertia of mechanical element, governor effort and range sensitivity, natural frequency and damping coefficient, torsional frequency, critical speeds of shafts, balancing mass of rotating and reciprocating masses, and transmissibility ratio.

### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Cam follower setup.	1 No.
2	Motorised gyroscope.	1 No.
3	Governor apparatus - Watt, Porter, Proell and Hartnell governors.	1 No.
4	Whirling of shaft apparatus.	1 No.
5	Dynamic balancing machine.	1 No.
6	Two rotor vibration setup.	1 No.
7	Spring mass vibration system.	1 No.

8	Torsional Vibration of single rotor system setup.	1 No.
9	Gear Models	1 No.
10	Kinematic Models to study various mechanisms.	1 No.
11	Turn table apparatus.	1 No.
12	Transverse vibration setup of a) cantilever	1 No.

**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.



**OBJECTIVE:**

- To familiar with different measurement equipments and use of this industry for quality inspection.

**LIST OF EXPERIMENTS**

- Calibration and use of measuring instruments – Vernier caliper, micrometer, Vernier height gauge – using gauge blocks
- Calibration and use of measuring instruments – depth micrometer, bore gauge, telescopic gauge
- Measurement of linear dimensions using Comparators
- Measurement of angles using bevel protractor and sine bar
- Measurement of screw thread parameters – Screw thread Micrometers and Three wire method (floating carriage micrometer)
- Measurement of gear parameters – disc micrometers, gear tooth vernier caliper
- Measurement of features in a prismatic component using Coordinate Measuring Machine (CMM)
- Programming of CNC Coordinate Measuring Machines for repeated measurements of identical components
- Non-contact (Optical) measurement using Toolmaker's microscope / Profile projector and Video measurement system
- Measurement of Surface finish in components manufactured using various processes (turning, milling, grinding, etc.,) using stylus based instruments.
- Machine tool metrology – Level tests using precision level; Testing of straightness of a machine tool guide way using Autocollimator, spindle tests.
- 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

**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 standard laboratory precautions and best practices for experimental work
- To provide orientation for basic mathematical computation useful in basic research

**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:**

Basic mathematical and experimental skills and exposure to window-based computer operation system.

**UNIT I**

Introduction to Research – Definition, Objectives, Motivation and purpose – types of research – Pure and applied, survey, case study experimental, exploratory – Research Design – Steps in selection and formulation of research problem - Steps in research – Criteria of Good Research, Problems Encountered by Researchers in India.

**UNIT II**

Research Problem: Definition of research problem, selecting the problem - Necessity of defining the problem - Techniques involved in defining the problem - Research design - Needs and features of good design - Different research design - Basic principles of experimental designs. Development of a research plan, Formulation of Hypothesis – Sampling techniques –Sampling error and sample size. 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. 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.

#### **UNIT IV**

Processing and analysis of data – editing – coding – transcription – tabulation –outline of statistical analysis- Uncertainty, accuracy and precision- Mean value; standard deviation; error on the mean-Using a spreadsheet for data analysis- Graphs and graph plotting-Least squares methods – 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. 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, Technical Presentation.

#### **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.

# 201AGIE INNOVATION AND ENTREPRENEURSHIP LTPC

## 0002

### Course Outcomes

After the completion of the course, the students will be able to:

- Comprehend the role of bounded rationality, framing, causation and effectuation in entrepreneurial decision making.
- Demonstrate an ability to design a business model canvas.
- Evaluate the various sources of raising finance for startup ventures.
- Understand the fundamentals of developing and presenting business pitching to potential investors.

### Course Content

#### Module – I

**Introduction to Entrepreneurship:** Entrepreneurs; entrepreneurial personality and intentions- characteristics, traits and behavioral; entrepreneurial challenges.

#### Module-II

**Module Entrepreneurial Opportunities:** Opportunities. discovery/ creation, Pattern identification and recognition for venture creation: prototype and exemplar model, reverse engineering.

#### Module –III

**Entrepreneurial Process and Decision Making:** Entrepreneurial ecosystem, Ideation, development and exploitation of opportunities; Negotiation, decision making process and approaches, Effectuation and Causation.

#### Module-IV

**Crafting business models and Lean Start-ups:** Introduction to business models; Creating value proposition - conventional industry logic, value innovation logic; customer focused innovation; building and analyzing business models; Business model canvas, Introduction to lean startups, Business Pitching.

#### Module – V

**Organizing Business and Entrepreneurial Finance:** Forms of business organizations; organizational structure; Evolution of Organisation, sources and selection of venture finance options and its managerial implications. Policy Initiatives and focus; role of institutions in promoting entrepreneurship.

### Books for References

- Ries, Eric(2011), The lean Start-up: How constant innovation creates radically successful businesses, Penguin Books Limited.
- Blank, Steve (2013), The Startup Owner’s Manual: The Step by Step Guide for Building 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, Technology Ventures: From Idea to Enterprise, McGraw Hill (2013)
- Osterwalder, Alex and Pigneur, Yves (2010) Business Model Generation.
- Kachru, Upendra, India Land of a Billion Entrepreneurs, Pearson
- Bagchi, Subroto, (2008), Go Kiss the World: Life Lessons for the Young Professional, Portfolio Penguin
- Bagchi, Subroto, (2012). MBA At 16: a Teenager’s Guide to Business, Penguin Books
- Bansal, Rashmi, Stay Hungry Stay Foolish, CIIE, IIM Ahmedabad
- Bansal, Rashmi, (2013). Follow Every Rainbow, Westland.
- Mitra, Sramana (2008), Entrepreneur Journeys (Volume 1), Booksurge Publishing
- Abrams, R. (2006). Six-week Start-up, Prentice-Hall of India.
- Verstraete, T. and Laffitte, E.J. (2011). a Business Model of Entrepreneurship, Edward Elgar Publishing.
- Johnson, Steven (2011). Where Good Ideas comes from, Penguin Books Limited.
- Gabor, Michael E. (2013), Awakening the Entrepreneur Within, Primento.
- Guillebeau, Chris (2012), The \$100 startup: Fire your Boss, Do what you love and work better to live more, Pan Macmillan
- Kelley, Tom (2011), The ten faces of innovation, Currency Doubleday

**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”, 4<sup>th</sup> Edition, Tata McGraw-Hill Book Co, 2016.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett “Mechanical Engineering Design”, 8<sup>th</sup> Edition, Tata McGraw-Hill, 2008.

**REFERENCES:**

1. Merhyle F. Spotts, Terry E. Shoup and Lee E. Hornberger, “Design of Machine Elements” 8<sup>th</sup> 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<sup>th</sup> Edition, Wiley, 2005
5. Sundararamoorthy T. V, Shanmugam .N, “Machine Design”, Anuradha Publications, Chennai, 2003.

**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 and B-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.

**OBJECTIVES:**

- To understand the mechanisms of heat transfer under steady and transient conditions.
- To understand the concepts of heat transfer through extended surfaces.
- To learn the thermal analysis and sizing of heat exchangers and to understand the basic concepts of mass transfer.

(Use of standard HMT data book permitted)

**UNIT I CONDUCTION****9+6**

General Differential equation of Heat Conduction– Cartesian and Polar Coordinates – One Dimensional Steady State Heat Conduction — plane and Composite Systems – Conduction with Internal Heat Generation – Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis – Semi Infinite and Infinite Solids –Use of Heisler’s charts.

**UNIT II CONVECTION****9+6**

Free and Forced Convection - Hydrodynamic and Thermal Boundary Layer. Free and Forced Convection during external flow over Plates and Cylinders and Internal flow through tubes .

**UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS****9+6**

Nusselt’s theory of condensation - Regimes of Pool boiling and Flow boiling. Correlations in boiling and condensation. Heat Exchanger Types - Overall Heat Transfer Coefficient – Fouling Factors - Analysis – LMTD method - NTU method.

**UNIT IV RADIATION****9+6**

Black Body Radiation – Grey body radiation - Shape Factor – Electrical Analogy – Radiation Shields. Radiation through gases.

**UNIT V MASS TRANSFER****9+6**

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

**TOTAL : 75 PERIODS****OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Apply heat conduction equations to different surface configurations under steady state and transient conditions and solve problems
- CO2 Apply free and forced convective heat transfer correlations to internal and external flows through/over various surface configurations and solve problems
- CO3 Explain the phenomena of boiling and condensation, apply LMTD and NTU methods of thermal analysis to different types of heat exchanger configurations and solve problems
- CO4 Explain basic laws for Radiation and apply these principles to radiative heat transfer between different types of surfaces to solve problems
- CO5 Apply diffusive and convective mass transfer equations and correlations to solve problems for different applications

**TEXT BOOKS:**

1. Holman, J.P., "Heat and Mass Transfer", Tata McGraw Hill, 2000
2. Yunus A. Cengel, "Heat Transfer A Practical Approach", Tata McGraw Hill, 5th Edition 2015

**REFERENCES:**

1. Frank P. Incropera and David P. Dewitt, "Fundamentals of Heat and Mass Transfer", John Wiley & Sons, 1998.
2. Kothandaraman, C.P., "Fundamentals of Heat and Mass Transfer", New Age International, New Delhi, 1998.
3. Nag, P.K., "Heat Transfer", Tata McGraw Hill, New Delhi, 2002
4. Ozisik, M.N., "Heat Transfer", McGraw Hill Book Co., 1994.
5. R.C. Sachdeva, "Fundamentals of Engineering Heat & Mass transfer", New Age International Publishers, 2009

**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.

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**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 PRINCIPLES 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 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, Princes 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	4	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**

113



- 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**

<b>S.No.</b>	<b>Description of Equipment</b>	<b>Qty</b>
<b>HARDWARE</b>		
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
<b>SOFTWARE</b>		
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**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**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.

**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 : *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 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**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>2</b>	<b>0</b>	<b>4</b>

**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”, 9<sup>th</sup> 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.

**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:**

- Bolton, “Mechatronics”, Prentice Hall, 2008
- 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.



**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

**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**

**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:**

- JAF Stoner, Freeman R.E and Daniel R Gilbert “Management”, 6th Edition, Pearson Education, 2004.
- Stephen P. Robbins & Mary Coulter, “Management”, Prentice Hall (India) Pvt. Edition, Ltd., 10<sup>th</sup> 2009.

**REFERENCES:**

- Harold Koontz & Heinz Weihrich, “Essentials of Management”, Tata McGraw Hill, 1998.
- Robert Kreitner & Mamata Mohapatra, “Management”, Biztantra, 2008.

3. Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management", 7<sup>th</sup> Edition, Pearson Education, 2011.
4. Tripathy PC & Reddy PN, "Principles of Management", Tata Mcgraw Hill, 1999

20154PW83

**PROJECT WORK**

L	T	P	C
0	0	20	15

**OBJECTIVE:**

- 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.

**TOTAL: 300 PERIODS**

**OUTCOME:**

- 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.

L	T	P	C
0	0	0	2

**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**

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**

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**

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

**UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS**

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**

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 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, 2004.
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.

## 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.

**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", 3<sup>rd</sup> 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.

**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<sub>2</sub>, MgO, ZrO<sub>2</sub>, NiO, nanoalumina, CaO, AgTiO<sub>2</sub>, 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, Nanobiotechnology: 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. 133

**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.

**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

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**NON CONVENTIONAL MACHINING  
PROCESSES**

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**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.



**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:**

- Hillier and Libebberman, “Operations Research”, Holden Day, 2005
- Taha H.A., “Operations Research”, Sixth Edition, Prentice Hall of India, 2003.

**REFERENCES:**

- Bazara M.J., Jarvis and Sherali H., “Linear Programming and Network Flows”, John Wiley, 2009.
- Budnick F.S., “Principles of Operations Research for Management”, Richard D Irwin, 1990.
- Philip D.T. and Ravindran A., “Operations Research”, John Wiley, 1992.
- Shennoy G.V. and Srivastava U.K., “Operation Research for Management”, Wiley Eastern, 1994.
- Tulsian and Pasdey V., “Quantitative Techniques”, Pearson Asia, 2002.

**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:**

- Dale H.Besterfield, 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:**

- James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8<sup>th</sup> Edition, First Indian Edition, Cengage Learning, 2012.
- Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
- Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
- ISO 9001-2015 standards

**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.

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**DESIGN OF JIGS, FIXTURES AND PRESS TOOLS**

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**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", 5<sup>th</sup> 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**

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**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](http://www.bee-india.com)

**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 equation<sup>145</sup>



- 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", Maneeel Dekker Inc, 1993.
5. Mallick, P.K. and Newman, S., (edition), "Composite Materials Technology: Processes and Properties", Hansen Publisher, Munish, 1990.

**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", 2<sup>nd</sup> Edition, Oxford university press, 2007.
5. Melynk, Denzler, " Operations management – A value driven approach" Irwin Mcgraw hill.
6. Norman Gaither, G. Frazier, "Operations Management" 9<sup>th</sup> 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" 1<sup>st</sup> Edition, Excel books 2007

**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.

**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.

**UNIT2: BOILERS****9**

Introduction -Boiler Systems -Boiler Types and Classifications -Performance Evaluation of Boilers -Boiler Blowdown - Boiler Water Treatment -Energy Conservation Opportunities -Case Study.

**UNIT3: STEAM SYSTEM****9**

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.

**UNIT4: FURNACES AND INSULATION****9**

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.

**UNIT 5: FBC BOILERS, COGENERATION AND WASTE HEAT RECOVERY****9**

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](http://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](http://www.onlineethics.org)
2. [www.nspe.org](http://www.nspe.org)
3. [www.globalethics.org](http://www.globalethics.org)
4. [www.ethics.org](http://www.ethics.org)



## OPEN ELECTIVE-I

<b>20150FE54A</b>	<b>DATABASE MANAGEMENT SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### 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 - IaaS – 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.

**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 physiological 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.

20152FE54B

**SENSORS AND TRANSDUCERS**

**L T P C**

**3 0 0 3**

**OBJECTIVES:**

- To understand the concepts of measurement technology.
- To learn the various sensors used to measure various physical parameters.
- To learn the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development.

**UNIT I INTRODUCTION**

**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 Output Signal Types.

**UNIT II MOTION, PROXIMITY AND RANGING SENSORS**

**9**

Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer.,– GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).

**UNIT III FORCE, MAGNETIC AND HEADING SENSORS**

**9**

Strain Gage, Load Cell, Magnetic Sensors –types, principle, requirement and advantages: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclometers

**UNIT IV OPTICAL, PRESSURE AND TEMPERATURE SENSORS**

**9**

Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC, Thermistor, RTD, Thermocouple. Acoustic Sensors – flow and level measurement, Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors, LASER sensors.

**UNIT V ALTERNATIVE ENERGY SOURCES**

**9**

Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and multi channel data acquisition – Data logging - applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

Expertise in various calibration techniques and signal types for sensors. **CO2.** Apply the various sensors in the Automotive and Mechatronics applications **CO3.** Study the basic principles of various smart sensors. **CO4.** Implement the DAQ systems with different sensors for real time applications

**TEXTBOOKS:**

160

Ernest O Doebelin, “Measurement Systems – Applications and Design”, Tata McGraw-Hill, 2009.

2. Sawney A K and Puneet Sawney, “A Course in Mechanical Measurements and Instrumentation and Control”, 12th edition, Dhanpat Rai & Co, New Delhi, 2013.

**REFERENCES:**

Patranabis D, “Sensors and Transducers”, 2nd Edition, PHI, New Delhi, 2010.

2. John Turner and Martyn Hill, “Instrumentation for Engineers and Scientists”, Oxford Science Publications, 1999.

3. Richard Zurawski, “Industrial Communication Technology Handbook” 2nd edition, CRC Press, 2015.



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**

Nanocatalysts – 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)

<b>20153FE54B</b>	<b>ENERGY CONSERVATION AND MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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](http://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.

**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 tilted 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

**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.

**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.



<b>20155FE54A</b>	<b>AIR POLLUTION AND CONTROL ENGINEERING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- 
- To impart knowledge on the principle and design of control of Indoor/ particulate/ gaseous air pollutant and its emerging trends.
- 

**UNIT I INTRODUCTION 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:** 170

- 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.

**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 ELECTIVE II

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 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 – 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

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**3 0 0 3**

**DATA STRUCTURES AND ALGORITHMS**

**L T P C**

**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<sup>nd</sup> Edition, Pearson Education, 1997.
2. Brian W. Kernighan and Dennis M. Ritchie, “The C Programming Language”, 2<sup>nd</sup> Edition, Pearson Education, 1988.

**REFERENCES:**

176

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. Yashvant Kanetkar, "Data Structures Through C", BPB publications, II edition, 2003



**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 Servicing 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-Variou 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., Chmielewski T.A and Negin M., “Robotic Engineering - An Integrated Approach”, Prentice Hall, 2003. 2. Groover M.P., “Industrial Robotics -Technology Programming and Applications”, McGraw Hill, 2001.

**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 diode Zener 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”, 4<sup>th</sup> 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”, 4<sup>TH</sup> Edition, McGraw Hill, 2016.

**REFERENCES:**

1. Donald A Neaman, "Semiconductor Physics and Devices", 4<sup>th</sup> Edition, McGraw Hill, 2012.
2. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory" Pearson Prentice Hall, 11<sup>th</sup> Edition, 2014.
3. Bhattacharya and Sharma, "Solid State Electronic Devices", 2<sup>nd</sup> Edition, Oxford University Press, 2014.
4. R.S.Sedha, "A Textbook of Electronic Devices and Circuits", 2<sup>nd</sup> Edition, S.Chand Publications, 2008.
5. David A. Bell, "Electronic Devices and Circuits", 5<sup>th</sup> Edition, Oxford University Press, 2008.

**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 introduce Phasor diagrams and analysis of three phase circuits

**UNIT I BASIC CIRCUITS ANALYSIS 9**

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 CIRCUITS 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 AC CIRCUITS 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: voltage and current division, source transformation –mesh and node analysis, Thevenins and Norton Theorems – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem – Millman's theorem.

**UNIT IV THREE PHASE CIRCUITS 9**

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 9**

Series and parallel resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Ability to introduce electric circuits and its analysis
- Ability to impart knowledge on solving circuit equations using network theorems
- Ability to introduce the phenomenon of resonance in coupled circuits.
- Ability to introduce Phasor diagrams and analysis of three phase circuits

**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.

**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 inc, 1995.
5. Andrzej M. Trzynadlowski, „Introduction to Modern Power Electronics“, Second edition, wiley

**OBJECTIVES :**

To impart knowledge on safety engineering fundamentals and safety management practices.

**UNIT I INTRODUCTION****9**

Evolution of modern safety concepts – Fire prevention – Mechanical hazards – Boilers, Pressure vessels, Electrical Exposure.

**UNIT II CHEMICAL HAZARDS****9**

Chemical exposure – Toxic materials – Ionizing Radiation and Non-ionizing Radiation - Industrial Hygiene – Industrial Toxicology.

**UNIT III ENVIRONMENTAL CONTROL****9**

Industrial Health Hazards – Environmental Control – Industrial Noise - Noise measuring instruments, Control of Noise, Vibration, - Personal Protection.

**UNIT IV HAZARD ANALYSIS****9**

System Safety Analysis –Techniques – Fault Tree Analysis (FTA), Failure Modes and Effects Analysis (FMEA), HAZOP analysis and Risk Assessment

**UNIT V SAFETY REGULATIONS****9**

Explosions – Disaster management – catastrophe control, hazard control ,Safety education and training - Factories Act, Safety regulations Product safety – case studies

**TOTAL : 45 PERIODS****OUTCOMES:**

Students must be able to identify and prevent chemical, environmental mechanical, fire hazard through analysis and apply proper safety techniques on safety engineering and management

**TEXT BOOK:**

1. John V.Grimaldi, “Safety Management”, AITB S Publishers, 2003.

**REFERENCES:**

1. Safety Manual, “EDEL Engineering Consultancy”, 2000.
2. David L.Goetsch, “Occupational Safety and Health for Technologists”, 5th Edition, Engineers and Managers, Pearson Education Ltd., 2005.

**OBJECTIVE:**

To understand the various destructive and non destructive testing methods of materials and its industrial applications.

**UNIT I INTRODUCTION TO MATERIALS TESTING****9**

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 MECHANICAL TESTING****9**

Introduction to mechanical testing, Hardness test (Vickers, Brinell, Rockwell), Tensile test, Impact test (Izod, Charpy) - Principles, Techniques, Methods, Advantages and Limitations, Applications. Bend test, Shear test, Creep and Fatigue test - Principles, Techniques, Methods, Advantages and Limitations, Applications.

**UNIT III NON DESTRUCTIVE TESTING****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 MATERIAL CHARACTERIZATION TESTING****9**

Macroscopic and Microscopic observations, Optical and Electron microscopy (SEM and TEM) Principles, Types, Advantages and Limitations, Applications. Diffraction techniques, Spectroscopic Techniques, Electrical and Magnetic Techniques- Principles, Types, Advantages and Limitations, Applications.

**UNIT V OTHER TESTING****9**

Thermal Testing: Differential scanning calorimetry, Differential thermal analysis. Thermo-mechanical and Dynamic mechanical analysis: Principles, Advantages, Applications. Chemical Testing: X-Ray Fluorescence, Elemental Analysis by Inductively Coupled Plasma-Optical Emission Spectroscopy and Plasma-Mass Spectrometry.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Identify suitable testing technique to inspect industrial component
- Ability to use the different technique and know its applications and limitations

**TEXT BOOKS:**

1. Baldev Raj, T.Jayakumar, M.Thavasimuthu “Practical Non-Destructive Testing”, Narosa Publishing House, 2009.
2. Cullity, B. D., “Elements of X-ray diffraction”, 3<sup>rd</sup> Edition, Addison-Wesley Company Inc., New York, 2000.
3. P. Field Foster, “The Mechanical Testing of Metals and Alloys” 7<sup>th</sup> Edition, Cousens Press, 2007.

**REFERENCES:**

1. Metals Handbook: Mechanical testing, (Volume 8) ASM Handbook Committee, 9 Edition, American Society for Metals, 1978.



2. ASM Metals Handbook, "Non-Destructive Evaluation and Quality Control", American Society of Metals, Metals Park, Ohio, USA.
3. Brandon D.G., "Modern Techniques in Metallography", Von Nostrand Inc. NJ, USA, 1986.

**UNIT I ENVIRONMENTAL IMPLICATIONS OF BUILDINGS****9**

Energy use, carbon emissions, water use, waste disposal; Building materials: sources, methods of production and environmental Implications. Embodied Energy in Building Materials: Transportation Energy for Building Materials; Maintenance Energy for Buildings.

**UNIT II IMPLICATIONS OF BUILDING TECHNOLOGIES EMBODIED ENERGY OF BUILDINGS****9**

Framed Construction, Masonry Construction. Resources for Building Materials, Alternative concepts. Recycling of Industrial and Buildings Wastes. Biomass Resources for buildings.

**UNIT III COMFORTS IN BUILDING****9**

Thermal Comfort in Buildings- Issues; Heat Transfer Characteristic of Building Materials and Building Techniques. Incidence of Solar Heat on Buildings-Implications of Geographical Locations.

**UNIT IV UTILITY OF SOLAR ENERGY IN BUILDINGS****9**

Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings.

**UNIT V GREEN COMPOSITES FOR BUILDINGS****9**

Concepts of Green Composites. Water Utilisation in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes. Management of Sullage Water and Sewage. Urban Environment and Green Buildings. Green Cover and Built Environment.

**TOTAL: 45 PERIODS****TEXT BOOKS:**

1. K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao. Alternative Building Materials and Technologies. New Age International, 2007.
2. Low Energy Cooling For Sustainable Buildings. John Wiley and Sons Ltd, 2009. 3. Sustainable Building Design Manual. Vol 1 and 2, Teri, New Delhi, 2004.
- 3.

**REFERENCES:**

1. Osman Attmann Green Architecture Advanced Technologies and Materials. McGraw Hill, 2010.
2. Jerry Yudelson Green building Through Integrated Design. McGraw Hill, 2009.
3. Fundamentals of Integrated Design for Sustainable Building By Marian Keeler, Bill Burke

**OBJECTIVES**

- To make the student conversant with the water treatment methods including adsorption and oxidation process.
- To provide basic understandings 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”, 4<sup>th</sup> ed., McGraw Hill Higher Edu., 2002.
2. W. Wesley Eckenfelder, Jr., “Industrial Water Pollution Control”, 2<sup>nd</sup>Edn., McGraw Hill Inc., 1989.

## REFERENCES

1. S.P. Mahajan, "Pollution control in process industries", 27<sup>th</sup> Ed. Tata McGraw Hill Publishing Company Ltd., 2012.
2. M. Lancaster, "Green Chemistry: An Introductory Text", 2<sup>nd</sup> edition, RSC publishing, 2010.
3. C.S. Rao, "Environmental Pollution Control Engineering", New Age International, 2007.

**PRIST DEEMED TO BE UNIVERSITY**  
**School of Engineering & Technology**  
**Department of Mechanical Engineering**  
**Mapping of Courses to Cross cutting Issues**  
**B.Tech Mechanical Engineering (R - 2020)**

Programme Name & Code	Course Code	Title of the Course	Cross cutting Issues				
			Gender Sensitization and Human Values	Professional Ethics and Human Values	Environment and Sustainability and Human Values	Human Values	Professional Ethics
B.Tech - 20UGMECHFT	20154C51	Thermal Engineering- II	-	-	-	-	-
B.Tech - 20UGMECHFT	20154C52	Design of Machine Elements	-	-	-	-	-
B.Tech - 20UGMECHFT	20154C53	Metrology and Measurements	-	-	-	-	-
B.Tech - 20UGMECHFT	20154C55	Theory of Machines-II	-	-	-	-	-
B.Tech - 20UGMECHFT	20154L56	Theory of Machines Laboratory	-	-	-	-	-
B.Tech - 20UGMECHFT	20154L57	Thermal Engineering Laboratory	-	-	-	-	-
B.Tech - 20UGMECHFT	20154L58	Metrology and Measurements Laboratory	-	-	-	-	-
B.Tech - 20UGMECHFT	201AGIE	Innovation and Entrepreneurship	-	-	-	-	✓

B.Tech - 20UGMECHFT	20154C61	Design of Transmission Systems	-	-	-	-	-
B.Tech - 20UGMECHFT	20154C62	Computer Aided Design And Manufacturing	-	-	-	-	-
B.Tech - 20UGMECHFT	20154C63	Heat and Mass Transfer	-	-	-	-	-
B.Tech - 20UGMECHFT	20154C64	Finite Element Analysis	-	-	-	-	-
B.Tech - 20UGMECHFT	20154C65	Hydraulics And Pneumatics	-	-	-	-	-
B.Tech - 20UGMECHFT	20154L67	CAD / CAM Laboratory	-	-	-	-	-
B.Tech - 20UGMECHFT	20154L68	Design and Fabrication Project	-	-	-	-	-
B.Tech - 20UGMECHFT	20154L69	Professional Communication	✓	-	-	-	-
B.Tech - 20UGMECHFT	201ASTT	Technical Training	-	✓	-	-	-
B.Tech - 20UGMECHFT	20154E66A	Automobile Engineering	-	-	-	-	-
B.Tech - 20UGMECHFT	20154E66B	Artificial and Neural Network	-	-	-	-	-
B.Tech - 20UGMECHFT	20154E66C	Refrigeration and Air Conditioning	-	-	-	-	-
B.Tech - 20UGMECHFT	20154E66D	Machine Tool Design	-	-	-	-	-
B.Tech - 20UGMECHFT	20154E66E	Plant Layout and Material handling	-	-	-	-	-

B.Tech - 20UGMECHFT	20150OE54A	Data Base management systems	-	-	-	-	-
B.Tech - 20UGMECHFT	20150OE54B	Cloud computing	-	-	-	-	-
B.Tech - 20UGMECHFT	20152OE54A	Basics Of Bio Medical Instrumentation	-	-	-	-	-
B.Tech - 20UGMECHFT	20152OE54B	Sensors And Transducers	-	-	-	-	-
B.Tech - 20UGMECHFT	20153OE54A	Industrial Nano Technology	-	-	-	-	-
B.Tech - 20UGMECHFT	20153OE54B	Energy Conservation and Management	-	-	-	-	-
B.Tech - 20UGMECHFT	20155OE54A	Air Pollution And Control Engineering	-	-	-	-	-
B.Tech - 20UGMECHFT	20155OE54B	Geographic Information Systems	-	-	-	-	-
B.Tech - 20UGMECHFT	20154FE54A	Renewable energy sources	-	-	-	-	-
B.Tech - 20UGMECHFT	20154OE54B	Automotive Systems	-	-	-	-	-

## 1.3.1 SUPPORTING DOCUMENTS

Courses (offered in 2019-20) which address the Gender Sensitization, Human Values, Professional Ethics, Environment and sustainability.

### SCHOOL OF ENGINEERING AND TECHNOLOGY

#### DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Gender Sensitization and Human Values	
Professional Ethics	
Human Values	
Environment and sustainability	
Professional Ethics & Human Values	



## 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
<b>1</b>	3	3	2	3	2	1	1	2	1	1	3	1	3
<b>2</b>	3	3	3	3	3	1	1	1	1	1	1	2	2
<b>3</b>	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**

## SEMESTER I

S.No	Course Code	Course Title	L	T	P	C
1	<b>19147S11</b>	<b>Communicative English</b>	4	0	0	4
2	<b>19148S12</b>	Engineering Mathematics - I	4	0	0	4
3	<b>19149S13</b>	Engineering Physics	3	0	0	3
4	<b>19149S14</b>	Engineering Chemistry	3	0	0	3
5	<b>19154S15</b>	Engineering Graphics	2	0	4	4
6	<b>19150S16</b>	Problem Solving and Python programming	3	0	0	3
<b>PRACTICAL</b>						
7	<b>19150L17</b>	Problem Solving and Python Programming Laboratory	0	0	4	2
8	<b>19149L18</b>	Physics and Chemistry Laboratory	0	0	4	2
9	<b>191VEA19</b>	Value Education				-
<b>TOTAL CREDITS</b>						<b>25</b>

## SEMESTER – II

S.No	Course Code	Course Name	L	T	P	C
1	<b>19147S21</b>	<b>Technical English</b>	4	0	0	4
2	<b>19148S22A</b>	Engineering Mathematics - II	4	0	0	4
3	<b>19149S23B</b>	Physics for Electronics Engineering	3	0	0	3
4	<b>19149S24A</b>	Environmental Science and Engineering	3	0	0	3
5	<b>19153S25C</b>	Circuit Theory**	2	2	0	3
6	<b>19154S26C</b>	Basic Civil and Mechanical Engineering	4	0	0	2
<b>PRACTICAL</b>						
7	<b>19154L27</b>	Engineering Practices Laboratory	0	0	4	2
8	<b>19153L28C</b>	Electric Circuits Laboratory	0	0	4	2
9	<b>191ICA29</b>	Fundamentals of Indian Constitution and Economy				-
<b>TOTAL CREDITS</b>						<b>25</b>

### SEMESTER III

S.No	Course Code	Course Name	L	T	P	C
1	<b>19149S31C</b>	Transforms and Partial Differential Equations	3	1	0	4
2	<b>19153C32</b>	Digital Logic Circuits	3	1	0	4
3	<b>19153C33</b>	Electromagnetic Theory	2	2	0	4
4	<b>19153C34</b>	Electrical Machines - I**	2	2	0	4
5	<b>19153C35</b>	Electron Devices and Circuits	3	0	0	4
6	<b>19153C36</b>	Power Plant Engineering	3	0	0	4
<b>PRACTICAL</b>						
7	<b>19153L37</b>	Electronics Laboratory	0	0	3	2
8	<b>19153L38</b>	Electrical Machines Laboratory - I###	0	0	3	2
<b>TOTAL CREDITS</b>						<b>28</b>

### SEMESTER IV

S.No	Course Code	Course Name	L	T	P	C
1	<b>19149C41C</b>	Numerical Methods	3	1	0	4
2	<b>19153C42</b>	Electrical Machines - II**	2	2	0	4
3	<b>19153C43</b>	Transmission and Distribution	3	1	0	4
4	<b>19153C44</b>	Measurements and Instrumentation	3	1	0	4
5	<b>19153C45</b>	Linear Integrated Circuits and Applications	3	1	0	4
6	<b>19153C46</b>	Control Systems	2	2	0	4
<b>PRACTICAL</b>						
7	<b>19153L47</b>	Electrical Machines Laboratory - II###	0	0	4	2
8	<b>19153L48</b>	Linear and Digital Integrated Circuits Laboratory	0	0	4	2
9	<b>19153L49</b>	Technical Seminar	0	0	2	1
10	<b>19153CRS</b>	Research Led Seminar	1	0	0	1
<b>TOTAL CREDITS</b>						<b>30</b>

## 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
<b>PRACTICAL</b>						
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
<b>RESEARCH SKILL DEVELOPMENT (RSD) COURSE</b>						
10	19153CRM	Research Methodology	3	0	0	3
<b>TOTAL CREDITS</b>						<b>31</b>

## 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
<b>PRACTICAL</b>						
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
<b>RESEARCH SKILL DEVELOPMENT (RSD) COURSE</b>						
9	19153CBR	Participation in Bounded Research	0	0	3	2
<b>TOTAL CREDITS</b>						<b>26</b>

## SEMESTER – VII

S.No	Course Code	Course Name	L	T	P	C
1	<b>19153C71</b>	High Voltage Engineering	4	0	0	4
2	<b>19153C72</b>	Power System Operation and Control	4	0	0	4
3	<b>19153C73</b>	Renewable Energy Systems**	4	0	0	4
4	<b>19153FE74_</b>	Free Elective -II	3	0	0	3
5	<b>19153E75_</b>	Elective - III	3	0	0	3
6	<b>19153E76_</b>	Elective - IV	3	0	0	3
<b>PRACTICAL</b>						
7	<b>19153L77</b>	Power System Simulation Laboratory##	0	0	3	2
8	<b>19153L78</b>	Renewable Energy Systems Laboratory	0	0	3	2
<b>RESEARCH SKILL DEVELOPMENT (RSD) COURSE</b>						
9	<b>19153CSR</b>	Participation in Scaffolded Research (Design / Socio Technical Project)	0	0	5	5
<b>TOTAL CREDITS</b>						<b>30</b>

## SEMESTER – VIII

S.No	Course Code	Course Name	L	T	P	C
1.	<b>19153E81_</b>	Elective - V	3	0	0	3
2.	<b>19153E82_</b>	Elective - VI	3	0	0	3
<b>PRACTICAL</b>						
3.	<b>19153P81</b>	Project Work	-	-	-	15
4.	<b>19153PEE</b>	Programme Exit Examination				2
<b>TOTAL CREDITS</b>						<b>23</b>
<b>TOTAL NO.OF CREDITS =226</b>						

\*\* 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.	<b>19153E64A</b>	Design of Electrical Apparatus	3	0	0	3
2.	<b>19153E64B</b>	Power Systems Stability	3	0	0	3
3.	<b>19153E64C</b>	Modern Power Converters	3	0	0	3
4.	<b>19153E64D</b>	Intellectual Property Rights	3	0	0	3

### ELECTIVE – II (VI SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1.	<b>19153E65A</b>	<b>Principles of Robotics</b>	3	0	0	3
2.	<b>19153E65B</b>	Special Electrical Machines	3	0	0	3
3.	<b>19153E65C</b>	Power Quality	3	0	0	3
4.	<b>19153E65D</b>	EHVAC Transmission	3	0	0	3

### ELECTIVE – III (VII SEMESTER)

S.No	Course Code	Course Name	L	T	P	C
1	<b>19153E75A</b>	<b>Disaster Management</b>	3	0	0	3
2	<b>19153E75B</b>	<b>Human Rights</b>	3	0	0	3
3	<b>19153E75C</b>	Operations Research	3	0	0	3
4	<b>19153E75D</b>	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
<b>TOTAL CREDITS</b>													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

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>1</b>	<b>0</b>	<b>4</b>

**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, 43<sup>rd</sup> Edition, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7<sup>th</sup> 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, 10<sup>th</sup> Edition, 2016.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3<sup>rd</sup> 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", 12<sup>th</sup> 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 conduction 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<sub>2</sub>-O<sub>2</sub> 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 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, 50<sup>th</sup> 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, 2<sup>nd</sup> 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'', 2<sup>nd</sup> 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 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 polymer by viscometry.

1. Estimation of HCl using  $\text{Na}_2\text{CO}_3$  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<sup>TH</sup> 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 supplementary 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  $w = cz + z^2$  - 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, 43<sup>rd</sup> Edition, 2014.
2. Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10<sup>th</sup> 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, 7<sup>th</sup> Edition, 2009.
2. Jain R.K. and Iyengar S.R.K., " Advanced Engineering Mathematics ", Narosa Publications, New Delhi , 3<sup>rd</sup> 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, 4<sup>th</sup> 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&amp;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 theorem – 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 NANO-ELECTRONIC 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 structures,
- 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', 2<sup>nd</sup> 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, Hyderabad, 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 CIRCUITS****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 Publishing Co., New Delhi, 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., “Basic Civil Engineering”, Anuradha Agencies, 2005.
4. ShanthaKumar SRJ., “Basic Mechanical Engineering”, Hi-tech Publications, Mayiladuthurai, 2000.
5. Venugopal K. and Prahuraja 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 of AC signal parameter (peak-peak, rms period, frequency) using CR. measurement
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, foundry 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**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>

**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**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**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.



**UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS AND PROGRAMMABILITY LOGIC DEVICES 6+6**

Asynchronous sequential logic circuits-Transition stability, flow stability-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**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>2</b>	<b>2</b>	<b>0</b>	<b>4</b>

**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



**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<sup>th</sup> 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, 3<sup>rd</sup> Edition, Reprint 2015.
3. S.K. Bhattacharya, 'Electrical Machines' McGraw - Hill Education, New Delhi, 3<sup>rd</sup> 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 diode characteristics- 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 able 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<sup>th</sup> edition 2008.
2. Sedra and smith, “Microelectronic circuits”,7<sup>th</sup> Ed., Oxford University Press

**REFERENCES:**

1. Balbir Kumar, Shail.B.Jain, “Electronic devices and circuits” PHI learning private limited, 2<sup>nd</sup> edition 2014.
2. Thomas L.Floyd, “Electronic devices” Conventional current version, Pearson prentice hall, 10<sup>th</sup> 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 : *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.

**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:**

- Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008.

**REFERENCES:**

- El-Wakil. M.M., "Power Plant Technology", Tata McGraw – Hill Publishing Company Ltd., 2010.
- Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.
- 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 enable the students to understand the behavior of semiconductor device based on experimentation.

**LIST OF EXPERIMENTS**

- Characteristics of Semiconductor diode and Zener diode
- Characteristics of a NPN Transistor under common emitter, common collector and common base configurations
- Characteristics of JFET and draw the equivalent circuit
- Characteristics of UJT and generation of saw tooth waveforms
- Design and Frequency response characteristics of a Common Emitter amplifier
- Characteristics of photo diode & photo transistor, Study of light activated relay circuit
- Design and testing of RC phase shift and LC oscillators
- Single Phase half-wave and full wave rectifiers with inductive and capacitive filters
- Differential amplifiers using FET
- Study of CRO for frequency and phase measurements
- Realization of passive filters

**OUTCOMES:**

- Ability to understand and analyse electronic circuits.

**TOTAL: 60 PERIODS****LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

- Semiconductor devices like Diode, Zener Diode, NPN Transistors, JFET, UJT, Photo diode, Photo Transistor
- Resistors, Capacitors and inductors
- Necessary digital IC 8
- Function Generators 10
- Regulated 3 output Power Supply 5,  $\pm$  15V 10
- CRO 10
- Storage Oscilloscope 1
- Bread boards
- Atleast one demo module each for the listed equipments.
- 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", 9<sup>th</sup> Edition, Cengage Learning, 2016.
2. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10<sup>th</sup> 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<sup>th</sup> Edition, New Delhi, 2006.
3. Mathews, J.H. "Numerical Methods for Mathematics, Science and Engineering", 2<sup>nd</sup> Edition, Prentice Hall, 1992.
4. Sankara Rao. K., "Numerical Methods for Scientists and Engineers", Prentice Hall of India Pvt. Ltd, 3<sup>rd</sup> Edition, New Delhi, 2007.
5. Sastry, S.S, "Introductory Methods of Numerical Analysis", PHI Learning Pvt. Ltd, 5<sup>th</sup> 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<sup>th</sup> 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<sup>rd</sup> 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**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**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 cables 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 CABILITIES 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.



**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

<b>UNIT I</b>	<b>SYSTEMS AND REPRESENTATION</b>	<b>9</b>
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.		
<b>UNIT II</b>	<b>TIME RESPONSE</b>	<b>9</b>
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.		
<b>UNIT III</b>	<b>FREQUENCY RESPONSE</b>	<b>9</b>
Frequency response: – Bode plot – Polar plot – Determination of closed loop response from open loop response - Correlation between frequency domain and time domain specifications		
<b>UNIT IV</b>	<b>STABILITY AND COMPENSATOR DESIGN</b>	<b>9</b>
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.		
<b>UNIT V</b>	<b>STATE VARIABLE ANALYSIS</b>	<b>9</b>
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 Houppis Stuart, 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**

- Regulation of three phase alternator by EMF and MMF methods.
- Regulation of three phase alternator by ZPF and ASA methods.
- Regulation of three phase salient pole alternator by slip test.
- Measurements of negative sequence and zero sequence impedance of alternators.
- V and Inverted V curves of Three Phase Synchronous Motor.
- Load test on three-phase induction motor.
- No load and blocked rotor tests on three-phase induction motor (Determination of equivalent circuit parameters).
- Separation of No-load losses of three-phase induction motor.
- Load test on single-phase induction motor.
- No load and blocked rotor test on single-phase induction motor.
- 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:**

- Synchronous Induction motor 3HP – 1 No.
- DC Shunt Motor Coupled With Three phase Alternator – 4 nos
- DC Shunt Motor Coupled With Three phase Slip ring Induction motor – 1 No.
- Three Phase Induction Motor with Loading Arrangement – 2 nos
- Single Phase Induction Motor with Loading Arrangement – 2 nos
- Tachometer -Digital/Analog – 8 nos
- Single Phase Auto Transformer – 2 nos
- Three Phase Auto Transformer – 3 nos
- Single Phase Resistive Loading Bank – 2 nos
- Three Phase Resistive Loading Bank – 2 nos
- 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	
<b>Consumabilitys (sufficient quantity)</b>			
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.



**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. Kinley '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 basic 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-pulse converters— 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  $120^\circ$  mode and  $180^\circ$  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<sup>th</sup> 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”, 8<sup>th</sup> Edition, McGraw Hill Education, 2011.
2. Cay S. Horstmann, Gary cornell, “Core Java Volume –I Fundamentals”, 9<sup>th</sup> Edition, Prentice Hall, 2013.

**REFERENCES**

1. Paul Deitel, Harvey Deitel, “Java SE 8 for programmers”, 3<sup>rd</sup> 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.

<b>19153L57</b>	<b>CONTROL AND INSTRUMENTATION LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>

**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) LVDT 20mm 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

- 1 | Develop and implement Java programs for simple applications that make use of classes, packages and interfaces.

- 1 | Develop and implement Java programs with arraylist, exception handling and multithreading .
- 1 | 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 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. **Interact** English Lab Manual for Undergraduate Students,. OrientBlackSwan: 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
4	0	0	4

19153C61

**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", 6<sup>th</sup> edition, Pearson Education, 2015
5. N.K. De., P.K. SEN "Electric drives" PHI, 2012.

**19153C62****PROTECTION AND SWITCHGEAR**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**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, SF<sub>6</sub>, 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 International Pvt 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., New Delhi, 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**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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<sup>2</sup>C) –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 (1 $\Phi$  & 3 $\Phi$  semi converters, 1 $\Phi$  & 3 $\Phi$  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



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, vandigrav 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 capability.

**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

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

#### 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.

**19153L77****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. Compilers: C, C++, VB, VC++ - 30 users

**RENEWABLE ENERGY SYSTEMS LABORATORY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>

**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	

<b>Consumabilitys (Minimum of 5 Nos. each)</b>			
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**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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 single 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**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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**

**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 control issues- 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 and statics in robotics
- To know about the various path planning techniques.
- To know about the dynamics and control in robotics industries.

**TEXT BOOKS:**

1. R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi, 4th Reprint, 2005.
2. John J. Craig, Introduction to Robotics Mechanics and Control, Third edition, Pearson Education, 2009.
3. M.P.Groover, M.Weiss, R.N. Nagel and 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 Granaghan, 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**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:** To impart knowledge about the following topics:

- EHVAC Transmission lines
- Electrostatic field of AC lines
- Corona in E.H.V. lines

<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
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.		
<b>UNIT II</b>	<b>ELECTROSTATIC FIELDS</b>	<b>9</b>
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.		
<b>UNIT III</b>	<b>POWER CONTROL</b>	<b>9</b>
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.		
<b>UNIT IV</b>	<b>CORONA EFFECTS AND RADIO INTERFERENCE</b>	<b>9</b>
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.		
<b>UNIT V</b>	<b>STEADY STATE AND TRANSIENT LIMITS</b>	<b>9</b>
Design of EHV lines based on steady state and transient limits - EHV capabilities 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 capabilities.
- 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 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, Scenarios 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, IAS 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 Magna 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 Disability 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**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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 Libebberman, "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**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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<sup>th</sup> Edition, 2015.
2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4<sup>th</sup> Edition, 2007.

**REFERENCES :**

1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8<sup>th</sup> Edition, 2014.
2. Papoulis, A. and Unnikrishnapillai, S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4<sup>th</sup> Edition, New Delhi, 2010.
3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3<sup>rd</sup> 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<sup>th</sup> Edition, 2007.

<b>19153E76A</b>	<b>SYSTEM IDENTIFICATION AND ADAPTIVE CONTROL</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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, 3<sup>rd</sup> 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**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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 MOTOR DRIVE****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 Control Prentice- 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 lightning strokes and the production of lightning 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 lightning 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, 2<sup>nd</sup> 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:**

- Dale H.Besterfield, 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:**

- James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8<sup>th</sup> Edition, First Indian Edition, Cengage Learning, 2012.
- Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
- Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
- ISO9001-2015 standards

<b>19153E81A</b>	<b>FLEXIBLE AC TRANSMISSION SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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, "Flexible A.C. Transmission Systems", Institution of Electrical and Electronic Engineers (IEEE), 1999.
3. V.K.Sood, HVDC and FACTS controllers—Applications of Static Converters in Power System, APRIL 2004, Kluwer Academic Publishers, 2004.

**SOFT COMPUTING TECHNIQUES**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

19153E81B

**OBJECTIVES:** To impart knowledge about the following topics:

- 11 Basics of artificial neural network.
- 11 Concepts of modelling and control of neural and fuzzy control schemes.
- 11 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:**

- 11 Ability to understand the concepts of ANN, different features of fuzzy logic and their modelling, control aspects and different hybrid control schemes.
- 11 Ability to understand the basics of artificial neural network.
- 11 Ability to get knowledge on modelling and control of neural.
  
- 11 Ability to get knowledge on modelling and control of fuzzy control schemes.
- 11 Ability to acquire knowledge on hybrid control schemes.
- 11 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,



- 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.

<b>19153E81D</b>	<b>ELECTRIC ENERGY GENERATION, UTILIZATION CONSERVATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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-Variou 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.

<b>19153E82A</b>	<b>ENERGY MANAGEMENT AND AUDITING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:** To impart knowledge about the following topics:

- || To impart 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 impart 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, 1<sup>st</sup> 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**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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, 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), 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”, CRC Press 2012.
2. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, “Smart Grid: Technology and Applications”, Wiley 2012.

**REFERENCES**

- || Vehbi C. 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, November 2011.
- || 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.
- || 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 pCO<sub>2</sub>, pO<sub>2</sub>, 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, 2<sup>nd</sup> edition, 2003
3. Joseph J Carr and John M.Brown, Introduction to Biomedical Equipment Technology, JohnWiley and sons, New York, 4<sup>th</sup> 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.



# COURSE STRUCTURE

B.TECH PT

EEE

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## B. Tech (PT) EEE R 19

## SEMESTER I

Sl. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
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
<b>Total No of Credits</b>						<b>19</b>

## SEMESTER II

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
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
<b>Total No of Credits</b>						<b>19</b>

## 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	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
<b>Total No of Credits</b>						<b>18</b>

## 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
<b>Total No of Credits</b>						<b>18</b>

## 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
<b>Total No of Credits</b>						<b>18</b>

## 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
<b>Total No of Credits</b>						<b>18</b>

## 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
<b>Total No of Credits</b>						<b>20</b>

## 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

**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

# 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**

## 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”, Macmillan , 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**



## **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 & NETWORK 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.

**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, $\pi$ , 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.

# 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 AMPLIFIER & OSCILLATORS

12

Four basic types of feedback – effect of feedback on amplifier performance – condition for oscillation – Barkhausen 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 able 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, 4<sup>th</sup> Edition, 2001.
2. Millman Taub.H, “Pulse Digital & Switching waveform”, Tata McGraw Hill International 2001.
3. Jacob Millman Cristas C.Halkias, “Integrated Electronics”, Tata McGraw Hill, Edition 1991.

# 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**

## **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.

- 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

- 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.

**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**

## **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.

**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.

## UNIT II: 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. Lucas M.Fualkenberry ,Walter Coffe, '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

### **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.

**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****COURSE 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. 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, 4<sup>th</sup> edition, 2002 / PHI.
3. David A.Bell, 'Op-amp & Linear ICs', Prentice Hall of India, 2<sup>nd</sup> 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° & 180° mode] 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.

- Ability to choose the converters for real time applications.

**TEXT BOOKS:**

1. Rashid M.H., "Power Electronics Circuits, Devices and Applications", Prentice Hall India, 3<sup>rd</sup> Edition, New Delhi, 2004.
2. Ned Mohan, T.M.Undeland, W.P.Robbins, "Power Electronics: Converters, applications and design", John wiley and Sons, 3<sup>rd</sup> 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.

# 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**

## 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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## 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

**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 earthing 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<sub>6</sub> 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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# 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

**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.



# 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 to design the systems for enhancing stability.

## UNIT I- THE POWER SYSTEM AN OVER VIEW AND MODELLING 12

Modern 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 the 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 – Clearing 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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## 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.McGranaghram, Surya Santoso, H.Wayne Beaty, 'Electrical Power Systems Quality' McGraw Hill, 2003.
2. PSCAD User Manual.

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**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, 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.

### 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.

## 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.

**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.



<b>UNIT 1</b>	<b>9</b>
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.	
<b>UNIT 2</b>	<b>9</b>
Static Relay Circuits (Using Analog and Digital IC’s) for Over Current, Inverse Time Characteristics, Differential Relay and Directional Relay.	
<b>UNIT 3</b>	<b>9</b>
Static Relay Circuits for Generator Loss of Field, Under Frequency Distance Relays, Impedance, Reactance, MHO, Reverse Power Relays.	
<b>UNIT 4</b>	<b>9</b>
Static Relay Circuits for Carrier Current Protection – Steady State and Transient Behavior of Static Relays – Testing and Maintenance – Tripping Circuits using Thyristor.	
<b>UNIT 5</b>	<b>9</b>
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”.

## 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  $\lambda$ -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.

## 19153L65P POWER SYSTEMS LAB

0 0 3 2  
Semester VI

### AIM

To simulate analysis and planning cases for a practical power system.

### 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

**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 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. Dale H. Besterfield, 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 – Heinemann Ltd., Oxford. 1989.
3. Narayana V. and Sreenivasan, N.S. "Quality Management – Concepts and Tasks", New Age International 1996



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 single 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

<b>UNIT I -THERMAL POWER PLANTS</b>	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	
<b>UNIT II - HYDRO ELECTRIC POWER PLANTS</b>	9
Layout – Dams – Selection of water turbines – Types – Pumped storage hydel plants	
<b>UNIT III - NUCLEAR POWER PLANTS</b>	9
Principles of nuclear energy – Fission reactions – Nuclear reactor – Nuclear power plants	
<b>UNIT IV- GAS AND DIESEL POWER PLANTS</b>	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	
<b>UNIT V- NON – CONVENTIONAL POWER GENERATION</b>	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

**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****COURSE 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. 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.

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**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.
- |
- |

- 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.

**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**

### **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.Pfaffer, 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.

**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 hetero 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: Czochralski (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.

# 19153E44EP NON-CONVENTIONAL ENERGY SYSTEMS AND APPLICATIONS 2024

## 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**

**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.

**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**

**COURSE OUTCOMES**

- Analysis of transients using various parametric & non parametric methods.

- Analysis of various control schemes used 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**

<b>UNIT I</b>	<b>9</b>
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.	
<b>UNIT II</b>	<b>9</b>
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.	
<b>UNIT III</b>	<b>9</b>
Sampling theorem, PAM, PWM, PPM, Pulse Code Modulation, Noise in PCM, Delta Modulation, Adaptive Delta modulation, DPCM, M'ary system, FDM and TDM.	
<b>UNIT IV</b>	<b>9</b>
Digital Modulation, ASK, FSK, PSK, DPSK, Basic Principles of Optical Communication, Satellite Comm., Mobile Comm.	
<b>UNIT V</b>	<b>9</b>
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



**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.

**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

**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, Commercial 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 Peregrinus 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

**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**

## **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 Resources 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.

**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.

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 Learning, 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 .

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**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, 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, laser applications.

**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.

**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.

- 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  $V_{ref}$  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.

## 19153E74AP - POWER SYSTEM TRANSIENTS

**3 0 0 3**  
Semester VII

### AIM

To understand generation of switching and lightning transients, their propagation, reflection and refraction on the grid and 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 lightning strokes and the production of lightning 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 devices 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 lightning 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.

## 19153E74BP -EHV AC and DC TRANSMISSION SYSTEMS

3 0 0 3

<b>UNIT I</b>	<b>TRANSMISSION ENGINEERING</b>	<b>9</b>
Transmission line trends – Standard transmission voltages – Power handling capacity and line losses Cost of transmission lines and equipment – Mechanical consideration – Transmission Engineering principles.		
<b>UNIT II</b>	<b>LINE PARAMETER</b>	<b>9</b>
Calculation of line and ground parameters - Resistance, capacitance and Inductance calculation – Bundle conductors – modes propagation – Effect of earth.		
<b>UNIT III</b>	<b>POWER CONTROL</b>	<b>9</b>
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.		
<b>UNIT IV</b>	<b>EHV AC Transmission</b>	<b>9</b>
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.		
<b>UNIT V</b>	<b>HVDC TRANSMISSION</b>	<b>9</b>
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', 3<sup>rd</sup> 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.
-

**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.

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

**PRIST**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**  
**RING M.TECH - POWER ELECTRONICS AND DRIVES (FULL**  
**TIME) CURRICULUM – REGULATION 2019**  
**SEMESTER-I**

**SEMESTER-I**

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1.	19248S11D	Applied Mathematics For Electrical & Electronics Engineering	3	1	0	4
2	19272H12	System Theory	3	1	0	4
3	19272H13	Power System Modeling and Analysis	3	1	0	4
4	19272H14	Economic Operations of Power Systems-I	3	1	0	4
5	19272H15	High Voltage Direct Current Transmission System	3	1	0	4
6	19272E16_	Elective-I	3	1	0	4
7	19272L17	Power System Simulation Lab-I	0	0	3	3
8	19272CRS	Research Led Seminar				1
TOTAL						28

**SEMESTER-II**

SL. NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	19272H21	EHV power transmission	3	1	0	4
2	19272H22	Economic Operations of Power Systems-II	3	1	0	4
3	19272H23	Power System Protection	3	1	0	4
4	19272E24_	Elective-II	3	1	0	4
5	19272E25_	Elective-III	3	1	0	4
6	19272L26	Power System Simulation Lab-II	0	0	3	3
7	192TECWR	Technical Writing/Seminars	0	0	3	3
8	19272CRM	Research Methodology				3
9	19272CBR	Participation in Bounded Research				2
TOTAL						31



**SEMESTER-III**

SL. NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	19272H31	Electrical Transients in power systems	3	1	0	4
2	19272E32_	Elective-IV	3	1	0	4
3	19272E33_	Elective-V	3	1	0	4
4	19272E34_	Elective-VI	3	1	0	4
5	19272P35	ProjectworkPhase-I	0	0	6	6
6	19272CSR	Design Project/Socio Technical Project (Scaffolded Research)				4
TOTAL						26

**SEMESTER-IV**

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	19272P44	ProjectworkPhase-II	0	0	12	12

**Total Credits= 97****Elective-I**

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	19272E16A	Analysis of Inverters	3	1	0	4
2.	19272E16B	Modeling and Analysis of Electrical Machines	3	1	0	4

**Elective-II**

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	19272E24A	Flexible AC Transmission system	3	1	0	4
2.	19272E24B	Power System Planning and Reliability	3	1	0	4

**Elective-III**

SL.NO.	SUBJECT CODE	SUBJECT	L	T	P	C
1	19272E25A	Wind Energy conversion systems	3	1	0	4
2.	19272E25B	AI Techniques to Power Systems	3	1	0	4

**Elective-IV**

<b>SL.NO.</b>	<b>SUBJECTCODE</b>	<b>SUBJECT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1	19272E32A	PowerElectronics applicationsinPower systems	3	1	0	4
2.	19272E32B	PowersystemDynamics	3	1	0	4

**Elective-V**

<b>SL.NO.</b>	<b>SUBJECTCODE</b>	<b>SUBJECT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1	19272E33A	Power Conditioning	3	1	0	4
2.	19272E33B	Powersystem restructuringand deregulation	3	1	0	4

**Elective-VI**

<b>SL.NO.</b>	<b>SUBJECTCODE</b>	<b>SUBJECT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1	19272E34A	SoftwareforControl system Design	3	1	0	4
2.	19272E34B	IndustrialPower system analysisanddesign	3	1	0	4

## 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
<b>Total Credits</b>											<b>100</b>

\*RSD-Research Skill Development

# ***SYLLABUS***

**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

$$\frac{d^2f}{dx^2} + \frac{1}{x} \frac{df}{dx} \quad \text{and Transform of} \quad \frac{d^2f}{dx^2} + \frac{1}{x^2} \frac{df}{dx} + \frac{n^2f}{x^2}$$

$$\frac{dx^2}{x dx} \quad \frac{dx^2}{x dx} + \frac{n^2}{x^2}$$

$$L=45T=15P=0C=4$$

**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).

**1. PHYSICAL SYSTEMS AND STATE ASSIGNMENT 9**

Systems-electrical- mechanical-hydraulic-pneumatic-thermalsystems- 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=45T=15P =0C=4*

**REFERENCES**

1. M.Gopal, 'Modern Control Engineering', Wiley, 1996.
2. J.S.Bay, 'Linear State Space Systems', McGraw-Hill, 1999.
3. Eroni-Umezand 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-POWERSYSTEMMODELLINGAND ANALYSIS****3104****1. SOLUTIONTECHNIQUE****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. POWERFLOWANALYSIS****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. OPTIMALPOWER 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. SHORTCIRCUITANALYSIS****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. TRANSIENTSTABILITYANALYSIS****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=45T=15P =0C=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****3104****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 siting 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.

$$L=45T=15P=0C=4$$

**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 Wiley and sons Inc, New York, 1958.
3. Krichmayer L.K., "Economic control of interconnected systems", John Wiley and sons Inc, New York, 1959.
4. Elgerd O.I., "Electric energy system theory – an introduction", McGraw Hill, New Delhi, 1971.



**19253E16B-HIGHVOLTAGEDIRECTCURRENTTRANSMISSIONSYSTEM****3104**

- 1. DCPOWERTRANSMISSIONTECHNOLOGY** **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. ANALYSISOFHVDCCONVERTERS** **9**  
Pulse number – choice of converter configuration simplified analysis of Graetz circuit converter converter bridge characteristics – characteristics of a twelve pulse converter – detailed analysisof converters.
- 3. CONVERTERANDHVDCSYSTEMCONTROL** **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. HARMONICSANDFILTERS** **9**  
Introduction – generation of harmonics – design of AC filters – DC filters – carrier frequencyand RI noise.
- 5. SIMULATIONOFHVDCSYSTEMS** **9**  
Introduction– systemsimulation: Philosophyand tools- HVDC systemsimulation– modeling of HVDC systems for digital dynamic simulation.

**L =45T=15P =0C=4****REFERENCES**

1. Padiyar.K.R.,HVDCpowertransmissionsystem,WileyEasternLimited,NewDelhi,1990.
2. EdwardWilsonKimbark,Direct CurrentTransmission,Vol.1,WileyInterscience,NewYork, London, Sydney, 1971.
3. RakoshDas Begamudre, Extrahighvoltage AC transmissionengineering WileyEasternLtd., New Delhi, 1990.
4. Arrillaga,J,Highvoltagedirect currenttransmission,peterPregrinus,London, 1983.
5. Adamson.CandHingorani.N.G.,HighVoltageDirectCurrentPowerTransmission, Garraway Limited, London, 1960. WWW.hvdc.ca

**19272L17-POWER SYSTEMSIMULATIONLABORATORY-I0033**

**EXPERIMENTS**

1. Formation of Ybus, Zbus, 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-EHVPOWERTRANSMISSION

3104

**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<sup>2</sup>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

$$L=45T=15P=0C=4$$

**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](http://www.microtran.com)).

**19272H22-ECONOMIC OPERATIONS OF POWER SYSTEMS-II****3104****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", McGrawHill, 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", McGrawHill, 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. Cusum, C. Vournas, "voltage stability of power system", Kluwer Academic Publishers, 1998.
7. Elgerd O.L., "Electric energy system theory – an introduction", McGrawHill, New Delhi, 1971.

## 19272H23-POWERSYSTEMPROTECTION

3104

## 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.

$$L=45T=15P=0C=4$$

**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, Rayroll’s 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.

**LIST OF EXPERIMENTS:**

1. Small signal stability analysis: SMIB and Multi-machine configuration.
2. Transient 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

3104

- 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.

$$L = 45T = 15P = 0C = 4$$

**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 MS 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 SLTPC****3003****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.



**TEXTBOOKS:**

- 1 Ned Mohan, T. M. Undeland and W. P. Robbins, "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 Vencislav Cekov Valchev, "Inductors and Transformers for Power Electronics", CRC Press, Taylor & Francis Group, 2005
- 8 W. G. Hurley and W. H. Wolfe, "Transformers and Inductors for Power Electronics Theory, Design and Applications", 2013 John Wiley & Sons Ltd.
- 9 Marian. K. Kazimierczuk and Dariusz Czarkowski, "Resonant Power Converters", John Wiley & Sons limited, 2011

**19272E16B -MODELLINGANDANALYSISOFFELECTRICAL MACHINES****3104****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 DETERMINATION OF 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.

$$L=45T=15P=0C=4$$

**TEXTBOOKS**

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.

**OBJECTIVES:****3003**

- 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 SUBSYNCHRONOUS 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**  
**OBJECTIVES:**

**DESIGN OF SUBSTATIONS**

**LTPC**  
**3003**

- 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 – Disconnecter 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 toward 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 PritindraChowdhuri, "Electromagnetictransientsinpowersystems", PHILearning Private Limited, New Delhi, Second edition, 2004.
- 6 "Designguideforruralsubstation", UnitedStatesDepartmentofAgriculture, RUS Bulletin, 1724E-300, June 2001.
- 7 AIEECommitteeReport, "SubstationOne-lineDiagrams," AIEETrans. OnPower Apparatus and Systems, August 1953.
- 8 HermannKoch, "GasInsulatedSubstations", Wiley-IEEEPress, 2014.

19272E24A

SMARTGRID

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.

**APPLICATIONS**

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, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley 2012.
- 3 Vehbi C. 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, 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.



**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 STANDALONE 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 stand alone 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.



## 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****LTPC****OBJECTIVES:****3003**

- 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 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 Dorin Neacsu, "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" Taylor and Francis Publications, Second edition 2006.

**19272E25A-WINDENERGYCONVERSIONSYSTEMS****3104****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 ELECTRIC 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 - Permanent 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. L. Freris, Prentice hall (U.K) Ltd., 1990.

**19272E25B-AITECHNIQUESTOPOWERSYSTEMS****3104**

- 1. INTRODUCTIONTONEURALNETWORKS 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**  
 Applicationofneuralnetworksto loadforecasting - 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-AlgorithmApplicationsand Programming Techniques", Addison Wesley, 1990.
2. GeorgeKlirandTinaFolger.A.,,Fuzzy sets,Uncertainty andInformation",PrenticeHall of India, 1993.
3. Zimmerman.H.J.,,FuzzySetTheoryanditsApplications",KluwerAcademicPublishers 1994.
4. IEEEtutorialon,,ApplicationofNeuralNetworktoPowerSystems",1996.
5. LoiLeiLai,,IntelligentSystemApplicationsinPowerEngineering",JohnWiley&SonsLtd.,1998.

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2. TuranGonen, "ElectricPowerDistributionSystemEngineering", McGrawHillCompany. 1986
3. JamesNorthcote-Green, RobertWilson, "ControlandAutomationofElectricalPower DistributionSystems", CRC Press, NewYork, 2007.
4. PablaHS, "ElectricalPowerDistribution Systems", TataMcGrawHill. 2004

## **19272E25 DENERGYMANAGEMENT AND AUDITING LTPC**

**OBJECTIVES:** **3003**

- 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****3104****UNIT: I STATIC COMPENSATOR CONTROL****9**

Theory of load compensation-voltage regulation and power factor correction- phase balance and PF correction of unbalanced 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 - Genex 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****TEXTBOOK**

Miller.T.J.E,“Reactive power control in Electric systems”.Wiley interscience,New York, 1982.

**REFERENCES**

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 Genex Excitation systems”, IEEE Trans.On PAS.PAS -96, July/August, 1977, pp1219-1325.

**19272E32B-POWERSYSTEMDYNAMICS****3104****1. SYNCHRONOUSMACHINEMODELLING 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 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.

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.

**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 ELECTRICVEHICLESANDVEHICLEMECHANICS 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 – Ultracapacitors

**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, Crosstalk- 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 IV EMI ELEMENTS AND CIRCUITS 9**

Electromagnetic Emission, noise sources, 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 measure 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 electronics systems", John Wiley & Sons, 1989
3. Bernhard Keiser, "Principles of Electro-magnetic Compatibility", Artech House, Inc. (685 Canton Street, Norwood, MA 02062 USA) 1987
4. Bridges, J.E. Millett, J. and Ricketts, L.W., "EM 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.

**19272E33A- 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-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: Detrit 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", Starsina Circle Publications, 1994 (2nd edition)
3. Dugan.R.C, "Electrical Power System Quality", TMH, 2008.
4. Arrillaga.A. 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)****19272E33B–POWERSYSTEMRESTRUCTURINGANDDEREGULATION****3104****1. FUNDAMENTALSANDARCHITECTUREOFPOWERMARKETS 9**

Deregulation of Electric utilities: Introduction-Unbundling-Wheeling- Reform motivations- Fundamentals of Deregulated Markets – Types (Future, Day-ahead and Spot) –Participating inMarkets(ConsumerandProducerPerspective) –bilateralmarkets – 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 – 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. 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 – 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. INDIANPOWER 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 =45T=15P =0C=4**

**REFERENCES**

1. KankarBhattacharya,MathH.J.BollenandJaapE.Daalder,“Operationof Restructured Power Systems”, Kluwer Academic Publishers, 2001
2. LoiLeiLai, “PowersystemRestructuringandRegulation”,JohnWileysons,2001.
3. Shahidehpour.M and Alomoush.M, “Restructuring Electrical Power Systems”, Marcel Decker Inc., 2001.
4. StevenStoft,“Power SystemEconomics”,Wiley–IEEEPress,2002
5. Daniel S. Kirschen and Goran Strbac, “ Fundamentals of Power System Economics”, John Wiley& Sons Ltd., 2004.
6. ScholarlyTransactionPapersand Utilityweb sites

<b>19272E33C</b>	<b>CONTROLSYSTEMDESIGNFORPOWER ELECTRONICS</b>	<b>L T P C</b>
		<b>3 0 0 3</b>

**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 Chakraborty, Marija, "Control and Optimization Methods for Electric Smart Grids", Springer, 2012.

19272E33D

ADVANCED DIGITAL SIGNAL PROCESSING

LTPC3003

**COURSE OBJECTIVES**

- To expose the student 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 DSP processors & develop logical functions of DSP processors
- To discuss on Application development with commercial family of DSP 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 TMS320C54xx and TMS320C6xxx 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**



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 Processor help 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. Rulph Chassaing 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 MBhaskar "Digital Signal Processors", TMH, 2<sup>nd</sup>, 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 Press 2009.
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.

**19272E34A-SOFTWAREFORCONTROLSYSTEMDESIGN****3104****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 =45T=15P =0C=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- INDUSTRIALPOWERSYSTEMANALYSISAND DESIGN**  
**3104**

- |  |          |
|--|----------|
| <b>1. MOTORSTARTINGSTUDIES</b>   | <b>9</b> |
| Introduction-Evaluation Criteria-Starting Methods-System Data-Voltage Drop Calculations- Calculationof Accelerationtime-MotorStartingwithLimited-CapacityGenerators-Computer-Aided Analysis-Conclusions.               |          |
| <b>2. POWERFACTORCORRECTIONSTUDIES</b>   | <b>9</b> |
| Introduction-System Description and Modeling-Acceptance Criteria-Frequency ScanAnalysis-Voltage Magnification Analysis-SustainedOvervoltages-Switching Surge Analysis- Back-to-Back Switching-Summary and Conclusions. |          |
| <b>3. HARMONICANALYSIS</b>   | <b>9</b> |
| Harmonic Sources-System Response to Harmonics-System Model for Computer-Aided Analysis-Acceptance Criteria-Harmonic Filters-Harmonic Evaluation-Case Study-Summary and Conclusions.                                    |          |
| <b>4. FLICKERANALYSIS</b>  | <b>9</b> |
| SourcesofFlicker-Flicker Analysis-FlickerCriteria-DataforFlickeranalysis-CaseStudy-Arc Furnace Load-Minimizing the Flicker Effects-Summary.  |          |
| <b>5. GROUNDGRIDANALYSIS</b>   | <b>9</b> |
| Introduction-Acceptance Criteria-Ground Grid Calculations-Computer-Aided Analysis - Improving the Performance of the Grounding Grids-Conclusions.  |          |

**L =45T=15P =0C=4**

**REFERENCES**

1. Ramasamy Natarajan, "Computer-Aided Power System Analysis", Marcel Dekker Inc., 2002.

**19272E34C      SOFT COMPUTING TECHNIQUES      LTPC****OBJECTIVES:      3003**

- To expose the concepts of feedforward neural networks.
- To provide adequate knowledge about feedback 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 FFLC 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 feedforward networks-Mc Culloch Pitts neuron model- perceptron model- Adaline and Madaline- multilayer perception model- back propagation learning methods- effect of learning rule coefficient -backpropagation algorithm-factors affecting backpropagation training-applications.

**UNIT II ARTIFICIAL NEURAL NETWORKS AND ASSOCIATIVE MEMORY      9**

Counterpropagation 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.

**UNITY****HYBRIDCONTROL SCHEMES****9**

Fuzzification and rule base using ANN-Neurofuzzy 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:45PERIODS****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  
OBJECTIVES:**

**RESTRUCTURED POWERSYSTEM**

**LTPC  
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 adequacy – 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 of 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. Bollen, "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 Wiley 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) : 5X4=20 Marks

● Seminar Review Presentation : 10 Marks

● Literature Survey : 10 Marks

● **Semester Examination :** **60 Marks**

(Essay type Questions set by the concerned resource persons)

**Blueprintforassessmentofstudent’sperformanceinDesign/SocioTechnical Project**

- **ContinuousInternalAssessmentthroughReviews:** **40 Marks**
  - ReviewI : 10Marks
  - ReviewII : 10Marks
  - ReviewIII : 20Marks
- **EvaluationofSocioTechnicalPracticumFinalReport:** **40Marks**
- **Viva-VoceExamination:** **20 Marks**
- **Total:** **100 Marks**

**Blueprintforassessmentofstudent’sperformanceinResearchMethodology**

**Courses**

**ContinuousInternalAssessment:** **20 Marks**

- ResearchTools(Lab): 10 Marks
- Tutorial: 10 Marks

**ModelPaperWriting:** **40 Marks**

- Abstract: 5 Marks
- Introduction: 10 Marks
- Discussion: 10 Marks
- Review ofLiterature: 5 Marks
- Presentation: 10 Marks

**SemesterExamination:** **40Marks**

**Total:** **100 Marks**

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**PRIST UNIVERSITY****FACULTY OF ENGINEERING AND TECHNOLOGY**

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

**PROGRAMME: M.TECH-POWER SYSTEMS (PART TIME)****CURRICULUM -REGULATION 2017****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
<b>Research Skill development course (RSD course)</b>						
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	192TECW RP	Technical Writing/Seminars	0	0	3	3
<b>Research Skill development course (RSD course)</b>						
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
<b>Research Skill development course (RSD course)</b>						
5	19272CSR	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
<b>Total Credits</b>											<b>100</b>

\*RSD-Research Skill Development

**HOD**

**DEAN E&T**

**DEAN ACADEMICS**

**VICE CHANCELLOR**

# ***SYLLABUS***



SEMESTER I

**19248S11DP -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  $\frac{df}{dx}$  where p is a root of  $J_n(p) = 0$ , Transform of

$$\frac{d^2f}{dx^2} + \frac{1}{x} \frac{df}{dx}, \text{ and Transform of } \frac{d^2f}{dx^2} + \frac{1}{x} \frac{df}{dx} - \frac{n^2f}{x^2}$$

$$L = 45 \quad T = 15 \quad P = 0 \quad C = 4$$

**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).

**19272C12P - SYSTEM THEORY****3 1 0 4**

<b>1. PHYSICAL SYSTEMS AND STATE ASSIGNMENT</b>	<b>9</b>
Systems - electrical - mechanical - hydraulic - pneumatic - thermal systems - modelling of some typical systems like D.C. Machines - inverted pendulum.	
<b>2. STATE SPACE ANALYSIS</b>	<b>9</b>
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.	
<b>3. MIMO SYSTEMS - FREQUENCY DOMAIN DESCRIPTIONS</b>	<b>9</b>
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.	
<b>4. NON-LINEAR SYSTEMS</b>	<b>9</b>
Types of non-linearity - typical examples - equivalent linearization - phase plane analysis - limit cycles - describing functions - analysis using describing functions - jump resonance.	
<b>5. STABILITY</b>	<b>9</b>
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.	

 **$L = 45 \quad T = 15 \quad P = 0 \quad C = 4$** **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.

$$L = 45 \quad T = 15 \quad P = 0 \quad C = 4$$

**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**

**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

$$L = 45 \quad T = 15 \quad P = 0 \quad C = 4$$

**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](http://www.microtran.com)).

**SEMESTER – II****19272C22P - POWER SYSTEM PROTECTION****3 1 0 4**  
**9****1. INTRODUCTION**

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.





**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 siting 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.

$$L = 45 \quad T = 15 \quad P = 0 \quad C = 4$$

**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.

**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](http://WWW.hvdc.ca)

**19272L34P- POWER SYSTEM SIMULATION LAB – II      0 0 3 3**

**LIST OF EXPERIMENTS:**

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**

**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 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 Academic Publishers, 1998.
7. Elgerd O.L., "Electric energy systems theory – an introduction", McGraw Hill, New Delhi, 1971.

**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.

**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 DETERMINATION OF 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.

$$L = 45 \quad T = 15 \quad P = 0 \quad C = 4$$

**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 ELECTRIC 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 - Permanent 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.

**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.

**REFERENCES**

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.

<b>Semester</b>	<b>RSB Courses</b>	<b>Credits</b>
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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# SCHOOL OF ENGINEERING AND TECHNOLOGY

## DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

### Mapping of Courses to Cross cutting Issues

#### Department of Electrical and Electronics Engineering (R-2019)

Programme Name & Code	Course Code	Title of the Course	Cross cutting Issues							
			Gender Sensitization and Human Values	Professional Ethics and Human Values	Environment and Sustainability and Human Values	Human Values	Professional Ethics	Environment and Sustainability	Professional Ethics, Human Values and Environment and Sustainability	Gender Sensitization
B.Tech -19UGEEEPT	19148S11P	Transforms and Partial Differential Equations					✓			
B.Tech -19UGEEEPT	19153H13P	Circuit Analysis and Networks								
B.Tech -19UGEEEPT	19153H14P	Electronic circuits								
B.Tech -19UGEEEPT	19153H15P	Electrical Machines-I								
B.Tech -19UGEEEPT	19148S21P	Numerical Methods					✓			
B.Tech -19UGEEEPT	19150S22P	Computer Architecture								
B.Tech -19UGEEEPT	19153H23P	Electrical Machines-II								
B.Tech -19UGEEEPT	19153H24P	Digital Electronics								

B.Tech -19UGEEEPT	19153H25P	Transmission and Distribution								
B.Tech -19UGEEEPT	19148S31P	Probability and Statistics					✓			
B.Tech -19UGEEEPT	19152S32P	Analog Integrated Circuits								
B.Tech -19UGEEEPT	19153H33P	Power Electronics								
B.Tech -19UGEEEPT	19153H34P	Measurements and Instrumentation								
B.Tech -19UGEEEPT	19153L35P	Machines Lab								
B.Tech -19UGEEEPT	19153H41P	Protection and switch gear								
B.Tech -19UGEEEPT	19153H42P	High Voltage DC Transmission								
B.Tech -19UGEEEPT	19153H43P	Solid State Drives								
B.Tech -19UGEEEPT	19153E44CP	BioMedical Instrumentation					✓			
B.Tech -19UGEEEPT	19153L45P	Control System & Measurements Lab								
B.Tech -19UGEEEPT	19153H51P	Power System Analysis								
B.Tech -19UGEEEPT	19153H52P	Power Quality								
B.Tech -19UGEEEPT	19153H53P	Special Electrical Machines								
B.Tech -19UGEEEPT	19158E54AP	Environmental Science and Engineering						✓		
B.Tech -19UGEEEPT	19153L55P	Power Electronics & Drives Lab								
B.Tech -19UGEEEPT	19153H61P	Utilization of Electrical Energy								
B.Tech -19UGEEEPT	19153H62P	Solid State Relays								
B.Tech -19UGEEEPT	197153H63P	Power System Operation and Control								
B.Tech -19UGEEEPT	19160E64AP	Principles of Management					✓			
B.Tech -19UGEEEPT	19153L65P	Power Systems Lab								
B.Tech -19UGEEEPT	19160S71P	Total Quality Management					✓			
B.Tech -19UGEEEPT	19153H72P	Electrical Machine Design								
B.Tech -19UGEEEPT	19153H73P	Power Plant Engineering								
B.Tech -19UGEEEPT	19153E74DP	Advanced Control systems					✓			



B.Tech -19UGEEEEFT	19153P75P	Project Work									
B.Tech -19UGEEEEFT	197147S11	Communicative English					✓				
B.Tech -17UGEEEEFT	197148S12	Engineering Mathematics - I									
B.Tech -19UGEEEEFT	19149S13	Engineering Physics									
B.Tech -19UGEEEEFT	19149S14	Engineering Chemistry									
B.Tech -19UGEEEEFT	19154S15	Engineering Graphics									
B.Tech -19UGEEEEFT	19150S16	Problem Solving and Python programming									
B.Tech -19UGEEEEFT	19150L17	Problem Solving and Python Programming Laboratory									
B.Tech -19UGEEEEFT	19147S21	Technical English					✓				
B.Tech -19UGEEEEFT	19148S22A	Engineering Mathematics - II									
B.Tech -19UGEEEEFT	19149S23B	Physics for Electronics Engineering									
B.Tech -19UGEEEEFT	19149S24A	Environmental Science and Engineering						✓			
B.Tech -19UGEEEEFT	19153S25C	Circuit Theory									
B.Tech -19UGEEEEFT	19154S26C	Basic Civil and Mechanical Engineering									
B.Tech -19UGEEEEFT	19154L27	Engineering Practices Laboratory									
B.Tech -19UGEEEEFT	19153L28C	Electric Circuits Laboratory									
B.Tech -19UGEEEEFT	191ICA29	Fundamentals of Indian Constitution and Economy									
B.Tech -19UGEEEEFT	19149S31C	Transforms and Partial Differential Equations					✓				
B.Tech -19UGEEEEFT	19153C32	Digital Logic Circuits									
B.Tech -19UGEEEEFT	19153C33	Electromagnetic Theory									
B.Tech -19UGEEEEFT	19153C34	Electrical Machines - I									
B.Tech -19UGEEEEFT	19153C35	Electron Devices and Circuits									

<b>B.Tech -19UGEEEEFT</b>	<b>19153C36</b>	Power Plant Engineering								
<b>B.Tech -19UGEEEEFT</b>	<b>19153L37</b>	Electronics Laboratory								
<b>B.Tech -19UGEEEEFT</b>	<b>19153L38</b>	Electrical Machines Laboratory - I								
<b>B.Tech -19UGEEEEFT</b>	<b>19149C41C</b>	Numerical Methods					✓			
<b>B.Tech -19UGEEEEFT</b>	<b>19153C42</b>	Electrical Machines - II								
<b>B.Tech -19UGEEEEFT</b>	<b>19153C43</b>	Transmission and Distribution								
<b>B.Tech -19UGEEEEFT</b>	<b>19153C44</b>	Measurements and Instrumentation								
<b>B.Tech -19UGEEEEFT</b>	<b>19153C45</b>	Linear Integrated Circuits and Applications								
<b>B.Tech -19UGEEEEFT</b>	<b>19153C46</b>	Control Systems								
<b>B.Tech -19UGEEEEFT</b>	<b>19153L47</b>	Electrical Machines Laboratory - II								
<b>B.Tech -19UGEEEEFT</b>	<b>19153L48</b>	Linear and Digital Integrated Circuits Laboratory								
<b>B.Tech -19UGEEEEFT</b>	<b>19153L49</b>	Technical Seminar					✓			
<b>B.Tech -19UGEEEEFT</b>	<b>19153CRS</b>	Research Led Seminar					✓			
<b>B.Tech -19UGEEEEFT</b>	<b>19153C51</b>	Power System Analysis								
<b>B.Tech -19UGEEEEFT</b>	<b>19153C52</b>	Microprocessors and Microcontrollers								
<b>B.Tech -19UGEEEEFT</b>	<b>19153C53</b>	Power Electronics								
<b>B.Tech -19UGEEEEFT</b>	<b>19154FE54A</b>	Renewable Energy Sources						✓		
<b>B.Tech -19UGEEEEFT</b>	<b>19153C55</b>	Digital Signal Processing								
<b>B.Tech -19UGEEEEFT</b>	<b>19153C56</b>	Object Oriented Programming								
<b>B.Tech -19UGEEEEFT</b>	<b>19153L57</b>	Control and Instrumentation Laboratory								
<b>B.Tech -19UGEEEEFT</b>	<b>19153L58</b>	Object Oriented Programming Laboratory								
<b>B.Tech -19UGEEEEFT</b>	<b>19153L59</b>	Professional Communication					✓			
<b>B.Tech -19UGEEEEFT</b>	<b>19153CRM</b>	Research Methodology								
<b>B.Tech -19UGEEEEFT</b>	<b>19153C61</b>	Solid State Drives								

<b>B.Tech -19UGEEEEFT</b>	<b>19153C62</b>	Protection and Switchgear								
<b>B.Tech -19UGEEEEFT</b>	<b>19153C63</b>	Embedded Systems								
<b>B.Tech -19UGEEEEFT</b>	<b>19153E64C</b>	Design of Electrical Apparatus								
<b>B.Tech -19UGEEEEFT</b>	<b>19155FE74B</b>	Waste water Treatment						✓		
<b>B.Tech -19UGEEEEFT</b>	<b>19153L66</b>	Power Electronics and Drives Laboratory								
<b>B.Tech -19UGEEEEFT</b>	<b>19153L67</b>	Microprocessors and Microcontrollers Laboratory								
<b>B.Tech -19UGEEEEFT</b>	<b>19153MP68</b>	Mini Project								
<b>B.Tech -19UGEEEEFT</b>	<b>19153CBR</b>	Participation in Bounded Research								
<b>B.Tech -19UGEEEEFT</b>	<b>19153C71</b>	High Voltage Engineering								
<b>B.Tech -19UGEEEEFT</b>	<b>19153C72</b>	Power System Operation and Control								
<b>B.Tech -19UGEEEEFT</b>	<b>19153C73</b>	Renewable Energy Systems						✓		
<b>B.Tech -19UGEEEEFT</b>	<b>19153E65B</b>	Special Electrical Machines								
<b>B.Tech -19UGEEEEFT</b>	<b>19153E75B</b>	Human Rights				✓				
<b>B.Tech -19UGEEEEFT</b>	<b>19153E76F</b>	Total Quality Management					✓			
<b>B.Tech -19UGEEEEFT</b>	<b>19153L77</b>	Power System Simulation Laboratory								
<b>B.Tech -19UGEEEEFT</b>	<b>19153L78</b>	Renewable Energy Systems Laboratory								
<b>B.Tech -19UGEEEEFT</b>	<b>19153CSR</b>	Participation in Scaffolded Research (Design / Socio Technical Project)								
<b>B.Tech -19UGEEEEFT</b>	<b>19153E81F</b>	Professional Ethics in Engineering					✓			
<b>B.Tech -19UGEEEEFT</b>	<b>19153E82G</b>	Fundamentals of Nano Science								
<b>B.Tech -19UGEEEEFT</b>	<b>19153P81</b>	Project Work								
<b>M.Tech -19PGPSFT</b>	19248S11D	Applied Mathematics For Electrical &Electronics Engineering					✓			
<b>M.Tech -19PGPSFT</b>	19272H12	System Theory								
<b>M.Tech -19PGPSFT</b>	19272H13	Power System Modeling and Analysis								

<b>M.Tech -19PGPSFT</b>	19272H14	Economic Operations of Power Systems-I				✓				
<b>M.Tech -19PGPSFT</b>	19272H15	High Voltage Direct Current Transmission System								
<b>M.Tech -19PGPSFT</b>	19272E16A	Analysis of Inverters								
<b>M.Tech -19PGPSFT</b>	19272L17	Power System Simulation Lab-I								
<b>M.Tech -19PGPSFT</b>	19272CRS	Research Led Seminar					✓			
<b>M.Tech -19PGPSFT</b>	19272H21	EHV power transmission								
<b>M.Tech -19PGPSFT</b>	19272H22	Economic Operations of Power Systems-II				✓				
<b>M.Tech -19PGPSFT</b>	19272H23	Power System Protection								
<b>M.Tech -19PGPSFT</b>	19272E24A	Flexible AC Transmission system								
<b>M.Tech -19PGPSFT</b>	19272E25B	AI Techniques to Power Systems					✓			
<b>M.Tech -19PGPSFT</b>	19272L26	Power System Simulation Lab-II								
<b>M.Tech -19PGPSFT</b>	192TECWR	Technical Writing/Seminars					✓			
<b>M.Tech -19PGPSFT</b>	19272CRM	Research Methodology								
<b>M.Tech -19PGPSFT</b>	19272CBR	Participation in Bounded Research								
<b>M.Tech -19PGPSFT</b>	19272H31	Electrical Transients in power systems					✓			
<b>M.Tech -19PGPSFT</b>	19272E32A	Power Electronics applications in Power systems								
<b>M.Tech -19PGPSFT</b>	19272E33A	Power Conditioning								
<b>M.Tech -19PGPSFT</b>	19272E34B	Industrial Power system analysis and design								
<b>M.Tech -19PGPSFT</b>	19272P35	Project work Phase-I								
<b>M.Tech -19PGPSFT</b>	19272CSR	Design Project / Socio Technical Project (Scaffolded Research)								
<b>M.Tech -19PGPSFT</b>	19272P44	Project work Phase-II								
<b>M.Tech -19PG PS PT</b>	19248S11DP	Applied Mathematics For Electrical & Electronics Engineering					✓			

<b>M.Tech -19PG PS PT</b>	1922H12P	System Theory									
<b>M.Tech -19PG PS PT</b>	19272H13P	Power System Modeling and Analysis									
<b>M.Tech -19PG PS PT</b>	19272L14P	Power System Simulation Lab-I									
<b>M.Tech -19PG PS PT</b>	19272CRSP	Research Led Seminar					✓				
<b>M.Tech -19PG PS PT</b>	19272H21P	EHV power transmission.									
<b>M.Tech -19PG PS PT</b>	19272H22P	Power System Protection									
<b>M.Tech -19PG PS PT</b>	19272E23AP	Flexible AC Transmission System									
<b>M.Tech -19PG PS PT</b>	192TECWRP	Technical Writing/Seminars					✓				
<b>M.Tech -19PG PS PT</b>	19272CRMP	Research Methodology									
<b>M.Tech -19PG PS PT</b>	19272CBRP	Participation in Bounded Research									
<b>M.Tech -19PG PS PT</b>	19272H31P	Economic Operations of Power Systems-I						✓			
<b>M.Tech -19PG PS PT</b>	19272H32P	High Voltage Direct Current Transmission System									
<b>M.Tech -19PG PS PT</b>	19272E33AP	Analysis of Inverters									
<b>M.Tech -19PG PS PT</b>	19272L34P	Power System Simulation Lab-II									
<b>M.Tech -19PG PS PT</b>	19272CSR	Design Project / Socio Technical Project (Scaffolded Research)									
<b>M.Tech -19PG PS PT</b>	19272H41P	Economic Operations Of Power Systems-II						✓			
<b>M.Tech -19PG PS PT</b>	19272H42P	Electrical Transients in power systems									
<b>M.Tech -19PG PS PT</b>	19272E43AP	Wind Energy conversion systems						✓			
<b>M.Tech -19PG PS PT</b>	19272P44P	Project work Phase -I									
<b>M.Tech -19PG PS PT</b>	19272E51BP	Power system Dynamics					✓				
<b>M.Tech -19PG PS PT</b>	19272E52AP	Power Conditioning									
<b>M.Tech -19PG PS PT</b>	19272E53AP	Software for Control system Design					✓				
<b>M.Tech -19PG PS PT</b>	19272P61P	Project work Phase -II									



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**SCHOOL OF ARTS AND SCIENCE  
 DEPARTMENT OF MICROBIOLOGY**

**B. Sc., MICROBIOLOGY  
 Academic year 2019-2020  
 2019 REGULATION  
 Mapping of courses to Cross cutting Issues**

			SCY	SCY	SCY	SCY	SCY
	19116AEC13	Fundamentals of Microbiology		■			
	19116AEC14L	Fundamentals of Microbiology Lab		■			
	19115AEC15	Bio Chemistry I		■			
	19115AEC16L	Bio Chemistry I Lab		■			
	191__SEC01	Skill Based Elective-I	■				
	19111SEC01L	Communicative English Lab-I	■				
	191INDCONS	Indian Constitution		■			

	19116AEC23	Microbial Physiology			-		
	19116AEC24L	Microbial Physiology Lab			-		
	19115AEC25	BioChemistry II			■		
	19115AEC26L	Bio Chemistry II Lab			■		
	19116RLC27	Research LED Seminar			-		
	191__SEC02__	Skill Based Elective –II	■				
	19111SEC02L	Communicative English Lab-II	■				
	19116AEC33	Immunology	■				
	19116AEC34L	Immunology Lab	■				
	19112AEC35	Biostatistics			-		
	19112AEC36L	Biostatistics Lab			-		
	19116RMC37	Research Methodology	■				
	191__SEC03__	Skill based Elective- III	■	■			
	19111SEC03L	Communicative English Lab-III	■				
	19116AEC43	Virology					■
	19116AEC44L	Virology Lab					■

	19116AEC45	Bioinformatics	■				
	19116AEC46L	Bioinformatics Lab	■				
	191__SEC04__	Skill based Elective- IV	■				
	19111SEC04L	Communicative English Lab-IV	■				
	191ENVTSTU	Environmental Studies				■	
	19116AEC51	Food and Dairy Microbiology	■				
	19116AEC52	Molecular Biology	■				
	19116AEC53	Agricultural and Environmental Microbiology					■
	19116AEC54L	Food and Dairy Microbiology and Molecular Biology Lab	■				■
	19116AEC55L	Agricultural and Environmental Microbiology Lab				■	
	19116DSC56__	Discipline Specific Elective -I					
	19116DSC56A	Proteomics					■
	19116DSC56B	Bioinoculants				■	



	19116BRC57	Participation in Bounded Research	-				
	191__SEC05__	Skill based Elective- V	-				
	19111SEC05L	Communicative English Lab-V	-				
	19116AEC61	Industrial Microbiology				-	
	19116SEC62	Clinical Microbiology				-	
	19116AEC63L	Industrial Microbiology Lab					-
	19116SEC64L	Clinical Microbiology Lab					-
	19116DSC65_	Discipline Specific Elective - II					
	19116DSC65A	Recombinant DNA Technnology				-	
	19116DSC65B	Bioethics				-	
	191—OEC_	Open Elective	-				
	19116PRW67	Project Work	-				
	191__SEC06__	Skill Based Elective –VI	-				

	19111SEC06L	Communicative English Lab-VI	-				
	19116EXACT	Extension activities	-				
	19116PEE	Programme exit examinations	-				



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**SCHOOL OF ARTS AND SCIENCE  
DEPARTMENT OF MICROBIOLOGY**

**M. Sc., Syllabus  
Academic year 2019-2020  
2019 Regulation  
Mapping of courses to Cross cutting Issues**

			ENVIRONMENTAL IMPACT	SAFETY	RESOURCES	SUSTAINABILITY	TECHNOLOGY
		Microbiology		*			
		Microbiology		*			
		Microbiology			*		
		Microbiology					*
		Microbiology					
		Microbiology	*				
		Microbiology			*		
		Bioremediation and Waste Management				*	
		Microbiology			*		
		Microbiology				*	
		Microbiology			*		
		Microbiology			*		
		Microbiology	*				
		Microbiology	*				
		Microbiology	*				
		Microbiology					*

		Genomics and Proteomics		*			*
			*				
		Biotechnology				*	
		Lab Biotechnology	*				
		Biotechnology				*	
		Open Access				*	
		Technical Research	*				
		Plant Tissue Culture	*				
		Biotechnology	*				
		Microbiology			*		
		Bioinformatics					*
		Microbiology			*		
		Biotechnology			*		
		Biotechnology	*				
		Biotechnology	*				
		Microbiology			*		
		Microbiology			*		



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**DEPARTMENT OF MICROBIOLOGY**

**M.PHIL MICROBIOLOGY SYLLABUS - REGULATION 2019**

### Cross cutting

		Title of the Course	Cross cutting issues				
			Values	Gender	Environment	Quality	Research Values
	<b>193__11</b> (Common Paper)	Research Methodology		■			
	<b>193MBC12</b>	Advanced Microbiology	■				
	<b>193MBC13</b>	A. Microbial Biotechnology				*	
		B .Bioprocess and Enzyme Engineering					
	<b>CPE_RPE</b> (Common Paper)	Research and Publication Ethics					*
	<b>193MBC21</b>	Project Work					*





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### 1.3.1 SUPPORTING DOCUMENTS

Courses (offered in 2019-20) which address the Gender Sensitization, Human Values, Professional Ethics, Environment and sustainability.

#### SCHOOL OF ARTS AND SCIENCE

#### DEPARTMENT OF MICROBIOLOGY

Gender Sensitization and Human Values	
Professional Ethics	
Human Values	
Environment and sustainability	
Professional Ethics & Human Values	



School of Arts and Science  
Department of Microbiology  
B. Sc., Syllabus-Regulation 2019

**COURSE STRUCTURE**

Course Code	Course Title	L	T	P	C
<b>SEMESTER I</b>					
19110AEC11/ 19111AEC11/ 19132AEC11/ 19135AEC11	Language-I (Tamil-I/ Advanced English-I/ Hindi-I/ French-I	4	0	0	2
19111AEC12	English-I	4	0	0	2
19116AEC13	Fundamentals of Microbiology	6	0	0	4
19116AEC14L	Fundamentals of Microbiology Lab	0	0	3	2
19115AEC15B	Bio Chemistry I	6	1	0	5
19115AEC16BL	Bio Chemistry I Lab	0	0	3	2
191 SEC01	Skill Based Elective-I	0	0	2	1
19111SEC01L	Communicative English Lab-I	0	0	1	1
191INDCONS	Indian Constitution	-	-	-	-
	<b>Total</b>	<b>20</b>	<b>1</b>	<b>9</b>	<b>19</b>
<b>SEMESTER II</b>					
19110AEC21/ 19111AEC21/ 19132AEC21/ 19135AEC21	Language-II (Tamil-II/ Advanced English-II / Hindi-II/ French-II)	4	0	0	2
19111AEC22	English-II	4	0	0	2
19116AEC23	Microbial Physiology	6	1	0	4
19116AEC24L	Microbial Physiology Lab	0	0	3	2
19115AEC25	BioChemistry II	6	0	0	5
19115AEC26L	Bio Chemistry II Lab	0	0	3	2
19116RLC27	Research LED Seminar	-	-	-	1
191 SEC02	Skill Based Elective –II	0	0	2	1
19111SEC02L	Communicative English Lab-II	0	0	1	1
	<b>Total</b>	<b>20</b>	<b>1</b>	<b>09</b>	<b>20</b>
<b>SEMESTER III</b>					

19110AEC31/ 19111AEC31/ 19132AEC31/ 19135AEC31	Language-III (Tamil-III/ Advanced English-III / Hindi-III/ French-III)	4	0	0	2
19111AEC32	English-III	4	0	0	2
19116AEC33	Immunology	5	0	0	4
19116AEC34L	Immunology Lab	0	0	3	2
19112AEC35	Biostatistics	5	1	0	5
19112AEC36L	Biostatistics Lab	0	0	3	2
19116RMC37	Research Methodology	2	0	0	2
191 SEC03	Skill based Elective- III	0	0	2	1
19111SEC03L	Communicative English Lab-III	0	0	1	1
	<b>Total</b>	<b>20</b>	<b>1</b>	<b>09</b>	<b>21</b>
	<b>SEMESTER IV</b>				
19110AEC41/ 19111AEC41/ 19132AEC41/ 19135AEC41	Language-IV (Tamil-IV/ Advanced English-IV/ Hindi-IV/ French-IV)	4	0	0	2
19111AEC42	English-IV	4	0	0	2
19116AEC43	Virology	5	0	0	4
19116AEC44L	Virology Lab	0	0	3	2
19116AEC45	Bioinformatics	6	0	0	5
19116AEC46L	Bioinformatics Lab	0	0	3	2
191 SEC04	Skill based Elective- IV	0	0	2	1
19111SEC04L	Communicative English Lab-IV	0	0	1	1
191ENVTSTU	Environmental Studies	2	0	0	2
	<b>Total</b>	<b>21</b>	<b>0</b>	<b>9</b>	<b>21</b>
	<b>SEMESTER V</b>				
19116AEC51	Food and Dairy Microbiology	5	0	0	4
19116AEC52	Molecular Biology	5	0	0	3
19116AEC53	Agricultural and Environmental Microbiology	4	1	0	4
19116AEC54L	Food and Dairy Microbiology and Molecular Biology Lab	0	0	3	2
19116AEC55L	Agricultural and Environmental Microbiology Lab	0	0	3	2
19116DSC56__	Discipline Specific Elective -I	5	0	0	3
19116BRC57	Participation in Bounded Research	-	-	-	1
191 SEC05	Skill based Elective- V	0	0	2	1
19111SEC05L	Communicative English Lab-V	0	0	1	1
	<b>Total</b>	<b>19</b>	<b>1</b>	<b>9</b>	<b>21</b>
	<b>SEMESTER VI</b>				
19116AEC61	Industrial Microbiology	5	0	0	4

19116SEC62	Clinical Microbiology	5	0	0	5
19116AEC63L	Industrial Microbiology Lab	0	0	3	2
19116SEC64L	Clinical Microbiology Lab	0	0	3	2
19116DSC65_	Discipline Specific Elective - II	5	0	0	3
191—OEC_	Open Elective	4	0	0	2
19116PRW67	Project Work	-	-	-	4
191__SEC06_	Skill Based Elective –VI	0	0	2	1
19111SEC06L	Communicative English Lab-VI	0	0	1	1
19116EXACT	Extension activities	-	-	-	-
19116PEE	Programme exit examinations	-	-	-	1
	<b>Total</b>	<b>19</b>	<b>0</b>	<b>9</b>	<b>25</b>
	<b>Total Credits for the Programme</b>				<b>127</b>

### Discipline Specific Electives

Semester	Discipline Specific Elective Courses-I
V	a) 19116DSC56A - Proteomics b) 19116DSC56B - Bioinoculants
	<b>Discipline Specific Elective Courses-I</b>
VI	a) 19116DSC65A-Recombinant DNA Technology b) 19116DSC65B - Bioethics

### Open Electives

Semester	Open Elective Courses
VI	a) 19110OEC-Tamil Ilakiya varalaru b) 19111OEC-Journalism c) 19112OEC-Development of Mathematical Skills d) 19113OEC-Instrumentation e) 19114OEC-Food and Adulteration f) 19120OEC-E-Learning g) 19122OEC-Web Technology h) 19161OEC-Banking services

### Skill based Electives

Semester	Skill based Elective Courses
I	a) 19120SEC01AL-Package Lab – I b) 19160SEC01B-Soft skill – I
II	a) 19120SEC02AL-Package Lab – II b) 19160SEC02B-Soft skill – II
III	a) 19120SEC03AL-Package Lab –III

	b) 19160SEC03B-Soft skill – III
IV	a) 19120SEC04AL-Package Lab –IV b) 19160SEC04B- Soft skill – IV
V	a) 19120SEC05AL-Package Lab –V b) 19160SEC05B-Soft skill - V
VI	a) 19120SEC06AL-Package Lab –VI b) 19160SEC06B-Soft skill – VI

### Credit Distribution

Sem	AEC	SEC	DSC	OEC	Research	Others	Total
I	17	2	-	-	-	-	19
II	17	2	-	-	1	-	20
III	17	2	-	-	2	-	21
IV	17	2	-	-	-	2	21
V	12	5	3	-	1	-	21
VI	06	9	3	2	4	1	25
<b>Total</b>	<b>86</b>	<b>22</b>	<b>6</b>	<b>2</b>	<b>08</b>	<b>3</b>	<b>127</b>

Course Code	Course Title	L	T	P	C
19110AEC11	Tamil-I	4	0	0	2

## SEMESTER – I

முதல் பருவம் - தாள் - 1

**அலகு - I**

**பாரதியார் தேசபக்திப் பாடல்கள்**

- சுதந்திரப் பெருமை
- சுதந்திரப் பயிர்
- சுதந்திர தேவியின் துதி
- தொண்டு செய்யும் அடிமை

**பாரதிதாசன்**

- விரத்தாய்

**அலகு -II**

**சுரதா - நல்ல தீர்ப்பு**

**கண்ணதாசன் - கந்தல் துணியின் கதை**

**பட்டுக்கோட்டை கல்யாணசுந்தரம் - நண்டு செய்த தொண்டு - காலம் சரியில்லே**

**மு.மேத்தா - வாழையடி வாழை**

**வாலி - தாய்**

**அலகு - III**

**சிறுகதை - இளவேனிற் குழிப்புகள் - திருவையாறு பாலகுமார்**

**அலகு - IV**

**இலக்கணம்**

**எழுத்து**

**மனப்பாடப்பகுதி**

**அலகு - V**

**இலக்கிய வரலாறு**

**சிறுகதை, புதினம், நாடகம், உரைநடை, கவிதை,புதுக்கவிதை**

Course Code	Course Title	L	T	P	C
19111AEC11	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
19111AEC12	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
19116AEC13	Fundamentals of Microbiology	6	0	0	4

### Aim

To impart the basic principles of microorganism

### Objectives

To provide a strong, fundamental of microorganism for advanced studies in biological sciences

### 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 archaebacteria, Eubacteria, Cyanobacteria, Rickettsiae, 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:**

<b>S. No</b>	<b>Author Name</b>	<b>Title of the Book</b>	<b>Edition/year</b>	<b>Publisher</b>
1.	Jr. M.J. Pelczar, E.C.S. Chan and N.R. Kreig.	Microbiology	5 <sup>th</sup> /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
19116AEC14L	Fundamentals of Microbiology Lab	0	0	3	2

### Aim

- To isolate the microorganisms and understand the basic principles of microorganisms

### Objectives

- Isolation and culture techniques of bacteria
- The external features of bacteria and colony characteristics.
- Various staining techniques

### Outcomes

CO1 – To Develop basic skills in aseptic techniques for microbiology practical.

CO2 – To gain Hands on experience in handling various 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 glasswares and sterilization methods – autoclaving and hot air oven

3 Preparation of culture media

4 Experimental demonstration of the 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*, *Agaricus*) and protozoa (*Entamoeba histolytica* 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
19115AEC15B	Bio Chemistry I	6	1	0	5

### Aim

To provide the basics of biochemistry and its application.

### Objectives

It serves as good research techniques and the ability to combine and analyze information.

### 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 , 25<sup>th</sup> edn., McGraw Hill.

<b>Course Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
19115AEC16BL	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 quantitative and qualitative estimation biochemical analysis.

1. Qualitative Analysis of Carbohydrate.
2. Qualitative Analysis of Proteins.
3. Colour Reactions for Amino Acids.

**Skill Based Elective-I  
MS-WORD**

Course Code	Course Title	L	T	P	C
19120SEC01AL	Package Lab-I	0	0	2	1

**Outcome**

CO1- To Recognize when to use each of the Microsoft Office programs to create professional and academic documents.

CO2- To Use Microsoft Office programs to create personal, academic and business documents following current professional and/or industry standards.

CO3- To Apply skills and concepts for basic use of computer hardware, software, networks, and the Internet in the workplace and in future coursework as identified by the internationally accepted Internet and Computing Core (IC3) standards.

1. Prepare a bio-data with photo using text styles.
2. Prepare a college course details with headings, bullets and numbering.
3. Prepare a document in a newspaper format with header and footer.
4. Create a calendar by using auto format.
5. Prepare a contemporary letter using templates.
6. picture insertion and alignment
  - a. prepare a greeting card
  - b. prepare a handout
7. Create a mark sheet using tables. And find out the total marks.
8. Prepare a business letter for more than one company using mail merge

<b>Course Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
19160SEC01B	Soft Skill I	0	0	2	1

**Course outcome**

Make effective communication

**Part- I Effective Communication**

**UNIT I Effective communication I**

**Oral Communication:** Listening skills -Speaking skills (what to say and how to say it) – Gender neutral Language-Conflict, criticism, anger- Telephone skills.

**UNIT II Effective communication II**

**Written Communication:** Mechanics of writing, letters, notes, and reports- Resume preparation Faxes- Web sites- Email and Memos.

**Nonverbal Communication:** Behavior, Body language and Attitude.

Course Code	Course Title	L	T	P	C
19111SEC01L	Communicative English Lab -I	0	0	1	1

**Aim:**

- To acquaint with the basic grammar

**Objective:**

- To know English grammar and all the concomitant linguistic items
- To be aware of basic concepts related to the study of communication
- To understand the types of sentences and its patterns

**Outcome:**

CO1- To Learn grammar.

CO2- To Enrich vocabulary

CO3- To Understand the process of communication

CO4- To Develop listening skill

**UNIT –I**

Noun

Pronoun

Adjective

**UNIT – II**

Verb

Adverb

**UNIT –III**

Conjunction

Preposition

Interjection

**UNIT – IV**

Kinds of Sentences

**UNIT –V**

Patterns of sentences

**References:-**

A Practical English Grammar  
English Grammar

-A.J Thomson and A.V.Martinet  
-Wren and Martin

Course Code	Course Title	L	T	P	C
191INDCONS	Indian Constitution	0	0	0	0

### Objectives:

1. To make the students understand about the democratic rule and parliamentary 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



## SEMESTER II

Course Code	Course Title	L	T	P	C
19110AEC21	Tamil-II	4	0	0	2

### 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 பாசரம்- திருவாய்மொழி - எம்பெருமானுக்கு ஆட்படுதல் இன்பமே  
பெரியாழ்வார் - 1 பாசரம் - திருப்பல்லாண்டு - தாலப்பருவம்  
நாச்சியார் திருமொழி - 10 பாடல்கள்- ஆறாம் திருமொழி

### அலகு-III

சீற்றிலக்கியம் ,  
முக்கூடற்பள்ளு - வளமை, செழுமை  
மதுரை மீனாட்சியம்மை பிள்ளைத்தமிழ்- தாலப்பருவம்-ஐந்துபாடல்கள்

### அலகு-IV

இலக்கணம் - சொல்  
மனப்பாடப்பகுதி

### அலகு-V

இலக்கிய வரலாறு  
சைவ, வைணவ இலக்கியங்கள்  
சீற்றிலக்கியப்பள்ளு  
பிள்ளைத்தமிழ்  
பரணி

Course Code	Course Title	L	T	P	C
19111AEC21	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
19111AEC22	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
19116AEC23	Microbial Physiology	6	1	0	4

### Aim

To impart brief description on the microbial metabolism and its energetic

### Objectives

It deals with the various aerobic and anaerobic processes through which the organisms obtain and utilize the energy for their growth.

Explains photosynthesis and photosynthetic bacteria.

### Outcomes

CO1- To Determine the growth features of the microbes with various environmental factors.

CO2- To analyze 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 Mechanism 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

Anaerobic – 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	5 <sup>th</sup> /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 Manual of Determinative Bacteriology(9<sup>th</sup> 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
19116AEC24L	Microbial Physiology Lab	0	0	3	2

### Aim

To impart the chemical characterization of microbes

### Objectives

It Gives brief description on the microbial metabolism and its energetic

It deals with the various aerobic and anaerobic processes through which the organisms obtain and utilize the energy for their growth.

Explains photosynthesis and photosynthetic bacteria

### 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
19115AEC25	Bio Chemistry II	6	0	0	5

### **Aim**

To provide the basics of biochemistry and its application.

### **Objectives**

It serves as good research techniques and the ability to combine and analyze information.

### **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, Gibberlin 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
19115AEC26L	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



**Skill Based Elective-II  
MS-EXCEL**

<b>Course Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
19120SEC02AL	Package Lab-II	0	0	2	1

**Outcome**

- CO1- Identify the names and functions of the PowerPoint interface.
- CO2- Create, edit, save, and print presentations.
- CO3- Format presentations.
- CO4- Add a graphic to a presentation.
- CO5- Create and manipulate simple slideshow with outlines and notes.
- CO6- Create slide presentations that include text, graphics, animation, and transitions.

1. Prepare the addressing methods in excel
2. Describe the type of function
3. Draw a graph by using your own data
4. Prepare an Individual Pay Bill preparation for a employee in an organization.
5. Prepare a Mark list preparation for a student.
6. Prepare a Worksheet preparation for a company.
7. Prepare a Inventory Preparation
8. Prepare a Electricity Bill Preparation

<b>Course Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
19160SEC02B	Soft Skill II	0	0	2	1

## **Part -II Self Development**

### **UNIT I: Self -Assessment**

Self-Assessment, Self-Awareness, Self-Esteem, Personal success factors, handling failure, Depression and Habit, Self appraisal, SWOT analysis Perceptions and Attitudes, Positive Attitude, Values and Belief Systems, Personal Goal setting, Career Planning, Building of Self Confidence, prioritization.

### **UNIT II: Self- Management**

Managing Time, Managing Stress, Conflict Management

Course Code	Course Title	L	T	P	C
19111SEC02L	Communicative English Lab-II	0	0	1	1

**Aim:**

- To acquaint with the basic grammar

**Objective:**

- To learn about the auxiliary and the models
- To understand the different tenses and use it in sentences
- To know where to use and where not to use the articles
- To familiarize with the participle

**Outcome:**

CO1- Learn grammar.

CO2- Use a variety of reading strategies

CO3- Enhance the skill of making grammatically correct sentences.

**UNIT –I**

Auxiliaries

**UNIT –II**

Modals

**UNIT –III**

Tenses-Simple, Perfect

**UNIT –IV**

Tenses-Continuous, Perfect continuous

**UNIT –V**

Articles

Participle

**Reference**

A Practical English Grammar  
English Grammar

-A.J Thomson and A.V.Martinet  
-Wren and Martin

Course Code	Course Title	L	T	P	C
19110AEC31	Tamil-III	4	0	0	2

அலகு-I

சீலப்பதிகாரம்-  
மணிமேகலை -  
சீவகசிந்தாமணி -

வழக்குரை காதை  
ஆதிரை பிச்சையிட்ட காதை  
நாட்டுவளம் 10 பாடல்கள்

அலகு-II

பெரியபுராணம்-  
கம்பராமாயணம்

மெய்ப்பொருள் நாயனார் புராணம்  
-வாலி வதைப்படலம்

அலகு-III

சீறாப்புராணம் -  
இயேசுகாவியம் -

கரம் பொருத்து படலம்  
மலைப்பொழிவு

அலகு-IV

இலக்கணம்-  
மன்பாடப்பகுதி

யாப்பு இலக்கணம்

அலகு-V

இலக்கிய வரலாறு  
காப்பியங்கள்  
ஐஞ்சிறுகாப்பியங்கள்  
புராணங்கள், இதிகாசங்கள்

Course Code	Course Title	L	T	P	C
19111AEC31	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 clusters, syllables, 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
19111AEC32	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
19116AEC33	Immunology	5	0	0	4

**Aim:**

Designed to introduce the essential fundamentals of Immunology.

**Objectives**

- This course focuses on the concepts of immunology
- 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 Histocompatibility 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 <sup>th</sup> / 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
19116AEC34L	Immunology Lab	0	0	3	2

### Aim

To create the value on Immunology

### Objectives

- Acquire knowledge on medical experiments

### 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
19112AEC35	Biostatistics	5	1	0	5

**Aim:**

To represents an introduction to the field and provides a survey of data and data types.

**Objectives**

- Recognize and give examples of different types of data arising in public health and clinical studies
- Interpret differences in data distributions via visual displays
- Calculate standard normal scores and resulting probabilities

**Outcomes**

CO1- To gain Basic knowledge of mathematics as applied to biological phenomena.

CO2- To Improve the concepts of statistics and their importance

CO3- To Communicate the results of statistical analyses- accurately and effectively.

**Unit – I**

Use of statistics in biology – Measures of Central tendency – Mean, Median, Mode, Measure of dispersion Standard deviation – Standard error – Correlation Coefficient - Probability

**Unit – II**

Marginal conditional distribution – continuous and discrete distribution – Regression analysis – ‘t’ test, Chi-Square test, binomial, Normal and exponential, Biostat program.

**Unit – III**

Null hypothesis, level of significance, test of significance for mean / different

**Unit – IV**

Curve fitting – least square method – finite differences – difference operators – Newton’s forward and backward formula, Basics of the application of SPSS 7.5 window software package

**Unit – V**

MS Excel for computing data – Newton Raphson method, false position method – Solution of simultaneous algebraic equation.

**Reference:**

1. Introduction to numerical methods 1990 S.Shasta
2. Computer Oriented numerical methods 1971 V.Rajaraman
3. Introduction to Biostatistics by Sokal and Rohit 1973 Toppan Co. Japan

Course Code	Course Title	L	T	P	C
19112AEC36L	Biostatistics Lab	0	0	3	2

**Aim:**

- To represents an introduction to the field and provides a survey of data and data types.

**Objectives**

- Recognize and give examples of different types of data arising in public health and clinical studies
- Interpret differences in data distributions via visual displays
- Calculate standard normal scores and resulting probabilities

**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

1. Mean and Standard deviation using biological samples
2. Chi – Square test, Student ‘t’ test and Correlation coefficient
3. Regression Coefficient and regression lines

Course Code	Course Title	L	T	P	C
19116RMC37	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 the 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

**Prerequisites:**

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.

## Skill Based Elective-III

### POWER POINT

Course Code	Course Title	L	T	P	C
19120SEC03AL	PackageLab-III	0	0	2	1

#### Outcome

CO1- Indicate the names and functions of the **Excel** interface components.

CO2- Enter and edit data.

CO3- Format data and cells.

CO4- Construct formulas, including the use of built-in functions, and relative and absolute references.

CO5- Create and modify charts.

CO6- Preview and print worksheets.

1. Create a slideshow presentation for a seminar (choose your own topics)
  - a. Enter the text in the outline view
  - b. Create Non-bulleted and bulleted text
2. Create a slideshow presentation for a science exhibition
  - a. Create Non-bulleted and bulleted text
  - b. Apply appropriate text attributes
3. Create slide show presentation for an invitation
  - a. Insert an object from a bitmap file
  - b. Apply appropriate text attributes
  - c. Rotate the object to 45 degree
  - d. Apply shadow to the object
4. Create a slideshow presentation to display percentage of marks in each semester for all students
  - a. Use bar chart (x-axis: semester; y-axis: % of marks)
  - b. Use different presentation template and different transition effect for each slide
  - c. Use different text attributes in each slide
5. **Create a slideshow presentation for a shop advertisement to be open shortly**
6. Create a slideshow presentation to display percentage of sales in each quarter for the any vendor using bar chart (x-axis: Quarter; y-axis: % of sales)
7. Create a slideshow presentation for a tourists places
8. Create a slide for calendar using appropriate text attributes and insert an object from a bitmap file

Course Code	Course Title	L	T	P	C
19160SEC03B	SOFT SKILL III	0	0	2	1

### **Part -III Interpersonal Relations and Social Responsibilities**

#### **UNIT I: Interpersonal Relations**

Nature of groups and teams, Team effectiveness, Group discussions and decision making, Emotional Intelligence (EI) and Emotional Quotients (EQ), and its effect on team, Cross Cultural Aspects, Inter dependence, Peer Reviews.

#### **UNIT II: Ethics and Social Responsibilities**

Personal professional and corporate ethics, Ethical dilemma, Corporate social responsibilities: Green computing, Social accounting, Auditing, Civic sense.

Course Code	Course Title	L	T	P	C
19111SEC03L	Communicative English Lab-III	0	0	1	1

**Aim:**

To acquaint with the basic grammar

**Objective:**

- To familiarize with the clauses and phrases
- To learn the different degrees of comparison
- To change a sentence from active to passive and vice versa
- To know where to use punctuations
- To frame sentences
- To know the features, process, forms and barriers of communication

**Outcome:**

CO1- Learn grammar.

CO2- Enhance their fluency in English

CO3- Develop speaking and writing skills

CO4- Develop individual perspectives that demonstrate critical thinking skills

**UNIT –I**

Clauses

Phrases

**UNIT –II**

Degrees of comparison

**UNIT –III**

Active and Passive

**UNIT –IV**

Communication

Characteristics -Process -Forms - Barriers

**UNIT –V**

Punctuation

Forming sentences

**References:-**

A Practical English Grammar

English Grammar

Technical Communication

-A.J Thomson and A.V. Martinet

- Wren and Martin

-Meenakshi Sharma & Sangeetha Sharma

Course Code	Course Title	L	T	P	C
19110AEC41	Tamil-IV	4	0	0	2

**அலகு-I**

எட்டுத்தொகை  
நற்றிணை - குறிஞ்சி 356,முல்லை-242, பாலை-397  
குறுந்தொகை- 2,18,25,58,67,69,135,167,283,373  
ஐங்குறுநூறு- சீறுவெண் காக்கைப் பத்து

**அலகு-II**  
கலித்தொகை- பாலை 34,குறிஞ்சி-51,நெய்தல்-133  
அகநானூறு - 36,147,332  
புறநானூறு- 34,173,189,235,279

**அலகு-III**  
முல்லைப்பாட்டு - முழுவதும்  
திருக்குறள்- ஐந்து அதிகாரம்-  
அறம் 2,பொருள் 2,இன்பம் -1 வான்சிறப்பு,அழுக்காறாமை,இறைமட்சி,கூடாநட்பு,காதற்சிறப்புரைத்தல்

**அலகு-IV**  
இலக்கணம் அணி

மனப்பாடப்பகுதி

**அலகு-V**  
இலக்கிய வரலாறு  
எட்டுத்தொகை  
பத்துப்பாட்டு  
அறஇலக்கியங்கள்



Course Code	Course Title	L	T	P	C
19111AEC41	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
19111AEC42	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
19116AEC43	Virology	5	0	0	4

**Aim:**

- To study the general aspects of viral morphology

**Objectives**

- To study general aspects of viral morphology and classification, replication, interactions and immunity to viruses
- To discuss the application of various immunological and molecular diagnostic tools.

**Outcomes**

- CO1- To Understand the characteristic features of viruses.  
 CO2- To Gain the knowledge about the biology of bacteriophages.  
 CO3- To Learn the range 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	4 <sup>th</sup> / 2004	Mc Graw Hill Hyher Education
1.	R. C. Dubey, D.K. Maheswari	A Text Book of Microbiology	3 <sup>rd</sup> / 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, Australia.
3. James, C.Cappuccino. 1996. Microbiology. The Benjamin/Cummings Pub. Co. California.

Course Code	Course Title	L	T	P	C
19116AEC44L	Virology Lab	0	0	3	2

**Aim:**

- To study the general aspects of virus

**Objectives**

- To study general aspects of viral morphology and classification.
- 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
19116AEC45	Bioinformatics	6	0	0	5

### Aim:

- To learn about the bioinformatics databases, databanks, data format and data retrieval from the online sources.

### Objectives

- To make students understand the essential features of the interdisciplinary field of science for better understanding biological data.
- To provide the student with a strong foundation for performing further research in bioinformatics.

### Outcomes

CO1- To Develop skills to use computers for analysis of biological data.

CO2– To Gain the biological databases and compares the data of the biological macromolecules.

CO3– To Analysis the data retrieval, representation, and interpretation

### Unit – I

Introduction to Bioinformatics – Scope and application – Characteristics of Hardware and Software – Types of computer – Sending and receiving e-mails – Internet searching biological articles in internet

### Unit – II

Computer application in biology – Information theory and biology – Analysis tools for databases – BLAST, FASTA and DNA database – NCBI, DDBJ and EMBL.

### Unit – III

Protein structure determination by X- ray diffraction methods – Sequence alignment – Global alignment using Needleman – Wunsch algorithm and Local alignment using Smith – Waterman algorithm

### Unit – IV

Application to DNA and protein sequence – Biochips, Biosensors.

### Unit – V

Use of databases in biology: Sequence databases, structure databases. Sequence analysis – Protein and nucleic acids, Structure comparisons, molecular modeling, genome projects

## Text Books

S. No	Author Name	Title of the Book	Edition/year	Publisher
1.	D.R. Westhead, J. Howard Parish and Richard M. Twymans	Bioinformatics	1 <sup>st</sup> /2003	Viva Books Private Limited
2.	S. Sundara Rajan, R. Balaji	Introduction to Bioinformatics	1 <sup>st</sup> /2002	Himalaya Publishing House
3.	Keshav Trehan	Biotechnology	2002	New Age International Publisher (P) Ltd

## Reference Book:

1. Molecular databases for protein sequence and structure studies by Silliance M and Silliance M 1991 Springer Verlag
2. Sequence Analysis primer by M.Gnibskov, J.Devereux 1989 Stockton press
3. Computational Methods in Mol.Biol/Now comprehensive Biochemistry Vol.32. S.C. Seizberg DB Searls, S.Kasif Elsevier 1998.
4. Comutational methods for macromolecular analysis 1996 methods in Enzymology Vol.266 by R.F. Dorlitt Academic press.

Course Code	Course Title	L	T	P	C
19116AEC46L	Bioinformatics Lab	0	0	3	2

**Aim:**

- To learn about the bioinformatics databases, databanks and data format data retrieval from the online sources.

**Objectives**

- To make students understand the essential features of the interdisciplinary field of science for better understanding biological data.

**Outcomes**

CO1 - To Investigate the literature data of the given protein using PubMed.

CO2 - Explore the nucleotide sequence data of the given species using NCBI / EMBL / DDBJ.

CO3 - To identify the protein sequence of the species using PIR and Swissprot /

**UniProt**

1. Pairwise alignment using FASTA, BLAST.
2. Multiple alignments using Clustal W.
3. Study of internet resources in Bioinformatics – NCBI, EMBL, EBI.



**Skill Based Elective IV  
MS-ACCESS**

<b>Course Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
19120SEC04AL	Package Lab-IV	0	0	2	1

Outcome

- CO1- Examine database concepts and explore the Microsoft Office Access environment.
- CO2- Design a simple database.
- CO3- Build a new database with related tables.
- CO4- Manage the data in a table.
- CO5- Query a database using different methods.
- CO6- Design a form.
- CO7- Generate a report.
- CO8- Import and export data.

1. Create a database and a simple table
2. Create a database for sorting the marks scored by the student in the universality exams
3. Create a database for sorting the date of joining by the employee in the organization.
4. Create queries to select records that matches specific condition
5. Create relationships among the different tables
6. Create queries using built-in functions
7. Develop forms to enter data in to the student marks database
8. Develop forms to enter data in to the employee database

Course Code	Course Title	L	T	P	C
19160SEC04B	SOFT SKILL IV	0	0	2	1

## **PART -IV Etiquette and Interviewing Skills**

### **UNIT I Corporate**

Corporate grooming and dressing, Etiquettes in social as well as office settings, Email Etiquettes, Telephone Etiquettes, Contemporary issues in corporate life: diversity, Attrition, Work life balance, Hygiene and health.

### **UNIT II Interviewing Skills**

Researching the job-Researching the company -Questions to research the company-Informational interviews-Behavioral interviewing- Types of interview (Individual interviews, panel interviews, serial interviews, video interviews and teleconferencing) references-selling yourself-dressing for success-body language-stress reduction-Handling illegal questions.

Course Code	Course Title	L	T	P	C
19111SCE04L	Communicative English Lab-IV	0	0	1	1

**Aim:**

- To develop communicative skills

**Objective:**

- To use gerund and make sentences
- To change sentences from direct to indirect and vice versa
- To understand the listening skill
- To enhance reading skill
- To familiarize with the singular and plural forms
- To describe a picture

**Outcome:**

CO1- Learn grammar.

CO2- Enable to express their views in conversation

CO3- Develop soft skills

CO4- Enhance presentation skills

**UNIT –I**

Gerund

Infinitive

**UNIT –II**

Direct and Indirect

**UNIT –III**

Listening -types-features of a good listener-active and passive listening-effective listening

**UNIT –IV**

Reading-purpose-technique-types-reading rates-reading & interpretation

**UNIT –V**

Singular and Plural

Letter writing

**References:-**

A Practical English Grammar

English Grammar

Technical Communication

-A.J Thomson and A.V. Martinet

-Wren and Martin

-Meenakshi Sharma & Sangeetha Sharma

**ENVIRONMENTAL STUDIES**  
**(for under graduate students)**

Course Code	Course Title	L	T	P	C
191ENVTSTU	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 / Industrial / Agricultural.

or

Study of common plants, insects, birds.

or

Study of simple ecosystems — ponds, river, hill slopes, etc.

## References:

- 1) Agarwal, K.C, 2001, Environmental Biology, Nidi Pub. Ltd., Bikaner.
- 2) Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt, Ltd., Ahmedabad 380013, India, Email: [m4pin@icenet.net](mailto:m4pin@icenet.net) (R)
- 3) Brunner R.C., 1989, Hazardous 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, 1196p
- 6) De A.K., Environmental Chemistry, Wiley Western 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 Dev., 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, Cambridge Univ. Press 1140 p.
- 11) Jadhav, H. and Bhosale, V.J. 1995, Environmental Protection and Laws, Himalaya Pub. House, Delhi 284p.
- 12) Mickinney, M.L. and School. R.M. 1996, 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, 574p.
- 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 Publ. 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.

## SEMESTER V

Course Code	Course Title	L	T	P	C
19116AEC51	Food and Dairy Microbiology	5	0	0	4

### Aim:

- To learn about the epidemiology of foodborne diseases and the pathogens.

### Objectives

- To learn about food spoilage factors
- To know the preservation methods
- To make aware of food borne disease

### 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 <sup>th</sup> /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
19116AEC52	Molecular Biology	5	0	0	3

**Aim:**

- To introduce the fundamentals and basic biology of life.

**Objectives**

- To learn the basic principles of inheritance at the molecular, cellular and organismal levels.
- To understand causal relationships between molecule/cell level phenomena (“modern” genetics) and organism-level patterns of heredity (“classical” genetics)
- To test and deepen their mastery of genetics by applying this knowledge in a variety of problem-solving situations

**Outcomes**

CO1 - To understand Concept of central dogma of the cell and gene regulation.

CO2 - To know the Principles and applications of various molecular techniques.

CO3 - To grasp the significance of Concept, methods and application of r-DNA technology.

CO4 - To construct Gene library and gene mapping

**UNIT – I**

Nucleic acids: Structure of DNA and RNA, Types and forms – DNA, t-RNA, r-RNA, m-RNA – Definition and functions. DNA replication, Transcription, Translation, Protein synthesis.

**UNIT – II**

Vectors – plasmids, phages and cosmids, Shuttle vectors, Ti-plasmid, pBR322, pSC101, pUC. Structure and assay methods.

**UNIT – III**

Enzymes – Nucleases, ligases, polymerases, Restriction endonuclease (I, II, III), Reverse transcriptase, DNA modifying enzymes, Topoisomerases – their uses and applications.

**UNIT – IV**

Gene and its manipulation techniques – Definition of a gene, structure, cloning techniques, genomic library, C-DNA, expression systems. Gene rearrangement by RNA and DNA splicing.

**UNIT – V**

Nucleic acid and protein hybridization technique – Southern, Northern and Western methods of hybridization. DNA amplification techniques – PCR. DNA fingerprinting and its applications.

**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. Friedberg 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
19116AEC53	Agricultural and Environmental Microbiology	4	1	0	4

**Aim:**

- To learn about microorganisms in environment

**Objectives**

- To know the role of microbes in environmental field
- To get information on aquatic Microorganism

**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 Ectomycorrhizae – 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, salt 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	3 <sup>rd</sup> / 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
19116AEC54L	Food and Dairy Microbiology and Molecular Biology Lab	0	0	3	2

**Aim:**

- To analyze results for routine microbiological samples.

**Objectives**

- Apply analyses used commonly in the food industry.
- Correctly predict the types and levels of organisms commonly occurring in different foods.
- Clearly communicate in different oral and written formats, to different audiences, the results of laboratory analyses in food microbiology.

**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 auxotrophic 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 separation in agarose gel.

Course Code	Course Title	L	T	P	C
19116AEC55L	Agricultural and Environmental Microbiology Lab	0	0	3	2

**Aim:**

- To use appropriate lab techniques and analyze results for routine microbiological samples

**Objectives**

- To know the role of microbes in environmental field
- To get information on aquatic Microorganism

**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

## Discipline Specific Elective -I

Course Code	Course Title	L	T	P	C
19116DSC56A	Proteomics	5	0	0	3

### Aim

To acquaint the students to the versatile tools and techniques employed in proteomics.

### Objectives

- To illustrate creative use of modern biology linked with proteomics.
- To expose students to importance of proteomics
- To learn different approach and types of proteomics.

### Outcome

CO1- To acquire knowledge in protein functional and expressions.

CO2- To get Knowledge about 3-D structural prediction of proteins

CO3- To Study the protein purification with various chromatography techniques.

CO4- To Know about MALDI-TOF (Matrix assisted laser Desorption and Ionization)

### Unit I

Introduction to protein structure, Chemical properties of proteins. Physical interactions that determine the property of proteins. Short-range interactions, electrostatic forces, Van der Waal interactions, hydrogen bonds, hydrophobic interactions.

### Unit II

Proteomics: structural, functional, expression, interaction proteomics. Importance of proteomics. Determination of protein sizes (Sedimentation analysis, gel filtration, SDS-PAGE); Native PAGE,

### Unit III

Protein-protein interactions, gel based proteomic tools e.g. 2D, DIGE, Non-gel based proteomic tools, Gel based proteomics, LC-based proteomics.

### Unit IV

Protein array, Protein Identification and data evaluation, Identification of post-translational modifications: Phosphorylation, Glycosylation, Acetylation

### Unit V

Mass Spectrometry-Fundamental parameters: Mass accuracy, Resolution, Sensitivity, Ion sources: Electrospray ionization, Matrix assisted laser desorption and ionization. Peptide mass finger printing, Tandem mass spectrometry

### Reference Book

1. Hartl, Daniel L., Jones, Elizabeth W. "Genetics: Analysis of Genes and Genomes". Jones and Bartlett Publishers: Boston, 2005.
2. Weaver, Robert F. "Molecular Biology, 2nd Edition". McGraw Hill: Boston, 2002.
3. Colinge, Jacques and Keiryn L. Bennett. "Introduction to Computational Proteomics". PLoS Comput Biol. 2007 July; 3(7): e114.
4. Graves, P. R., T. A. J. Haystead. "Molecular Biologist's Guide to Proteomics". Microbiology and Molecular Biology Reviews: Vol.66 No.1, 2002.
5. van Wijk, K. J. "Challenges and Prospects of Plant Proteomics". Plant Physiol. 2001 June; 126(2): 501-508.



Course Code	Course Title	L	T	P	C
19116DSC56B	Bioinoculants	5	0	0	3

**Aim:**

- To introduce students to basic characteristics of microorganisms (morphology, cytology, metabolism), their ecologies and importance for life cycles in the nature, for plants growing, animal husbandry and processing of plant and animal products.

**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 biofertilizers for crop plants and their advantages. Symbiotic N<sub>2</sub> fixers: Rhizobium- Isolation, characterization, identification, classification, inoculum, production and field application. Frankia- Isolation, characterization-actinorrhizal nodules-non-leguminous crop symbiosis.

**UNIT – II**

Non-symbiotic N<sub>2</sub> fixers-Azospirillum-Free living-Azotobacter-free isolation, characterization, mass inoculum production and field application.

**UNIT – III**

Symbiotic N<sub>2</sub> 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 mycorrhizal 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:**

Kannaiyan, S. (2003). Biotechnology of Biofertilizers, CHIPS, Texas.

Mahendra K. Rai (2005). Hand book of Microbial biofertilizers, The Haworth press, Inc. New York.

Reddy, S. M. et al. (2002). Bioinoculants for sustainable agriculture and forestry, Scientific Publishers.

Subba rao N. S (1995). Soil microorganisms and plant growth. Oxford and IBH publishing co. Pvt. Ltd. New delhi.

Subba rao N. S (1998). Biofertilizers in Agriculture and forestry. Oxford and IBH publishing co. Pvt. Ltd. New delhi.

**Skill Based Elective V**  
**PHOTO SHOP**

<b>Course Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>19120SEC05AL</b>	<b>PackageLab-V</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

Outcome

- CO1- work with the Photoshop workspace
- CO2- navigate images
- CO3- resize and crop images
- CO4- make and work with selections
- CO5- create new layers and perform other basic layer functions
- CO6- transform images

1. Design a Visiting card.
2. Design a Identity card.
3. Design a letter pad with LOGO.
4. Create an advertisement for News paper and Poster creation.
5. Design a calendar with pictures.
6. Design a Magazine.
7. Create a front page for a Magazine
8. Design a CD Cover.

Course Code	Course Title	L	T	P	C
19160SEC05B	SOFT SKILL V	0	0	2	1

## **PART -V Leadership Skills and Body Language**

### **UNIT I Leadership Skills**

**Leaders:** their skills, roles, and responsibilities. Vision, Empowering and delegation, motivating others, organizational skills, team building, decision making, giving support, Vision, Mission, Coaching, Mentoring and counseling, Appraisals and feedback, conflict, Power and Politic, Organizing and conducting meetings, Public Speaking

### **UNIT II Body language**

Handshake: Type of Handshake - Posture- Universal Facial Gestures- Eye Contact- Nervous Ticks-reading and analyzing body language, Body language signals and meanings -eyes, mouth, head , arms , hands , handshakes , legs and feet, personal space

Course Code	Course Title	L	T	P	C
19111SEC05L	Communicative English Lab-V	0	0	1	1

**Aim:**

- To develop communicative skills

**Objective:**

- To develop vocabulary
- To comprehend meaning from context
- To involve in a dialogue
- To note the important points from the text.
- To write a letter
- To understand the subject verb agreement
- To teach the different genders

**Outcome:**

CO1- Develop corporate skills.

CO2- Handle their day to day affairs well with their knowledge of language skills.

CO3- Get a Job.

**UNIT –I**

Correct the spelling mistakes

Comprehension

**UNIT –II**

Find the odd one out

Picture description

**UNIT –III**

Abbreviations

Note making

**UNIT –IV**

Gender

Dialogue writing

**UNIT –V**

Acronyms

Concord

**References:-**

A Practical English Grammar

English Grammar

English Grammar and Composition

Technical Communication

-A.J Thomson and A.V.Martinet

-Wren and Martin

-Radhakrishna Pillai

-Meenakshi Sharma & Sangeetha Sharma

## SEMESTER VI

Course Code	Course Title	L	T	P	C
19116AEC61	Industrial Microbiology	5	0	0	4

### Aim:

- To train students practically in basic principles of food and industrial microbiology.

### Objectives

- It also emphasizes learning about the production of various fermented products and field trips to dairy, food industries, and sewage treatment plants.

### Outcomes

CO1- To understand the vital role of various substrates used in fermentation.

CO2- To Learn the different types of reactors or fermenters.

CO3- To gain knowledge about upstream and downstream processing

### 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, Sittig, 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
19116SEC62	Clinical Microbiology	5	0	0	5

**Aim:**

- To understand about the pathogenic microbes

**Objectives**

- To inculcate on the role of normal flora and pathogenic microbes
- To understand the pathogenesis of various diseases
- To understand the various clinical microbiological techniques.

**Outcomes**

CO1- To Understood 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) Meningitis, (d) Tuberculosis, (e) Leprosy, (f) Gastrointestinal disorders – typhoid, cholera, bacillary dysentery, (g) Sexually transmitted diseases – syphilis, gonorrhoea. (h) Anaerobic 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. Atlas (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. Hume W.B. and Russell A.D. (1989). Pharmaceutical Microbiology. IV edition. Blackwell Scientific Publications, Oxford.
5. Topley / Wilson's (1990). Principles of Bacteriology, Virology and Immunity, VIII edition, Vol. III Bacterial Diseases, Edward Arnold, London.



Course Code	Course Title	L	T	P	C
19116AEC63L	Industrial Microbiology Lab	0	0	3	2

**Aim:**

- To train students practically in basic principles of food and industrial microbiology.

**Objectives**

- It also emphasis to learn about the production of various fermented products and field trip to dairy, food industries, sewage treatment plants.

**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
19116SEC64L	Clinical Microbiology Lab	0	0	3	2

**Aim:**

- To provide technical knowledge on collection and processing of clinical samples

**Objectives**

- To prepare them to work in clinical laboratory 3. To learn the technique for isolation and identification of pathogens

**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 parasitic ova and cysts from faecal samples.
2. Identification 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*
  - *Trypanema pallidum*
  - *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
19116DSC65A	Recombinant DNA Technology	5	0	0	3

### Aim

To acquaint the students to the versatile tools and techniques employed in recombinant DNA technology.

### Objectives

- To illustrate creative use of modern tools and techniques for manipulation and analysis of genomic sequences
- To expose students to application of recombinant DNA technology in biotechnological research.
- To train students in strategizing research methodologies employing genetic engineering techniques.

### Outcome

CO1- To acquire knowledge in desired DNA and protein separation.

CO2- To Learn the gene and operon concept

CO3- To gain Knowledge about gene cloning and cDNA library

CO4- To Learn the blotting techniques.

### Unit -I

History and achievements of rDNA technology. Nomenclature, classification of Restriction Endonucleases - ligases, types - gene cloning in prokaryotes - Expression and cloning strategies. Construction of genomic library and cDNA library.

### Unit II

Restriction enzymes - restriction analysis of genomes- restriction sites- cloning of blunt end DNA, adapters. DNA analysis: labeling of DNA and RNA probes. Southern and fluorescence *in situ* hybridization, DNA fingerprinting, chromosome walking.

### Unit- III

Gene transfer Techniques - Physical - Biolistic method, Chemical - Calcium chloride and DEAE methods, Biological invitro package method - Screening and selection of recombinants.

### Unit-IV

Microbial synthesis of commercial products - Insulin, Interferons, Human growth hormone, antibiotics, biopolymers.

### Unit- V

Transgenic Plants - Ti plasmid, insect resistant plant. Transgenic animal - mice - retroviral method- DNA microinjection method. PCR methods and its applications.

### REFERENCES

1. Mitra (2005). Genetic engineering. Published by Macmillan India Ltd., Chennai.
2. JogdandSN (2005). Gene biotechnology. Himalaya Publishing House, Mumbai.
3. Satyanarayana (2005). Biotechnology. First edition, Books and Allied (P) Ltd., Kolkata.
4. Preeti Joshi (2002). Genetic engineering and its application. First edition, Agrobios (India).
5. Dubey RC (2005). A Text of Biotechnology. Multicolour Illustrative edition, S.Chand and Company Ltd., New Delhi.

Course Code	Course Title	L	T	P	C
19116DSC65B	Bioethics	5	0	0	3

**Aim:**

- To recognise and identify ethical dilemmas in a clinical encounter
- To analyse an ethical dilemma and come to a conclusion

**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
- Can develop and teach a curriculum in Bioethics for their field of medicine

**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, 5<sup>th</sup> edition, Oxford University Press. 2000.

Course Code	Course Title	L	T	P	C
19111OEC	Open Elective - 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
19112OEC	Open Elective: 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
19113GEC	Open Elective- 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 conversions).

**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
19114OEC	Open Elective-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 legislative 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
19120OEC	Open Elective -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
19120OEC	Open Elective -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
19161OEC	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-Padmalthasuresh,Justin paul .

**M. Sc Microbiology -SYLLABUS – REGULATION 2019**  
**Academic year 2019-2020**  
**COURSE STRUCTURE**

Course Code	Course Title	L	T	P	C
<b>SEMESTER I</b>					
19216SEC11	Prokaryotic Microbiology	6	1	0	5
19216SEC12	Eukaryotic Microbiology	6	1	0	5
19216SEC13	Microbial Physiology	6	1	0	4
19216SEC14L	Fundamentals of Microbiology Lab	0	0	4	2
19216DSC15	Discipline Specific Elective	5	0	0	4
19216RLC16	Research Led Seminar	-	-	-	1
<b>Total</b>		<b>23</b>	<b>3</b>	<b>4</b>	<b>21</b>
<b>SEMESTER II</b>					
19216SEC21	Industrial Microbiology	5	1	0	5
19216SEC22	Environmental and Agricultural Microbiology	5	1	0	5
19216SEC23	Clinical Microbiology	5	0	0	4
19216SEC24L	Industrial, Clinical and Environmental and Agricultural Microbiology Lab	0	0	4	2
19216DSC25_	Discipline Specific Elective II	5	0	0	4
19216RMC26	Research Methodology	3	0	0	2
19216BRC27	Participation in Bounded Research	-	-	-	2
<b>Total</b>		<b>23</b>	<b>2</b>	<b>4</b>	<b>24</b>
<b>SEMESTER III</b>					
19216SEC31	Microbial Genetics	6	1	0	6
19216SEC32	Microbial Biotechnology	6	1	0	6
19216SEC33L	Microbial Genetics and Biotechnology Lab	0	0	5	3
19216DSC34	Discipline Specific Elective III	5	0	0	4
192_OEC	Open Elective	4	0	0	4
19216SRC35	Design/Socio technical research	-	-	-	2
<b>Total</b>		<b>21</b>	<b>2</b>	<b>5</b>	<b>24</b>
<b>SEMESTER IV</b>					
19216SEC41	Pharmaceutical Microbiology	6	1	0	6
19216SEC42	Biostatistics and Bioinformatics	6	1	0	6
19216SEC43L	Pharmaceutical Microbiology Lab	0	0	5	3

19216SEC44_	Discipline Specific Elective IV	5	0	0	4
19216PRW45	Project Work	-	-	-	6
19216PEE	Programme exit examinations	-	-	-	2
	<b>Total</b>	17	2	5	27
	<b>Total Credits for the Program</b>				<b>96</b>

### Discipline specific Electives

Semester	Discipline specific Elective Courses-I
I	a)19216DSC15A- Immunotechnology b)19216DSC15B-Bioremediation and Waste Management
	Discipline specific Elective Courses-II
II	a)19216DSC25A-Biomolecules b)19216 DSC25B- Genomics and Proteomics
	Discipline specific Elective Courses-III
III	a)19216DSC34A- Plant Tissue Culture b)19216DSC34B-Nanotechnology
	Discipline specific Elective Courses-IV
IV	a)19216DSC44A- Bioethics and IPR b)19216DSC44B-Molecular Immunology

### General Electives

Semester	Open Elective Courses
III	a) 19211OEC-Writing for the Media b) 19212OEC-Applicable Mathematics Techniques c) 19213OEC-Bio-medical Instrumentation d) 19214OEC-Green Chemistry e) 19220OEC-M-Marketing f) 19261OEC- Insurance Services g) 19280OEC-Counselling Psychology

### 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
<b>Total</b>	<b>62</b>	<b>16</b>	<b>3</b>	<b>13</b>	<b>02</b>	<b>96</b>

Course Code	Course Title	L	T	P	C
19216SEC11	Prokaryotic Microbiology	6	1	0	5

## AIM

Prokaryotes are important to all life on earth and play a critical role in the recycling of nutrients by decomposing dead organisms and allowing their nutrients.

## OBJECTIVES

- To explore cell structure and morphology in prokaryotes.
- To gain more experience using the microscope.
- To obtain a better understanding of prokaryotes

## 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 – Bacteriophages – Ultra structure of T<sub>4</sub> 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**

<b>S. No</b>	<b>Author Name</b>	<b>Title of the Paper</b>	<b>Edition/year</b>	<b>Publication</b>
1.	Jr. M.J. Pelczar, E.C.S. Chan and N.R. Kreig.	Microbiology	5 <sup>th</sup> /1993	Tata McGraw-Hill, Inc, New york
2.	R.C. Dubey, D.K. Maheshwari	A Text Book of Microbiology	3 <sup>rd</sup> / 2003	Chand Publishing

### **Reference Book:**

1. Fundamental of Microbiology (2005) By Purohit, Agrobios Publishers, Meerut



Course Code	Course Title	L	T	P	C
19216SEC12	Eukaryotic Microbiology	6	1	0	5

### AIM

- To describe the basic structures and essential characteristics of eukaryotic cells

### OBJECTIVES

- Students will understand the structures and purposes of basic components of eukaryotic cells, especially macromolecules, membranes, and organelles.
- To generate and utilize energy in cells

### 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. Predaceous fungi and nematophagous fungi – Fungi in food spillage 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	5 <sup>th</sup> /1993	Tata McGraw-Hill, Inc, New york
2	R.C. Dubey, D.K. Maheshwari	A Text Book of Microbiology	3 <sup>rd</sup> / 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
19216SEC13	Microbial Physiology	6	1	0	4

**AIM:**

- Microbial physiology has traditionally played a very important role in both fundamental research and in industrial applications of microorganisms.

**OBJECTIVES:**

- To understand the major goal of Microbial Physiology and Metabolism is to assist students in rapidly communicating their research and education.
- The overall function is studied through analysis of the cellular response to different environmental conditions.

**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 Exopolysaccharides; 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 curve – measurement of growth – calculations of growth rate – generation time – synchronous growth – induction 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, phosphorescences – bacterochlorophyll – rhodopsin – carotenoids – phycobiliproteins: Carbohydrates – anabolism – autotrophy – oxygenic – anoxygenic photosynthesis – autotrophic generation of ATP; fixation of CO<sub>2</sub> – Calvin cycle – C<sub>3</sub> – C<sub>4</sub> pathways. Chemolithotrophy – sulphur – iron – hydrogen – nitrogen oxidations – Brief account of methanotrophs in relation to CO<sub>2</sub> 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**

<b>S. No</b>	<b>Author Name</b>	<b>Title of the Paper</b>	<b>Edition/year</b>	<b>Publication</b>
1.	Jr. M.J. Pelczar, E.C.S. Chan and N.R. Kreig.	Microbiology	5 <sup>th</sup> /1993	Tata McGraw-Hill, Inc, Newyork
2.	S. Meenakumari	Microbial physiology	1 <sup>st</sup> / 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
19216SEC14L	Fundamentals of Microbiology Lab	0	0	4	2

## AIM

- To impart knowledge of the **basic principles** of microbiology

## OBJECTIVES

- The goals for this laboratory course is to provide the students with a basic fundamental knowledge of how microorganisms grow, react with specific types of growth media and their biochemical reactions with media used in identification.
- Laboratory procedures are used to show students to learn the vital techniques.

## 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

Principles and methods and sterilization – (Wet, dry and cold sterilization)

Direct microscopic observations of bacterial shape – cocci, rods, chains, fungal spores, mycelium, yeast budding.

Preparation of Media: Nutrient broth, Nutrient agar, plates, slants, soft agar. Pure culture technique: Streak plate, spread plate and pour plate methods

Measurement of size of microbes – micrometry method. Motility determination – Hanging drop method.

Isolation and purification of cyanobacteria, actinomycetes, fungi and protozoans.

Staining methods: Simple, Negatives, acid fast, Gram staining, Capsule Metachromatic granular staining, Lactophenol cotton blue staining – Fungal slide preparation.

Measurement of growth – Direct haemocytometer count, viable count – growth curve,

Determination of growth rate and generation time.

Effect of pH, temperature and osmotic pressure on growth of bacteria.

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

Blood grouping

Widal test

Total count of RBC

Total count of WBC

Differential count of WBC

Erythrocyte Sedimentation Rate

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. 4<sup>th</sup> Edition, England, California
2. Gerhardt. P. Murray, R.G. Wood, W.A. and Kreig, N.R. (1994) Methods of General and Molecular Bacteriology, Ed. American 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 Bacteriology (Vol.II), Nobert pfeming Springer Publishers

### Discipline Specific Elective-I

Course Code	Course Title	L	T	P	C
19216DSC15A	Immunotechnology	5	0	0	4

**AIM:**

- Immunotechnology is a diverse and growing discipline that can be defined as the study of the tissues, cells and molecules involved in host defense mechanisms

**OBJECTIVES:**

- To understand how the immune system develops, how the body defends itself against disease, and what happens when it all goes wrong.

**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 –haptens; 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 Ir – 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, Immunofluorescence, 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.	Ivatt Roitt, Jonathan Brostoff, David Male	Immunology	3 <sup>rd</sup> /1993	Mosby Inc, St. Louis, MO
2.	R.A. Goldsby, T. J. Kindt, B.A. Osborne, J. Kuby	Immunology	5 <sup>th</sup> /2003	W.H. Freeman and Company
3.	M.S. Aslam	Immunobiology	1 <sup>st</sup> /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
19216DSC15B	Bioremediation and Waste Management	5	0	0	4

### AIM

- To reduce pollutant levels to undetectable, nontoxic or acceptable levels.

### OBJECTIVES:

- The **bioremediation** technology offers the potential to treat contaminated soil and groundwater on-site without the need for excavation and thus, it requires little energy input and preserves the soil structure.

### 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 Bioremediation: 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., Atlas, 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 Jersey.
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
19216SEC21	Industrial Microbiology	5	1	0	5

### AIM

To create **industrial** products in mass quantities, often using **microbial** cell factories.

### OBJECTIVE

- There are multiple ways to manipulate a microorganism in order to increase maximum product yields.
- To learn complete knowledge on upstream and downstream processing.

### COURSE OUTCOME

CO1- Students will get knowledge on strain improvement.

CO2- Enable them to work in fermentation industry.

CO3- Students will get idea on upstream and downstream fermentation process

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. Cruieger and A. Cruieger	A text book of Industrial microbiology	2 <sup>nd</sup> /1990	Sinauer Associates Incorporated
3.	Prescott and Dunn's	Industrial Microbiology	4 <sup>th</sup> /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 Biotechnology. 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
19216SEC22	Environmental and Agricultural Microbiology	5	1	0	5

## AIM

To address problems in environmental agricultural practices in microbial communities.

## OBJECTIVES

- To understand the role of Microbes, especially bacteria, are of great importance in the sense that their symbiotic relationship (either positive or negative) have special effects on the ecosystem.
- To improve soil fertility, such as microbial degradation of organic **matter** and soil nutrient transformations.

## 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 of Microbes 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 <sup>st</sup> / 2007	Margham Publicat
2.	Dirk, J., Elsas, V., Trevors, J.T., Wellington	Modern Soil Microbiology	1997	Marcel Dekker INC
3.	<b>R.R. Mishra</b>	Soil Microbiology	1 <sup>st</sup> /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
19216SEC23	Clinical Microbiology	5	0	0	4

### AIM

To introduce basic principles and application the relevance of **clinical** disease.

### OBJECTIVE

To learn bacteria, viruses and other pathogens related with infectious diseases in humans.

### OUTCOME

CO1-Learn normal flora of human body.

CO2- Get information about various sources of infection 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 diagnostic 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) Meningitis d) Diphtheriae) Pulmonary Tuberculosis,f) Leprosy, g) Typhoid, h) Cholera i) Tetanus, j) Syphilis, 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, Filariasis, **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 <sup>th</sup> /2004	McGraw-Hill Companies, Inc.
2.	V.V. Kale, K.P. Bhusari	Applied Microbiology (Pharmacy and other Bioscience)	1 <sup>st</sup> /2001	Himalaya Publishing House
3.	Jr. M.J. Pelczar, E.C.S. Chan and N.R. Kreig.	Microbiology	5 <sup>th</sup> /1993	Tata McGraw-Hill, Inc, Newyork

### References

- 1 Schachter, M., Med off, G. and Eisenstein, B.C.(1993) mechanism disease, 2<sup>nd</sup> 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. Medowleaf PressL shildon, England
- 4 Stokes,J., Ridway, G.L., and Wren, M.W.D.,(1993). Clinical Microbiology 7<sup>th</sup> Edn. Arnold a division of Hodder and Stoughton.
- 5 Wistriench, G.A. And lechtonan, M.D.(1988). Microbiology, 5<sup>th</sup> Edn., Mac publishing company NY
- 6 Atlas, R.M. (1989) Microbiology – fundamentals and applications 2<sup>nd</sup> Edn. Maxwell Mac Millan International Edition



Course Code	Course Title	L	T	P	C
19216SEC24L	Industrial, Clinical and Environmental and Agricultural Microbiology Lab	0	0	4	2

#### AIM

- To provide technical knowledge on collection and processing of industrial, clinical and environmental samples.

#### OBJECTIVE

- To test specimens from patients for microorganisms
- To prepare them to work in clinical laboratory.
- To learn the technique for isolation and identification of pathogens.

#### COURSE 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. Determition 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, 20<sup>th</sup> Edition, American 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. Patricia Cuning(1995) Official Methods of Analysis, Vol I and II, 16<sup>th</sup> 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
19216DSC25A	Biomolecules	5	0	0	4

### AIM

To teach students about important biomolecules essential to life processes.

### OBJECTIVES:

- To learn the principles of organic chemistry in the structure and function of important biomolecules.
- To understand the structure and function of important biological molecules such as DNA, RNA and some enzymes.
- To understand biological processes such as protein biosynthesis, DNA replication and RNA biosynthesis.

### COURSE 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  $\alpha$ -helix,  $\beta$ - 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	1 <sup>st</sup> / 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
19216DSC25B	Genomics and Proteomics	5	0	0	4

## AIM

To monitor the properties of the entire complement of proteins from a given cell or organism,

## OBJECTIVES:

To gain the knowledge and analyze the varying proteomes of an organism at different times in order to highlight differences between them.

## 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(FISH) for genome analysis, chromosome microdissection, 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, spin-spin 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 enzymes, 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 Cod	Course Title	L	T	P	C
19216RMC26	Research Methodology	3	0	0	2

**AIM:**

To systematically solve a research problem

**OBJECTIVES:**

- To learn and practice the literature survey aspects of projects and prepare the scope and goal of the proposed project.
- To learn, practice, improve the research presentation skill.

**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, Bibliography. 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 <sup>nd</sup> / 2004	New age international publishing (p) Ltd.
2.	S. Rajkumar	Research Methodology	1 <sup>st</sup> / 2008	Anuradha Publication
3.	Jerrold H. Zar	Biostatistical Analysis	4 <sup>th</sup> /2003	Pearson Education (Singapore) Pte. Ltd.
4.	D. J. Homie and Hazel Peck	Analytical Biochemistry	3 <sup>rd</sup> / 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<sup>nd</sup> Edition 1999.
3. Experimental Biochemistry, Robert Switzer and Liamgarrity, W.H. Freeman and Co, 3<sup>rd</sup> 1999.
4. Davis, G.B and C.A Parker, 1997. Writing the doctoral dissertation, Barrons Education series, 2<sup>nd</sup> 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
19216SEC31	Microbial Genetics	6	1	0	6

#### AIM

- To study the gene transfer from one organism to another.

#### OBJECTIVE

- To understanding molecular biological studies, the manipulation of eukaryotic organisms, and for practical applications (biotechnology) in diverse areas of life sciences.
- To provide relatively simple system for studying **genetic** phenomenon and thus useful to other higher organisms.

#### COURSE 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 <sup>nd</sup> /1990	Narosa Publishing House
3.	William S. Klug, Michael R. cummings	Concept of Genetics	7 <sup>th</sup> /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<sup>th</sup> edition, Benjamin / Cummings Publishing Company.

Course Code	Course Title	L	T	P	C
17216SEC32	Microbial Biotechnology	6	1	0	6

### AIM

- To adapt the **microbial** metabolism, so that the product is produced at maximum theoretical yield, whereas also ATP is produced to support growth and maintenance.

### OBJECTIVES

- To develop industrial processes for production of antibiotics, enzymes etc.
- To develop gene surgery and gene therapy to cure genetic disease.
- To create improved varieties of plants and animals through genetic engineering and plant breeding.

### 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 library. 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
19216SEC33L	Microbial Genetics and Biotechnology Lab	0	0	5	3

**AIM:**

- To understand the **microbial genes**, genomes, and gene expression and evolution of microorganisms and their interactions with the environment.

**OBJECTIVES**

- To provide 'hands-on' experience in the investigation and manipulation of microorganisms and their **genes**.
- To develop the ability to think critically and devise **genetic** strategies that might be used to address interesting biological problems.

**OUTCOMES**

CO1- Has acquired a fairly good knowledge of the tools and the methods for genetic engineering

CO2- Separation of DNA and Protein by gel electrophoresis.

CO3- Students can perform isolation of DNA, amplification of any gene by PCR

CO4- Hands on experience on Molecular genome isolation and identification techniques

**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 auxotrophic 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
19216SEC34A	Plant Tissue Culture	5	0	0	4

### AIM

- To understand the knowledge on culturing **plant** seeds, organs, explants, tissues.

### OBJECTIVE

- To understanding the basic process of preparing media for plant tissue culture.
- To learn micronutrients, macronutrients and organic elements.

### COURSE OUTCOME

CO1- To inculcate the basics of plant tissue culture

CO2- To impart the knowledge about the various aspects of tissue culture and their applications

CO3- Learn the role of micro and macro- nutrients in tissue culture plantation.

#### 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, cryoprotectors, 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
19216SEC34B	Nanotechnology	5	0	0	4

### AIM

- To provide basic knowledge in the interface between chemistry, physics and biology on the nanostructural level with a focus on biotechnological usage.

### OBJECTIVE

- Nanoscience is the study of materials which are in nanoscale range. Conversion of any material in nanoscale results in alteration of its physicochemical, biological, mechanical, optical, electronic, etc. properties.
- To learn advance research and promoting innovation through applications of nanobiotechnology to address issues in health, energy, agriculture and environment.

### COURSE OUTCOME

CO1- Describe the basic science behind the properties of materials at the nanometre scale

CO2- Advanced experimental and computational techniques for studying nanomaterials.

CO3- Learn clearly and effectively using conventional scientific and mathematical notation.

CO4- Systematically solve scientific problems related specifically to nanotechnological materials.

#### 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, Pentagon Press. 2006.
10. Vladimir P Torchilin. Nanoparticles as Drug Carriers. Imperial College Press, North Eastern University, USA. 2006.

## SEMESTER IV

Course Code	Course Title	L	T	P	C
19216SEC41	Pharmaceutical Microbiology	6	1	0	6

### AIM

To ensure safety and efficacy of **pharmaceutical** products.

### OBJECTIVES

To test and ensure sterility, determine effectiveness, contamination or bioburden, analyze toxins (exotoxin or endotoxin) of the drugs.

### COURSE OUTCOME

CO1- Acquired detailed knowledge of antimicrobial agents, their mechanism of action.

CO2- Developed understanding of different types of disinfectants/antiseptics bactericidal and bacteriostatic actions

CO3- Regulatory practices, biosensors and applications in Pharmaceuticals.

CO4- Quality Assurance and Validation.

#### **Unit – 1 Antibiotics and synthetic antimicrobial agents**

Antibiotics and synthetic antimicrobial agents, Antifungal antibiotics, antitumor substances. Peptide antibiotics, Chloramphenicol, Sulphonamides and Quinolone 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
19216SEC42	Biostatistics and Bioinformatics	6	1	0	6

## AIM

To provide the statistical, analytical and computational training

## OBJECTIVES

To advance statistical science and its application to problems of human health and disease, with the ultimate goal of advancing statistics.

To designing studies and analyzing data from research problems.

## COURSE OUTCOME

CO1- Learn about probability/variable analysis and collection, classification of data

CO2- Basic ideas of significance test (T-test, ANOVA)

CO3- Understanding about the information on the search engines and various software tools

CO4- Scope of Biological databases related software used in the bioinformatics

### 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 polygon – 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	1 <sup>st</sup> /2003	Viva Books Private Limited
2.	S. Sundara Rajan, R. Balaji	Introduction to Bioinformatics	1 <sup>st</sup> /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 Jersey.
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 Jersey.

Course Code	Course Title	L	T	P	C
19216SEC43L	Pharmaceutical Microbiology Lab	5	0	0	4

### AIM

To provide a knowledge and understanding of **pharmaceutical microbiology** relevant to healthcare

### OBJECTIVES

To gain the knowledge on culture and identification of microorganism, 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
19216SEC44A	Bioethics and IPR	5	0	0	4

### AIM

- To understand Bioethics and Human Rights in order to assist their application and promotion in the areas of science

### OBJECTIVES

- To encourage investigation, analysis and studying the **bioethical** principles, values, concepts, and social and juridical implications contained in the Universal Declaration on **Bioethics**.

### COURSE OUTCOME

CO1- Students will gain awareness about *Intellectual Property Rights (IPRs)*

CO2- To take measure for the protecting their ideas

CO3- Able to develop business strategies by taking account of *IPRs*

CO4- Able to assists in technology up gradation and enhancing competitiveness.

### 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](http://www.ipr.co.uk/IP_conventions/patent_cooperation_treaty.html)
6. [www.patentoffice.nic.in](http://www.patentoffice.nic.in)
7. [www.iprlawindia.org/](http://www.iprlawindia.org/) - 31k - Cached - Similar page



Course Code	Course Title	L	T	P	C
19216SEC44B	Molecular Immunology	5	0	0	4

## AIM

- To learn **immunological** response at the **molecular**, cellular and functional levels of innate and acquired **immunity**. It includes immune regulation, cell signaling and Immunochemistry.

## OBJECTIVES

- To identify the cellular and **molecular** basis of immune responsiveness.
- To describe the roles of the immune system in both maintaining health and contributing to disease.
- To understanding of humoral and cellular **immunity** and their relative significances.

## COURSE OUTCOME

CO1 - Able to identify the cellular and molecular basis of immune responsiveness.

CO2- Learn about Biosensor assays for assessing ligand –receptor interaction.

CO3- Rationale for vaccine design about new generation antibodies

CO4- Multi-gene organization of immunoglobulin gene

### Unit I Fundamental Concepts and Anatomy of the Immune System

Terminology – Antigen, immunogen, hapten, allergen, tolerogen, super antigens, antibody, immunoglobulin, antigenicity, immunogenicity. Self & nonself, innate & acquired immunity. Haematopoiesis. 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 Rave n.
3. E Roitt. 2011. Essential Immunology. 12th Edition. Blackwell Publication.

Course Code	Course Title	L	T	P	C
19211OEC	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
19212OEC	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, Lagrange'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
19213OEC	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

**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 – medical 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,
2. Biomedical Instrumentation, Anuradha Agencies, Kumbakonam (2000).

Course Code	Course Title	L	T	P	C
19214OEC	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 antibiotics.

**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<sub>2</sub> - 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
19220OEC	M-Marketing	4	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., 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
19261OEC	Open Elective-Insurance Services	4	0	0	2

**Aim:**

- To look after the interests of people from uncertainty by providing certainty of compensation.

**Objectives:**

- To learn the fundamental concepts and principles of insurance.
- To explain the nature of different insurance policies, insurance contracts and settlement of claims.

**Outcome:**

- The course helped the students to learn the principles of Insurance and the functions of Life and general insurances and the IRDA

**UNIT – I**

Insurance and Assurance – Importance of Insurance – Functions of Insurance – Insurance contract and their Elements – Fundamental Principles of Insurance contracts

**UNIT – II**

Types of Insurance contracts – Differences between Life and General Insurance – Concepts in Insurance - Insurer, Insured, Premiums and Claims – Reinsurance – Double Insurance

**UNIT – III**

Life Insurance – Advantages of Life Insurance – Procedure for Effective Life Insurance – Risk Factors in Life Insurance – Procedure for Settlement of Life Insurance Claims – Different kinds of Life Insurance Policies including Endowment and whole Life Policies.

**UNIT – IV**

General Insurance – Fire Insurance – Contract of Fire Insurance – Fire Policy Conditions – Subject matter of Fire Insurance – Fire Policy – Marine Insurance – Motor, burglary and Personal Accident Insurance.

**UNIT – V**

Reforms in Insurance Sector – principles and Types – I.R.D.A., Privatisation of Insurance – Insurance and Employment – Insurance Agents and career Agents – Investments by Insurance companies in housing sector and other infrastructure projects.

**Reference Books:**

Dr.MR.Mishra – Law of Insurance – Central Law Agency Allahabad

Dr.M.M.Verma & R.K.Agarwal – Insurance

Pandy & Ratogi – Insurance

M.N.Mishra & S.Chand - Principles and Practice of Insurance

Course Code	Course Title	L	T	P	C
19280OEC	Open Elective-Counselling Psychology	4	0	0	2

**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

**Outcome:**

- 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.(2007), 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

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**DEPARTMENT OF MICROBIOLOGY**

**M.PHIL MICROBIOLOGY SYLLABUS - REGULATION 2019**

**Cross cutting**

<b>SEMESTER - I</b>					
<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>193_11</b> <b>(Common Paper)</b>	<b>Research Methodology</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>2</b>
<b>193MBC12</b>	<b>Advanced Microbiology</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>2</b>
<b>193MBC13</b>	<b>A. Microbial Biotechnology</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>2</b>
	<b>B .Bioprocess and Enzyme Engineering</b>				
<b>CPE_RPE</b> <b>(Common Paper)</b>	<b>Research and Publication Ethics</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>2</b>
	<b>Total</b>	<b>08</b>	<b>08</b>	<b>00</b>	<b>08</b>
<b>SEMESTER - II</b>					
<b>193MBC21</b>	<b>Project Work</b>				<b>02</b>

## M Phil- SYLLABUS

(For the candidates admitted from the academic year 2020-2021 onwards)

### PAPER – I RESEARCH METHODOLOGY

(Common for all Subjects except Languages)

Course Code	Course Title	L	T	P	C
203___11	Research Methodology	2	2	0	2

#### Unit – I:

Methods and Technique. An introduction – Defining the research problem – What is a research problem?, Selecting the problem, Necessity of defining the problem, Technique involved in defining the problem, An illustration and conclusion. Research design – Meaning of research design, Need for research design, Features of good design, Important concepts of relating to research design, different research designs, Basic principles of experimental design and conclusion.

#### Unit – II:

Assignment and Thesis at the tertiary level: Writing at the tertiary level – assignments and term papers, thesis and dissertations, conventions of writing-the question of style. Planning the assignment – A time schedule, consulting source materials, preparing a work bibliography, taking notes, the outlines and the first draft. Planning the thesis – selecting a topic, reviewing the literature, designing the study and the chapter outline. Scholarly writing – a case study

### **Unit – III:**

Writing the thesis or assignment: General format – preliminaries, the text, the reference material, the abstract and final product Page and Chapter format – chapter divisions and sub-divisions, spacing, pagination, margins, paragraph indentation and sample pages Tables and Figures – use of tables and figures, placement of tables and figures, Numbering of tables, numbering of pages, numbering of figures, table and figure captions, format of tables, format of figures, preparation of figures, foot notes to tables and figures, very large table and figures, pagination and margin, spacing and alignment, abbreviations and special symbols and numbers. Referencing – Reference systems, Essential informations, spacing capitalization and underline, alphabetical and chronological order, edited works and sum special cases.

### **Unit – IV:**

Computer packages and Internet: Word Basics – Creating and working with documents – working with text and tables – Using Mail Merge. Using Excel: Working with worksheets – creating chart – working with Formula and Functions. Using Power Point: Working with power point – User Interfaces – Using templates and wizard (slide Presentation) - - Creating chart and Tables. Internet and World Wide Web (WWW) – Electronic Main (E-mail) – Intranet and Extranet.

### **Unit – V:**

Descriptive statistics – tabulation, graphical representation – bar diagram – and pie diagrams – various measures of variance, measures of central tendency and normal distribution. Differential statistics “t” test, Chi – square test, “F” test (ANOVA) co -variance (ANCOVA) correlation and multiple regression analysis - Introduction to SPSS.

### **References:**

- Thesis and Assignment writing by Janarthan Anderson and others – Wiley – Eastern Ltd, 1970. Part I Sections 1,2,3,4. Part II Sections 5,6,9,10.
- Research Methodology by C.R. Kothari, Chapter 1,2,3.
- Microsoft Office 2003 – Edward C. Willet. First Edition 2004, Wiley Publications, USA , (Chapters 2,3,4,5,6,12,14,15,26,28,29)

## PAPER II - ADVANCED MICROBIOLOGY

Course Code	Course Title	L	T	P	C
203MBC12	Advanced Microbiology	2	2	0	2

### Course Outcome

- CO1: To learn about microbial taxonomy and molecular characterization of microbes  
CO2: To Learn about applications of microbes in research aspects  
CO3: To Gain the knowledge about biotechnological engineering concept in research  
CO4: To Learn immune system and its mechanism  
CO5: To gain knowledge about nanotechnology and synthesis of nano-particles from microbes.

### Unit I:

Prokaryotic and eukaryotic microbial diversity – bacteria, cyanobacteria, microalgae, microfungi, Habitats, nutrition, ultrastructure and mode of reproduction. Isolation, cultivation and preservation of microorganisms. Classification - Haeckel's three kingdom concept.

Whittaker's five kingdom concept. Three domain concept of Carl Woese. Classification of bacteria according to Bergey's manual of determinative bacteriology. Criteria for classification and identification of microorganisms – morphological, physiological & biochemical. Numerical taxonomy. Phage typing. Nomenclature – bacteriological code. Introduction - DNA finger printing – RFLP, Plasmid profiles, G+C content. Importance of 16S rRNA in taxonomy & phylogeny.

### **Unit II:**

Basic concepts in medium design – design procedure growth limiting nutrient in designed medium – cell growth and product formation – immobilization and cell culture – cell immobilization – enzyme immobilization. Microbes involved in biodegradation of organic wastes and xenobiotic compounds – heavy metals, pesticides, insecticides. Bioinsecticides – BT toxin. Microbial leaching – Extraction of metals from ores. Biofuels, Microbial hydrogen production. biodegradation of oils and petroleum products.

### **Unit III:**

Diagnostic Immunology- methods for immunoglobulin determination – Quantitative and qualitative antigen and antibody reactions. Agglutination – precipitation Immunofluorescence, Immunoblotting, Immunometric methods, Immunology of transplantation and malignancies. Enzyme immunoassays, flow cytometry- Assessment of human allergic diseases-Molecular methods- HLA typing- Immunohaematology- transfusion and compatibility testing, Transfusion reactions. Chemiluminescent detection of proteins.

### **Unit IV:**

Introduction to molecular biology – DNA and RNA – composition and structure. DNA replication, Recombination and repair – Transcription and Translation, Regulation of gene expression. PCR based finger printing – RT PCR, 16S rDNA amplification, cloning, transformation, DNA sequencing. RAPD, STRR & LTRR, Blotting and hybridization. DNA Microarrays/Chips. Genome sequence comparison, alignment and data base searching. GenBank – NCBI, EMBL & DDBJ – retrieving sequences. Tools used for phylogenetic analysis – Ribosomal Database Project, FASTA, BLAST, Phylyp. RNA structure prediction, Restriction enzyme patterns. Designing primers & probes. DNA barcoding. Submission of rDNA sequences – Bankit & Sequin guidelines.

### **Unit V:**

History of nanobiotechnology; Terminologies of nanobiotechnology; Nanoparticals;

Nanotubes; Nanowires; Silver nanoparticles. Protein functions at the cellular level. biosensors; drug delivery, and tissue engineering. Microbial growth response to inorganic nanoparticles; Nanoparticle internalization and cytotoxicity; Nano curcumin(Polymeric nanoparticle-encapsulated curcumin) – a novel strategy for human cancer;Therapeutic application of gold nanoparticles.

## References:

1. Danial Lim ,1998, Microbiology, McGrawHill Companies , New York
2. Stanbury, P.F., A.Whitaker and S.J.Hall. 1995. Principles of fermentation technology-Elsevier Publications
3. Edward A. Birge ,1992, Modern Microbiology, Principles and application. Wm.C.Brown Publishers,USA.
4. HH Rashidi & LK Buehler (2002). Bioinformatics Basics: Applications in Biological Science and Medicine, CRC Press, London
5. Nanobiotechnology II: More Concepts and Applications (2007) by Chad A. Mirkin, Christof M. Niemeyer 1st edition Wiley-VCH Publisher.
6. NanoBiotechnology Protocols (Methods in Molecular Biology) (2005) by Sandra J Rosenthal, David W. Wright Humana press publisher.
7. Nanobiotechnology Molecular Diagnostics: Current Techniques and Applications (Horizon Bioscience) (2006) by K.K. Jain Taylor & Francis 1st edition. Taylor & Francis Publication.



### PAPER III - MICROBIAL BIOTECHNOLOGY

Course Code	Course Title	L	T	P	C
203MBC13A	Microbial Biotechnology	2	2	0	2

#### Course Outcomes

CO1: To gain Knowledge about isolation, purification and preservation of microorganisms.

CO2: To learn about the molecular tools of genetic engineering

CO3: To Know about the production of value added products

CO4: To gain the knowledge about industrial production from microbes.

CO5: To learn the methods of biofertilizer and biofuels production

#### Unit I:

Historical development of microbial technology. Products obtained from microorganism through recombinant techniques. Introduction to genetic engineering. Molecular tools of genetic engineering-vectors-Methods of gene transfer. Gene cloning strategies. Basic techniques in genetic engineering.

#### Unit II:

Biotechnology & Bioprocess Engineering, steps in bioprocess development, Microbial culture, Screening and selection for fermentation processes; Preservation and improvement of industrially important microorganisms, Strain development. Fermentation Material and Energy balance, Microbial growth kinetics: Microbial growth cycle, measurement of growth, Batch culture, continuous culture, fed-batch culture, applications and examples. . Bioinstrumentation and computer control of fermentation processes. Bioreactors - Solid State fermentation - Submerged fermentation. Downstream processing of industrial products

#### Unit III:

Bacteriology and starter rotations, improving starter cultures for food fermentation by genetic manipulation, recombination technology. Genetic improvement of lactic starters to enhance their technological functions for industrial applications e.g. acid, flavour, EPS, probiotic functions, Metabolic engineering of lactic acid bacteria, Production of recombinant dairy / food enzymes / proteins e.g. Chymosin, lactoferrin, lysozyme, lipases, proteases, etc. Single Cell Protein

#### **Unit IV:**

Microbial products of pharmaceutical value – raw materials, organism and Industrial processes involved in the Microbial production of antibiotics - Penicillin, Cephalosporins, Aminoglycosides, Tetracycline and aromatic antibiotics, Enzymes , Vitamins - B12, Riboflavin, aminoacids and Recombinant vaccines.

#### **Unit V:**

Soil microbes and fertility of soil. Role of microbes in biogeochemical cycles Microbial association – beneficial – nitrogen fixing organism – symbiosis, asymbiosis, associate symbiosis – bacteria actinomycetes, cyanobacteria – mycorrhizae –phosphate solubilizers. Nitrogen fixation and role of Ti plasmids in biotechnology: Biology of nitrogen fixation – nitrogen fixation genes and their regulation in *Klebsiella* – *Rhizobium* – *Azospirillum* & *Azotobacter* – *Agrobacterium* and plant tumour – Ti plasmids Ri plasmids – Genetic regulation of tumorigenicity in plants. Production of Biofertilizer

#### **References:**

1. Textbook of Microbiology - Ananthanarayanan and Jayaram panikar. Seventh Edition 2005
2. Microbiology - Pelczar, Chan and Krieg 5<sup>th</sup> Edition 1993 Reprint 2015. Tata Mc Craw Hill
3. Biotechnology - U. Sathyanarayana Eleventh Edition 2017

### PAPER III - BIOPROCESS AND ENZYME ENGINEERING

Course Code	Course Title	L	T	P	C
203MBC13B	Bioprocess and Enzyme Engineering	2	2	0	2

#### Course Outcome

CO 1- To understand different fundamentals concepts and specialized knowledge of different applied microbiology area

CO 2 - To apply the knowledge gained in developing industrial enzyme products.

CO 3- To become an entrepreneur through this industrial based learning strategies

CO 4 -To start an independent research and can contribute in solving new problems faced in current science

#### Unit-I

Bioprocesses- batch, fed-batch and continuous cultivation, sterile operations, design of experiment for bioprocess optimization, industrial synthetic biology, high throughput bioprocess design, bioseparation and downstream processing- membrane separation techniques, chromatographic separation techniques, water purification etc., interactions and integration of microorganisms, bioreactor and downstream processing, experimental basis and methods for biosystems analysis, modelling of bioreactors, dynamic behaviour of bioprocesses, analysis, modelling and simulation of biological networks.

#### Unit-II

Development of reactors and processes for stabilization of organic and industrial wastes, miniaturisation of bioreaction systems, miniplant technology for integration of biosynthesis and downstream processing, technical and economic assessment of bioproduction processes, application of bioinformatics for development of bioprocesses, biocatalysis for the sustainable synthesis of chemicals and pharmaceuticals from renewable resources, rational engineering of biological systems for sustainable bioprocessing, small mimics, microfluidics and mathematical models for process understanding, scale-translation.

#### Unit-III

Strain improvement – Applications of mutation, Recombination and DNA Technology.– Principles and applications, enzymology of process. Industrial enzymes production - Proteases, amylases, lipases, cellulases, pectinases, glucose isomerase, L-Asparaginase.

## Unit - IV

Kinetics of enzyme reactions, biochemical characterization of enzymes, graphical analysis of kinetic data, pH and temperature dependence, development of recombinant clones for overproduction of enzymes and metabolites, development of expression systems in bacteria and yeasts, bioenergetics and biological molecular machines, protein conformation study and structure-function relationship using biophysical methods, protein engineering by combinatorial methods.

## Unit-V

Enzyme engineering and design: substitution, insertion, hybrid proteins, genes for novel enzymes Aequorin and Enviropig, directed evolution and site directed mutagenesis approaches to improve industrial enzymes, engineering more stable enzymes, analysis and design of microbial and enzyme reactors for production of industrially important products such as biofuels, industrial enzymes, biopolymers, etc., development of bio-sensors for detection of various analytes, development of cell culture techniques for cultivation of plant and animal cells in specialized reactors for production of therapeutic compounds.

## Reference

Yoo YJ et al (2017) Fundamentals of Enzyme Engineering, Springer 2.

Stanbury et al (2003) Principle of Fermentation technology, Butter worth-Heinemann

## **PAPER IV - RESEARCH AND PUBLICATION ETHICS**

<b>Course Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
CPE_RPE	<b>Research and publication ethics</b>				2

### **THEORY**

#### **Unit I: PHILOSOPHY AND ETHICS ( 3 hours)**

1. Introduction to philosophy, definition, nature and scope, concept, branches.
2. Ethics: definition, moral philosophy, nature of moral judgements and reactions.

#### **Unit II: SCIENTIFIC CONDUCT ( 5 hours )**

1. Ethics with respect to science and research.
2. Intellectual honesty and research integrity.
3. Scientific misconducts: Falsification, Fabrication and Plagiarism (FFP)
4. Redundant publications: duplicate and overlapping publications, salami slicing.
5. Selective reporting and misrepresentation of data.

#### **Unit III : PUBLICATION ETHICS ( 7 hours )**

1. Publication ethics: definition, introduction and importance.
2. Best practices / standards setting initiatives and guidelines: COPE, WAME, etc.
3. Conflicts of interest.
4. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types.
5. Violation of publication ethics, authorship and contributorship.
6. Identification of publication misconduct, complaints and appeals.
7. Predatory publishers and journals.

### **PRACTICE**

#### **Unit IV: OPEN ACCESS PUBLISHING ( 4 hours.)**

1. Open access publications and initiatives.
2. SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies.
3. Software tool to identify predatory publications developed by SPPU.

4. Journal finder / journal suggestion tools viz, JANE, Elsevier Journal Folder, Springer Journal Suggester, etc.

## **UNIT V : PUBLICATION MISCONDUCT ( 4 hours)**

### **A. Group Discussions ( 2 hours )**

1. Subject specific ethical issues, FFP, authorship
2. Conflicts of interest.
3. Complaints and appeals: examples and fraud from India and abroad.

### **B. Software tools ( 2 hours )**

Use of plagiarism software like Turnitin, Urkund and other open source software tools.

## **UNIT VI: DATABASES AND RESEARCH METRICS (7 hours )**

### **A. Databases ( 4 hours )**

1. Indexing databases.
2. Citation database: Web of Science, Scopus etc.

### **B. Research Metrics ( 3 hours )**

1. Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score.
2. Metrics: h-index, g index, i10 index, altmetrics.