PONNAIYAH RAMAJAYAM INSTITUTE OF SCIENCE & TECHNOLOGY (PRIST)

Declared as DEEMED-TO-BE-UNIVERSITY
U/s 3 of UGC Act, 1956

Vallam, Thanjavur

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF
ELECTRONICS & COMMUNICATION ENGINEERING

PROGRAM HANDBOOK

B.TECH – PART TIME

[REGULATION 2024]

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, engineeringfundamentals, and an engineering specialization to the solution of complex engineering problems.

B. **Problem analysis**: Identify, formulate, review research literature, and analyze complexengineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

C. **Design/development of solutions**: Design solutions for complex engineering problemsand 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 andresearch 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, andmodern 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 toassess 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 engineeringsolutions 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 andnorms of the engineering practice.

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

J. Communication: Communicate effectively on complex engineering activities with theengineering 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 theengineering 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 toengage 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
1	3	3	2	3	2	1	1	2	1	1	3	1	3
2	3	3	3	3	3	1	1	1	1	1	1	2	2
3	3	3	3	3	3	2	2	3	1	2	2	2	2

Contribution   1:   Reasonable   2:   Significant   3:   Strong

B.TECH (PART TIME) – ECE – R-2024

SEMESTER I – VII CURRICULUM

SEMESTER-I

S.NO	SUB CODE	SUBJECT NAME	Periods Per Week			C
			L	T	P	
1	24148S11P	Transforms and Partial Differential Equations	3	1	0	4
2	24152C12P	Electromagnetic Fields	3	1	0	4
3	24152C13P	Digital Electronics	3	0	0	3
4	24152C14P	Electronic Devices and Circuits	3	0	0	3
5	24152C15P	Signals and Systems	4	0	0	4
		TOTAL CREDITS				**18**

SEMESTER-II

S.NO	SUB CODE	SUBJECT NAME	Periods Per Week			C
			L	T	P	
1	24148S21BP	Probability and Random Processes	3	1	0	4
2	24150S22P	Problem Solving and Python Programming	3	0	0	3
3	24152C23P	Communication Systems	3	0	0	3
4	24152C24P	Linear Integrated Circuits	3	1	0	4
5	24152L25P	Problem Solving and Python Programming Lab	0	0	3	2
		TOTAL CREDITS				**16**

SEMESTER-III

S.NO	SUB CODE	SUBJECT NAME	Periods Per Week			C
			L	T	P	
1.	24152C31P	Discrete-Time Signal Processing	3	1	0	4
2.	24152C32P	Microprocessor and Microcontrollers	3	0	0	3
3.	24152C33P	Transmission Lines and RF Systems	4	0	0	4
4.	24152C34P	Computer Networks	3	0	0	3
5.	24152L35P	Digital Signal Processing and Microcontroller Lab	0	0	3	2
		TOTAL CREDITS				**16**

SEMESTER-IV

S.NO	SUB CODE	SUBJECT NAME	Periods Per Week			C
			L	T	P	
1	24152C41P	Medical Electronics	3	0	0	3
2	24152C42P	Antenna and Wave Propagation	3	1	0	4
3	24152C43P	Wireless Communication	3	0	0	3
4	24152E44_P	Elective-I	4	0	0	4
5	24152L45P	Communication Networks Lab	0	0	3	2
			TOTAL CREDITS			16

SEMESTER-V

S.NO	SUB CODE	SUBJECT NAME	Periods Per Week			C
			L	T	P	
1	24152C51P	Optical Communication	4	0	0	4
2	24152C52P	Microwave Engineering	4	0	0	4
3	24160C53P	Principles of Management	3	0	0	3
4	24152E54_P	Elective-II	4	0	0	4
5	24152L55P	Optical Communication and Microwave Lab	0	0	3	2
			TOTAL CREDITS			17

SEMESTER-VI

S.NO	SUB CODE	SUBJECT NAME	Periods Per Week			C
			L	T	P	
1	24150S61P	Internet-of-Things	4	0	0	4
2	24152C62P	VLSI Design	3	1	0	4
3	24152C63P	Embedded and Real Time Systems	3	1	0	4
4	24152E64_P	Elective-III	4	0	0	4
5	24152L65P	VLSI and Embedded Systems Lab	0	0	3	2
			TOTAL CREDITS			18

SEMESTER-VII

S.NO	SUB CODE	SUBJECT NAME	L	T	P	C
1	21160S71P	Total Quality Management	3	0	0	3
2	24152C72P	Wireless Networks	3	0	0	3
3	24152C73P	Adhoc and Wireless Sensor Networks	4	0	0	4
4	24152E74_P	Elective-IV	3	0	0	3
5	24152P75P	Project Work	0	0	12	6
					TOTAL CREDITS	19

LIST OF ELECTIVES

ELECTIVE-I (SEMESTER-IV)

S.No	Sub Code	Sub Name	L	T	P	C
1	24152E44AP	High Speed Networks	4	0	0	4
2	24152E44BP	Advanced Digital Signal Processing	4	0	0	4
3	24152E44CP	Speech Processing	4	0	0	4
4	24152E44DP	Machine Learning Techniques	4	0	0	4
5	24152E44EP	Nano Technology and Applications	4	0	0	4

ELECTIVE-II (SEMESTER-V)

S.No	Sub Code	Sub Name	L	T	P	C
1	24152E54AP	Environmental Science and Engineering	4	0	0	4
2	24152E54BP	Optoelectronic Devices	4	0	0	4
3	24152E54CP	Radar and Navigational Aids	4	0	0	4
4	24152E54DP	Digital Image Processing	4	0	0	4
5.	24152E54EP	Intellectual Property Rights	4	0	0	4

ELECTIVE-III(SEMESTER-VI)

S.No	Sub Code	Sub Name	Periods Per Week			C
			L	T	P	
1	24152E64AP	Professional Ethics in Engineering	4	0	0	4
2	24152E64BP	Satellite Communication	4	0	0	4
3	24152E64CP	Robotics and Automation	4	0	0	4
4	24152E64DP	Network Security	4	0	0	4
5.	24152E64EP	CMOS Analog IC Design	4	0	0	4

ELECTIVE-IV (SEMESTER-VII)

S.No	Sub Code	Sub Name	Periods Per Week			C
			L	T	P	
1	24152E74AP	Power Electronics	3	0	0	3
2	24152E74BP	Advanced Microprocessors and Microcontrollers	3	0	0	3
3	24152E74CP	Electromagnetic Interference and Compatibility	3	0	0	3
4	24152E74DP	Solid State Electronic Drives	3	0	0	3
5	24152E74EP	Mixed Signal IC Design	3	0	0	3

B.TECH (PART TIME) – ECE – R-2024

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	-	-	-	-	18
II	05	19	-	-	-	-	16
III	04	16	01	02	-	-	16
IV	03	12	01	02	01	04	16
V	03	12	01	02	01	04	17
VI	03	12	01	02	01	04	18
VII	03	11	01	06	01	03	19
Total Credits							120

HOD   DEAN   DEAN -
                                               ACADEMIC AFFAIRS

TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS   3 1 0 4

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 identify – 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., ManicavachagomPillay, 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.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
CO2	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
CO3	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
CO4	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
CO5	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
Avg	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-

1-low,2-medium,3-high,'-'-nocorrelation

24152C12P   **SEMESTER I**

ELECTROMAGNETIC FIELDS   3 1 0 4

OBJECTIVES

- To impart knowledge on the basics of static electric and magnetic field and the associated laws.

- To give insight into the propagation of EM waves and also to introduce the methods in computational electromagnetics.
- To make students have depth understanding of antennas, electronic devices, Waveguides is possible.

UNIT I   STATIC ELECTRIC FIELD   9

Vector Algebra, Coordinate Systems, Vector differential operator, Gradient, Divergence, Curl, Divergence theorem, Stokes theorem, Coulombs law, Electric field intensity, Point, Line, Surface and Volume charge distributions, Electric flux density, Gauss law and its applications, Gauss divergence theorem, Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electricdipole,Electrostatic Energy and Energy density.

UNIT II   CONDUCTORS AND DIELECTRICS   9

Conductors and dielectrics in Static Electric Field, Current and current density, Continuity equation, Polarization, Boundary conditions, Method of images, Resistance of a conductor, Capacitance, Parallel plate, Coaxial and Spherical capacitors, Boundary conditions for perfect dielectric materials, Poisson"s equation, Laplace's equation, Solution of Laplace equation, Application of Poisson"s and Laplace"s equations.

UNIT III   STATIC MAGNETIC FIELDS   9

Biot -Savart Law, Magnetic field Intensity, Estimation of Magnetic field Intensity for straight and circular conductors, Ampere"s Circuital Law, Point form of Ampere"s Circuital Law, Stokes theorem, Magnetic flux and magnetic flux density, The Scalar and Vector Magnetic potentials, Derivation of Steady magnetic field Laws.

UNIT IV   MAGNETIC FORCES AND MATERIALS   9

Force on a moving charge, Force on a differential current element, Force between current elements, Force and torque on a closed circuit, The nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions involving magnetic fields, The magnetic circuit, Potential energy and forces on magnetic materials, Inductance, Basic expressions for self and mutual inductances, Inductance evaluation for solenoid, toroid, coaxial cables and transmission lines, Energy stored in Magnetic fields.

UNIT V   TIME VARYING FIELDS AND MAXWELL'S EQUATIONS   9

Fundamental relations for Electrostatic and Magnetostatic fields, Faraday"s law for Electromagnetic induction, Transformers, Motional Electromotive forces, Differential form of Maxwell"s equations, Integral form of Maxwell"s equations, Potential functions, Electromagnetic boundary conditions, Wave equations and their solutions, Poynting"s theorem, Time harmonic fields, Electromagnetic Spectrum.

TUTORIAL   15   **TOTAL : 60**

TEXTBOOKS
1. William H Hayt and Jr John A Buck, "Engineering Electromagnetics", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008
2. Sadiku MH, "Principles of Electromagnetics", Oxford University Press Inc, New Delhi, 2009

REFERENCES
1. David K Cheng, "Field and Wave Electromagnetics", Pearson Education Inc, Delhi, 2004
2. John D Kraus and Daniel A Fleisch, "Electromagnetics with Applications", McGraw Hill Book Co, 2005
3. Karl E Longman and Sava V Savov, "Fundamentals of Electromagnetics", Prentice Hall of India, New Delhi, 2006
4. AshutoshPramanic, "Electromagnetism", Prentice Hall of India , New Delhi, 2006

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	1	1	1	-	2	1	-	-	1	-	2
2	2	2	3	3	2	2	2	-	-	1	1	2
3	2	2	3	2	2	2	1	-	-	1	1	2
4	2	2	3	2	2	2	1	-	-	1	1	2
5	2	2	2	2	2	2	1	-	-	2	2	1
CO	**2**	**2**	**2**	**2**	**2**	**2**	**1**	-	-	**1**	**1**	**2**

1-low,2-medium,3-high,'-'-nocorrelation

24152C13P   **SEMESTER I**

DIGITAL ELECTRONICS   3 1 0 4

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 Design‖, 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 andS.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.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	-	2	-	-	-	-	3	3	3	3	2
2	-	-	-	-	-	-	-	-	-	-	2	1	2	3	2
3	-	3	3	2	-	2	-	-	-	-	2	2	3	3	2
4	-	-	-	-	-	-	-	-	-	-	3	2	2	3	1
5	-	3	3	3	-	-	-	-	-	-	2	2	3	3	2
CO	3	2.6	2.6	2.3	-	2	-	-	-	-	2	2	3	3	2

1-low,2-medium,3-high,'-'-nocorrelation

24152C14P   **SEMESTER I**

ELECTRONIC DEVICES AND CIRCUITS   3 0 0 3

COURSE OBJECTIVES:
- To give a comprehensive exposure to all types of devices and circuits constructed with discrete components. This helps to develop a strong basis for building linear and digital integrated circuits
- To analyze the frequency response of small signal amplifiers
- To design and analyze single stage and multistage amplifier circuits
- To study about feedback amplifiers and oscillators principles
- To understand the analysis and design of multi vibrators

UNIT I   SEMICONDUCTOR DEVICES   9
PN junction diode, Zener diode, BJT, MOSFET, UJT –structure, operation and V-I characteristics, diffusion and transition capacitance - Rectifiers – Half Wave and Full Wave Rectifier, Zener as regulator

UNIT II   AMPLIFIERS   9
Load line, operating point, biasing methods for BJT and MOSFET, BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response –MOSFET small signal model– Analysis of CS, CG and Source follower – Gain and frequency response- High frequency analysis.

UNIT III MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER
9

Cascode amplifier, Differential amplifier – Common mode and Difference mode analysis – MOSFET input stages – tuned amplifiers – Gain and frequency response – Neutralization methods.

UNIT IV FEEDBACK AMPLIFIERS AND OSCILLATORS 9
Advantages of negative feedback – Voltage / Current, Series , Shunt feedback Amplifiers – positive feedback–Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.

UNIT V POWER AMPLIFIERS AND DC/DC CONVERTERS 9
Power amplifiers- class A-Class B-Class AB-Class C-Power MOSFET-Temperature Effect- Class AB Power amplifier using MOSFET –DC/DC convertors – Buck, Boost, Buck-Boost analysis and design.

TOTAL: 45 PERIODS

COURSE OUTCOMES :
At the end of the course the students will be able to
CO1: Explain the structure and working operation of basic electronic devices.
CO2: Design and analyze amplifiers.
CO3: Analyze frequency response of BJT and MOSFET amplifiers
CO4: Design and analyze feedback amplifiers and oscillator principles.
CO5: Design and analyze power amplifiers and supply circuits

TEXT BOOKS:
1. David A. Bell, "Electronic Devices and Circuits", Oxford Higher Education press, 5th Edition, 2010.
2. Robert L. Boylestad and Louis Nasheresky, "Electronic Devices and Circuit Theory", 10th Edition, Pearson Education / PHI, 2008.
3. Adel .S. Sedra, Kenneth C. Smith, "Micro Electronic Circuits", Oxford University Press, 7th Edition, 2014.

REFERENCES:
1. Donald.A. Neamen, "Electronic Circuit Analysis and Design", Tata McGraw Hill, 3rd Edition, 2010.
2. D.Schilling and C.Belove, "Electronic Circuits", McGraw Hill, 3rd Edition, 1989
3. Muhammad H.Rashid, "Power Electronics", Pearson Education / PHI , 2004.

CO's-PO's&PSO'sMAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	3	3	3	3	2	1	-	-	-	-	-	1	2	1	1
2	3	2	2	3	2	2	-	-	-	-	-	1	2	1	1
3	3	3	3	2	1	2	-	-	-	-	-	1	2	1	1
4	3	3	2	3	2	2	-	-	-	-	-	1	2	1	1
5	3	2	3	2	2	1	-	-	-	-	-	1	2	1	1
CO	**3**	**3**	**3**	**3**	**2**	**2**	-	-	-	-	-	**1**	**2**	**1**	**1**

1-low,2-medium,3-high,'-'-nocorrelation

24152C15P   **SEMESTER I**

SIGNALS AND SYSTEMS   4 0 0 4

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. AlanV.Oppenheim, Alan S.Willsky with S.HamidNawab, Signals & Systems, 2ndedn., 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.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	3	-	3	2	-	-	-	-	-	3	-	-	1
2	3	-	3	-	-	2	-	-	-	-	-	3	-	3	-
3	3	3	-	-	3	2	-	-	-	-	-	3	2	-	-
4	3	3	-	-	3	2	-	-	-	-	-	3	-	3	1
5	3	3	-	3	3	2	-	-	-	-	-	3	-	3	1
CO	3	3	3	3	3	2	-	-	-	-	-	3	2	3	1

1-low,2-medium,3-high,'-'-nocorrelation

 24148S21BP   **SEMESTER II**

PROBABILITY AND RANDOM PROCESSES

3 1 0 4

OBJECTIVES

At the end of the course, the students would

- Have a fundamental knowledge of the basic probability concepts.
- Have a well – founded knowledge of standard distributions which can describe real life phenomena.
- Acquire skills in handling situations involving more than one random variable and functions of random variables.
- Understand and characterize phenomena which evolve with respect to time in probabilistic manner.
- Be able to analyze the response of random inputs to linear time invariant systems.

UNIT I   PROBABILITY AND RANDOM VARIABLE   9

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

UNIT II   STANDARD DISTRIBUTIONS   9
Binomial, Poisson, Geometric, Uniform, Exponential, Gamma, Weibull and Normal distributions and their properties - Functions of a random variable (excluding theorm).

UNIT III   TWO DIMENSIONAL RANDOM VARIABLES   9
Joint distributions - Marginal and conditional distributions – Covariance - Correlation and regression (for distributions only) - Transformation of random variables - Central limit theorem.

UNIT IV   CLASSIFICATION OF RANDOM PROCESSES   9
Definition and examples - first order, second order, strictly stationary, wide – sense stationary and Ergodic processes - Markov process - Binomial, Poisson and Normal processes - Sine wave process.

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 Pubishers, Fourth Edition, New Delhi, 2002. (Chapters 6, 7 and 8).

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	0	0	0	0	0	0	3	0	0	2	-	-	-
CO2	3	3	0	0	0	0	0	0	3	0	0	2	-	-	-
CO3	3	3	0	0	0	0	0	0	3	0	0	2	-	-	-
CO4	3	3	0	0	0	0	0	0	3	0	0	2	-	-	-
CO5	3	3	0	0	0	0	0	0	3	0	0	2	-	-	-
CO6	3	3	0	0	0	0	0	0	3	0	0	2	-	-	-

1-low,2-medium,3-high,'-'-nocorrelation

PROBLEM SOLVING AND PYTHON PROGRAMMING   3 0 0 3

COURSE OBJECTIVES:
- To understand the basics of algorithmic problem solving.
- To learn to solve problems using Python conditionals and loops.
- To define Python functions and use function calls to solve problems.
- To use Python data structures - lists, tuples, dictionaries to represent complex data.
- To do input/output with files in Python.

UNIT I   COMPUTATIONAL THINKING AND PROBLEM SOLVING   9
Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation   (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II   DATA TYPES, EXPRESSIONS, STATEMENTS   9
Python interpreter and interactive mode,debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III   CONTROL FLOW, FUNCTIONS, STRINGS   9
Conditionals:Boolean values and operators, conditional (if), alternative (if-else),chained conditional (if-elif-else);Iteration: state, while, for, break, continue, pass; Fruitful functions: return values,parameters, local and global scope, function composition, recursion;   Strings: string slices,immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV   LISTS, TUPLES, DICTIONARIES   9
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

UNIT V   FILES, MODULES, PACKAGES   9
Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).
                                                          TOTAL : 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, students will be able to
CO1: Develop algorithmic solutions to simple computational problems.
CO2: Develop and execute simple Python programs.
CO3: Write simple Python programs using conditionals and loops for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python lists, tuples, dictionaries etc.
CO6: Read and write data from/to files in Python programs.

TEXT BOOKS:
1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

REFERENCES:
1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press, 2021
4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5. https://www.python.org/
6. Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.

CO's-PO's&PSO'sMAPPING

CO	Pos											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	3	3	3	2	1	1	-	-	-	1	1
2	3	3	3	3	2	1	1	-	-	-	1	1
3	3	3	3	3	3	1	1	-	-	-	1	1
4	3	3	3	3	3	1	1	-	-	-	1	1
	3	3	3	3	2	1	1	-	-	-	1	1
Avg	3	3	3	3	2.5	1	1	-	-	-	1	1

1-low,2-medium,3-high,'-'-nocorrelation

COMMUNICATION SYSTEMS 3 0 0 3

COURSE OBJECTIVES:
- To introduce Analog Modulation Schemes
- To impart knowledge in random process
- To study various Digital techniques
- To introduce the importance of sampling & quantization
- To impart knowledge in demodulation techniques
- To enhance the class room teaching using smart connectivity instruments

UNIT I   AMPLITUDE MODULATION   9

Review of signals and systems, Time and Frequency domain representation of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals. SSB Generation – Filter and Phase Shift Methods, VSB Generation – Filter Method, Hilbert Transform, Pre-envelope & complex envelope AM techniques, Superheterodyne Receiver.

UNIT II   RANDOM PROCESS & SAMPLING   9

Review of probability and random process. Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and De- emphasis, Threshold effect in angle modulation.
Low pass sampling – Aliasing- Signal Reconstruction-Quantization - Uniform & non-uniform quantization - quantization noise - Nyquist criterion- Logarithmic Companding – PAM, PPM, PWM, PCM – TDM, FDM

UNIT III   DIGITAL TECHNIQUES   9

Pulse modulation Differential pulse code modulation. Delta modulation, Noise considerations in PCM,, Digital Multiplexers, Channel coding theorem - Linear Block codes - Hamming codes - Cyclic codes - Convolutional codes - Viterbi Decoder

UNIT IV   DIGITAL MODULATION SCHEME   9

Geometric Representation of signals - Generation, detection, IQ representation, PSD & BER of Coherent BPSK, BFSK, & QPSK - QAM - Carrier Synchronization - Structure of Non-coherent Receivers Synchronization and Carrier Recovery for Digital modulation, Spectrum Analysis – Occupied bandwidth – Adjacent channel power, EVM, Principle of DPSK

UNIT V DEMODULATION TECHNIQUES 9

Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations. Baseband Pulse Transmission- Inter symbol Interference, Optimum demodulation of digital signals over band-limited channels.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course students will be able to
CO1: Gain knowledge in amplitude modulation techniques
CO2: Understand the concepts of Random Process to the design of communication systems
CO3: Gain knowledge in digital techniques
CO4: Gain knowledge in sampling and quantization
CO5: Understand the importance of demodulation techniques

TEXTBOOKS:
1. Simon Haykins," Communication Systems", Wiley, 5th Edition, 2009.(Unit I - V)
2. B.P.Lathi, "Modern Digital and Analog Communication Systems", 4th Edition, Oxford University Press, 2011.

REFERENCES:
1. Wayner Tomasi, Electronic Communication System, 5th Edition, Pearson Education,2008.
2. D.Roody, J.Coolen, Electronic Communications, 4th Edition PHI 2006
3. A.Papoulis, "Probability, Random variables and Stochastic Processes", McGraw Hill, 3rd 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

CO's-PO's&PSO'sMAPPING

CO	Pos											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	3	3	3	2	1	1	-	-	-	1	1
2	3	3	3	3	2	1	1	-	-	-	1	1
3	3	3	3	3	3	1	1	-	-	-	1	1
4	3	3	3	3	3	1	1	-	-	-	1	1
	3	3	3	3	2	1	1	-	-	-	1	1
Avg	3	3	3	3	2.5	1	1	-	-	-	1	1

1-low,2-medium,3-high,'-'-nocorrelation

LINEAR INTEGRATED CIRCUITS   3 1 0 4

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, 4thEdition, Tata McGraw-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, 5th Edition, 2009.
5. William D.Stanley, ―Operational Amplifiers with Linear Integrated Circuits, Pearson Education,4th Edition,2001.
6. S.Salivahanan& V.S. KanchanaBhaskaran, ―Linear Integrated Circuits‖, TMH,2nd Edition, 4th Reprint, 2016.

CO's-PO's&PSO'sMAPPING

CO	Pos											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	3	3	3	2	1	1	-	-	-	1	1
2	3	3	3	3	2	1	1	-	-	-	1	1
3	3	3	3	3	3	1	1	-	-	-	1	1
4	3	3	3	3	3	1	1	-	-	-	1	1
	3	3	3	3	2	1	1	-	-	-	1	1
Avg	3	3	3	3	2.5	1	1	-	-	-	1	1

1-low,2-medium,3-high,'-'-nocorrelation

PROBLEM SOLVING AND PYTHON PROGRAMMING LAB   0 0 3 2

COURSE OBJECTIVES:
- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To practice various computing strategies for Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

LIST OF EXPERIMENTS:
1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building – operations of list & tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)
11. Exploring Pygame tool.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

COURSE OUTCOMES:
At the end of the lab, the students will be able to:
CO1: Develop algorithmic solutions to simple computational problems
CO2: Develop and execute simple Python programs.
CO3: Implement programs in Python using conditionals and loops for solving problems.
CO4: Deploy functions to decompose a Python program.
CO5: Process compound data using Python data structures.

CO6: Utilize Python packages in developing software applications.

CO's-PO's&PSO'sMAPPING

C	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO	PSO
1	2	-	-	-	-	-	-	-	-	1	-	2	1	1	
2	2	3	3	2	-	-	-	-	-	-	-	-	2	1	1
3	1	-	-	2	-		-	-	-	-	-	-	2	1	1
4	1	-	-	2	-	-	-	-	-	-	-	-	2	1	1
5	1	2	3	3	-	-	-	-	-	-	-	3	2	1	1
C	1.4	2.5	3	2.2	-	-	-	-	-	-	1	3	2	1	1

1-low,2-medium,3-high,'-'-nocorrelation

24152C31P   **SEMESTER III**

DISCRETE TIME SIGNAL PROCESSING   3 1 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&DimitrisG.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. Schafer and J.R. Buck, ―Discrete-Time Signal Processing, 8th Indian Reprint, Pearson, 2004.
3. Sanjit K. Mitra, ―Digital Signal Processing – A Computer Based Approach, Tata McGraw Hill, 2007.
4. Andreas Antoniou, ― Digital Signal Processing, Tata McGraw Hill, 2006.

CO's-PO's&PSO'sMAPPING

C	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO	PSO
1	2	-	-	-	-	-	-	-	-	-	1	-	2	1	1
2	2	3	3	2	-	-	-	-	-	-	-	-	2	1	1
3	1	-	-	2	-	-	-	-	-	-	-	-	2	1	1
4	1	-	-	2	-	-	-	-	-	-	-	-	2	1	1
5	1	2	3	3	-	-	-	-	-	-	-	3	2	1	1
C	1.4	2.5	3	2.2	-	-	-	-	-	-	1	3	2	1	1

1-low,2-medium,3-high,'-'-nocorrelation

24152C32P   **SEMESTER**

III

MICROPROCESSORS AND MICROCONTROLLERS   3 1 0 4

OBJECTIVES:
The student should be made to:
- Study the Architecture of 8086 microprocessor.
- Learn the design aspects of I/O and Memory Interfacing circuits.
- Study about communication and bus interfacing.
- Study the Architecture of 8051 microcontroller.

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 – IO 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.

 TUTORIAL: 15 Hrs   **TOTAL: 45 PERIODS**

OUTCOMES:
At the end of the course, the student should be able to:
- Design and implement programs on 8086 microprocessor.

- Design I/O circuits.
- Design Memory Interfacing circuits.
- Design and implement 8051 microcontroller based systems.

TEXT BOOKS:
1. Yu-Cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design", Second Edition, Prentice Hall of India, 2007.
2. Mohamed Ali Mazidi, Janice GillispieMazidi, RolinMcKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Second Edition, Pearson education, 2011.

REFERENCE:
1. DoughlasV.Hall, "Microprocessors and Interfacing, Programming and Hardware",TMH,2012

CO's-PO's&PSO'sMAPPING

C	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO	PSO
1	2	-	-	-	-	-	-	-	-	-	1	-	2	1	1
2	2	3	3	2	-	-	-	-	-	-	-	-	2	1	1
3	1	-	-	2	-		-	-	-	-	-	-	2	1	1
4	1	-	-	2	-	-	-	-	-	-	-	-	2	1	1
5	1	2	3	3	-	-	-	-	-	-	-	3	2	1	1
C	1.4	2.5	3	2.2	-	-	-	-	-	-	1	3	2	1	1

1-low,2-medium,3-high,'-'-nocorrelation

TRANSMISSION LINES AND RF SYSTEMS   4 0 0 4

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 Z0 - 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 HallIndia, 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.

CO's-PO's&PSO'sMAPPING

C	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO	PSO
1	2	-	-	-	-	-	-	-	-	-	1	-	2	1	1
2	2	3	3	2	-	-	-	-	-	-	-	-	2	1	1
3	1	-	-	2	-		-	-	-	-	-	-	2	1	1
4	1	-	-	2	-	-	-	-	-	-	-	-	2	1	1
5	1	2	3	3	-	-	-	-	-	-	-	3	2	1	1
C	**1.4**	**2.5**	**3**	**2.2**	-	-	-	-	-	-	**1**	**3**	**2**	**1**	**1**

1-low,2-medium,3-high,'-'-nocorrelation

COMPUTER NETWORKS   3 0 0 3

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**
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

COURSE OUTCOMES:
At the end of the course, the students will be able to:
- 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.

TEXT BOOKS

1. Behrouz A. Foruzan, "Data communication and Networking", Tata McGraw-Hill, 2004.

REFERENCES

1. James .F. Kurouse & 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.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
CO2	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
CO3	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
CO4	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
CO5	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
Avg	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-

1-low,2-medium,3-high,'-'-nocorrelation

DIGITAL SIGNAL PROCESSING AND MICROCONTROLLER LAB
0 0 3 2

OBJECTIVES:
The student should be made to:
- To perform basic signal processing operations such as Linear Convolution, Circular Convolution in MATLAB
- To implement FIR and IIR filters in MATLAB and DSP Processor
- To study the architecture of DSP processor
- Introduce ALP concepts and features
- Write ALP for arithmetic and logical operations in 8086 and 8051
- Interface different I/Os with Microprocessors
- Be familiar with MASM

LIST OF EXPERIMENTS:

MATLAB / EQUIVALENT SOFTWARE PACKAGE
1. Generation of elementary Discrete-Time sequences
2. Linear and Circular convolutions
3. Design of FIR filters (LPF/HPF/BPF/BSF) and 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

8086 Programs using kits and MASM
1. Basic arithmetic and Logical operations
2. Code conversion, decimal arithmetic and Matrix operations.
3. Floating point operations, string manipulations, sorting and searching

Peripherals and Interfacing Experiments
4. Traffic light control
5. Stepper motor control
6. Key board and Display
7. A/D and D/A interface and Waveform Generation

8051 Experiments using kits and MASM
8. Basic arithmetic and Logical operations
9. Square and Cube program, Find 2"s complement of a number
10. Unpacked BCD to ASCII

TOTAL: 45 PERIODS

OUTCOMES:

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

- Carryout basic signal processing operations
- Analyze the architecture of a DSP Processor
- Write ALP Programmes for fixed and Floating Point and Arithmetic
- Interface different I/Os with processor
- Generate waveforms using Microprocessors
- Execute Programs in 8051
- Explain the difference between simulator and Emulator

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
CO2	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
CO3	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
CO4	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
CO5	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
Avg	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-

1-low,2-medium,3-high,'-'-nocorrelation

24152C41P   **SEMESTER IV**

MEDICAL ELECTRONICS   3 0 0 3

OBJECTIVES:

The student should be made:

- To gain knowledge about the various physiological parameters both electrical and non electrical and the methods of recording and also the method of transmitting these parameters
- To study about the various assist devices used in the hospitals
- To gain knowledge about equipment used for physical medicine and the various recently developed diagnostic and therapeutic techniques.

UNIT I   ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING
9

Sources of bio medical signals, Bio-potentials, Biopotential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, typical waveforms and signal characteristics

UNIT II   BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT   9

pH, PO2, PCO2, Colorimeter, Blood flow meter, Cardiac output, respiratory, blood pressure, temperature and pulse measurement, Blood Cell Counters.

UNIT III   ASSIST DEVICES   9
Cardiac pacemakers, DC Defibrillator, Dialyser, Ventilators, Magnetic Resonance Imaging Systems, Ultrasonic Imaging Systems.

UNIT IV   PHYSICAL MEDICINE AND BIOTELEMETRY   9
Diathermies- Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy, Biotelemetry.

UNIT V   RECENT TRENDS IN MEDICAL INSTRUMENTATION   9
Telemedicine, Insulin Pumps, Radio pill, Endomicroscopy, Brain machine interface, Lab on a chip.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of this course, the student should be able to:
- Know the human body electro- physiological parameters and recording of bio-potentials
- Comprehend the non-electrical physiological parameters and their measurement – body temperature, blood pressure, pulse, blood cell count, blood flow meter etc.
- Interpret the various assist devices used in the hospitals viz. pacemakers, defibrillators, dialyzers and ventilators
- Comprehend physical medicine methods eg. ultrasonic, shortwave, microwave surgical diathermies , and bio-telemetry principles and methods
- Know about recent trends in medical instrumentation

TEXT BOOK:
1. Leslie Cromwell, ―Biomedical Instrumentation and Measurement‖, Prentice Hall of India, New Delhi, 2007. (UNIT I – V)

REFERENCES:
1. Khandpur, R.S., ―Handbook of Biomedical Instrumentation‖, TATA Mc Graw-Hill, New Delhi, 2003.
2. John G.Webster, ―Medical Instrumentation Application and Design‖, 3rd Edition, Wiley India Edition, 2007
3. Joseph J.Carr and John M.Brown, ―Introduction to Biomedical Equipment Technology‖, John Wiley and Sons, New York, 2004.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
CO2	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
CO3	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
CO4	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
CO5	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
Avg	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-

1-low,2-medium,3-high,'-'-nocorrelation

24152C42P   **SEMESTER IV**

ANTENNA AND WAVE PROPAGATION   3 1 0 4

OBJECTIVES
- To study radiation from a current element.
- To study antenna arrays
- To study aperture antennas
- To learn special antennas such as frequency independent and broad band antennas.
- To study radio wave propagation.

UNIT I   RADIATION   9
Concept of Vector potentials- Modification for Time varying , retarded case- Fields and radiation resistance of an alternating current element-   -Radiation resistance –Effective length – Radiation intensity-Gain and Directivity-Field patterns- Beamwidth – Effective area-Relation between gain, effective length and radiation resistance.

UNIT II   ANTENNA ARRRAYS   9
Arrays of two point sources- Broadside array and End fire arrays – Binomial arrays   - Pattern multiplication- Uniform linear array-

UNIT III   SPECIAL PURPOSE ANTENNAS   9
Radiation from traveling wave on wire- Rhombic antenna – Loop antennas- Three element Yagi antenna- Log periodic antenna- Horn antenna -

UNIT IV   PROPAGATION   9
Ground wave propagation: Attenuation characteristics – Calculation of field strength – Sky wave Propagation: Structure of Ionosphere – Effective dielectric constant of ionized

region-Mechanism of Refraction and Refractive index- Critical Frequeny- Skip distance-Maximum usable frequency –Fading and Diversity Techniques.

Space Wave Propagation: Calculation of Field strength –-Duct propagation.

UNIT V   MEASUREMENTS   9

Impedance – Field Pattern and Gain of Antennas- Radiation Pattern –Ionospheric measurements-Vertical incidence measurements of the ionosphere- Relation between oblique and vertical incidence transmission.

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 RonalatoryMarhefka- Antenna-T McGraw Hill – 2002
2. R.E.Collins-Antennas and Radio Propagation- McGrawhill- 1987
3. Ballany – Antenna Theory- Jhonwiley& sons – 2nd edition 2003.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
CO2	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
CO3	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
CO4	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
CO5	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
Avg	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-

1-low,2-medium,3-high,'-'-nocorrelation

WIRELESS COMMUNICATION   3 0 0 3

Course Objectives:
- Know the characteristic of wireless channel
- Learn the various cellular architectures
- Understand the concepts behind various digital signaling schemes for fading channels
- Be familiar the various multipath mitigation techniques
- Understand the various multiple antenna systems

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 Macrodiversity, 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

Course Outcomes:
- Know the characteristic of wireless channel
- Learn the various cellular architectures
- Understand the concepts behind various digital signaling schemes for fading channels

- Be familiar the various multipath mitigation techniques
- Understand the various multiple antenna systems

TEXT BOOKS:
1. Rappaport,T.S., "Wireless communications", Second Edition, Pearson Education, 2010.
2. Andreas.F. Molisch, "Wireless Communications", John Wiley – India, 2006.

REFERENCES:
1. David Tse and PramodViswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2005.
2. UpenaDalal, " Wireless Communication", Oxford University Press, 2009.
3. Van Nee, R. and Ramji Prasad, "OFDM for wireless multimedia communications", Artech House, 2000.

CO's-PO's&PSO'sMAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	3	2	2	3	3	1	-	-	-	-	-	1	3	1	1
2	3	3	2	1	3	2	-	-	-	-	-	-	3	1	2
3	3	3	3	3	2	2	-	-	-	-	-	1	3	1	2
4	2	3	2	2	2	2	-	-	-	-	-	1	2	1	1
5	2	-	3	3	2	1	-	-	-	-	-	1	2	2	2
CO	**3**	**3**	**2**	**2**	**2**	**2**	-	-	-	-	-	**1**	**3**	**1**	**2**

1-low,2-medium,3-high,'-'-nocorrelation

COMMUNICATION NETWORKS LAB   0 0 3 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.

CO's-PO's&PSO'sMAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	3	2	2	3	3	1	-	-	-	-	-	1	3	1	1
2	3	3	2	1	3	2	-	-	-	-	-	-	3	1	2
3	3	3	3	3	2	2	-	-	-	-	-	1	3	1	2
4	2	3	2	2	2	2	-	-	-	-	-	1	2	1	1
5	2	-	3	3	2	1	-	-	-	-	-	1	2	2	2
CO	**3**	**3**	**2**	**2**	**2**	**2**	-	-	-	-	-	**1**	**3**	**1**	**2**

1-low,2-medium,3-high,'-'-nocorrelation

ELECTIVE - I

24152E44AP   **SEMESTER IV**

HIGH SPEED NETWORKS   4 0 0 4

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 IILAN 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 & PravinVaraiya, "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

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	2	2	-	-	-	-	1	1	3	3	2
2	3	3	3	3	2	2	-	-	-	-	1	1	2	2	2
3	3	3	2	2	2	2	-	-	-	-	1	1	1	2	2
4	3	3	2	2	3	1	-	-	-	-	1	1	2	2	3
5	3	2	2	2	3	2	-	-	-	-	1	1	2	2	1
CO	3	3	2	2	2	2	-	-	-	-	1	1	2	2	2

1-low,2-medium,3-high,'-'-nocorrelation

24152E44BP

ADVANCED DIGITAL SIGNAL PROCESSING   4 0 0 4

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   9
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   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   LINEAR ESTIMATION AND PREDICTION   9
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   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

Course Outcomes:

- Study the parametric methods for power spectrum estimation.
- Study adaptive filtering techniques using LMS algorithm and to study the applications of adaptive filtering.
- Study multirate signal processing fundamentals.
- Study the analysis of speech signals.
- Introduce the student to wavelet transforms.

REFERENCES:

1. Monson H.Hayes, Statistical Digital Signal Processing and Modeling, John Wiley and Sons, Inc., Singapore, 2002.
2. John G. Proakis, DimitrisG.Manolakis, Digital Signal Processing Pearson Education, 2002.
3. John G. Proakiset.al.,'Algorithms for Statistical Signal Processing', Pearson Education, 2002.
4. DimitrisG.Manolakiset.al.,'Statistical and adaptive signal Processing', McGraw Hill, Newyork,2000.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	2	2	-	-	-	-	1	1	3	3	2
2	3	3	3	3	2	2	-	-	-	-	1	1	2	2	2
3	3	3	2	2	2	2	-	-	-	-	1	1	1	2	2
4	3	3	2	2	3	1	-	-	-	-	1	1	2	2	3
5	3	2	2	2	3	2	-	-	-	-	1	1	2	2	1
CO	3	3	2	2	2	2	-	-	-	-	1	1	2	2	2

1-low,2-medium,3-high,'-'-nocorrelation

24152E44CP **SEMESTER IV**

SPEECH PROCESSING 4 0 0 4

OBJECTIVES:
- 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

COURSE OUTCOMES:

- 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.

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 Vertag, 1972.
2. Witten I.H., "Principles of Computer Speech", Academic Press, 1983.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	2	2	-	-	-	-	1	1	3	3	2
2	3	3	3	3	2	2	-	-	-	-	1	1	2	2	2
3	3	3	**2**	2	2	2	-	-	-	-	1	1	1	2	2
4	3	3	2	2	3	1	-	-	-	-	1	1	2	2	3
5	3	2	2	2	3	2	-	-	-	-	1	1	2	2	1
CO	**3**	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**1**	**2**	**2**	**2**

1-low,2-medium,3-high,'-'-nocorrelation

24152E44DP **SEMESTER IV**

MACHINE LEARNING TECHNIQUES 4 0 0 4

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. EthemAlpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
2. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective‖, CRC Press, 2009.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	2	2	-	-	-	-	1	1	3	3	2
2	3	3	3	3	2	2	-	-	-	-	1	1	2	2	2
3	3	3	**2**	2	2	2	-	-	-	-	1	1	1	2	2
4	3	3	2	2	3	1	-	-	-	-	1	1	2	2	3
5	3	2	2	2	3	2	-	-	-	-	1	1	2	2	1
CO	**3**	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**1**	**2**	**2**	**2**

1-low,2-medium,3-high,'-'-nocorrelation

NANOTECHNOLOGY AND APPLICATIONS

4 0 0 4

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 NANOMATERIALS9
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.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	2	2	-	-	-	-	1	1	3	3	2
2	3	3	3	3	2	2	-	-	-	-	1	1	2	2	2
3	3	3	**2**	2	2	2	-	-	-	-	1	1	1	2	2
4	3	3	2	2	3	1	-	-	-	-	1	1	2	2	3
5	3	2	2	2	3	2	-	-	-	-	1	1	2	2	1
CO	**3**	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**1**	**2**	**2**	**2**

1-low,2-medium,3-high,'-'-nocorrelation

OPTICAL COMMUNICATION   **4 0 0 4**

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 model 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-noisesources-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.

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. GerdKeiser,"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.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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5	3	2	2	2	3	2	-	-	-	-	1	1	2	2	1
CO	**3**	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**1**	**2**	**2**	**2**

1-low,2-medium,3-high,'-'-nocorrelation

MICROWAVE ENGINEERING   4 0 0 4

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

Course Outcomes:

- Study about passive microwave components and their S- Parameters.
- Study about Microwave semiconductor devices & applications.
- Study about Microwave sources and amplifiers.

Text Book:

1. Samuel Y.LIAO : Microwave Devices and Circuits – Prentice Hall of India – 3rd Edition (2003)
2. Annapurna Das and SisirK.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 – 2nd Edition (2003)
3. P.A.RIZZI – Microwave Engg. (Passive)

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	2	2	-	-	-	-	1	1	3	3	2
2	3	3	3	3	2	2	-	-	-	-	1	1	2	2	2
3	3	3	**2**	2	2	2	-	-	-	-	1	1	1	2	2
4	3	3	2	2	3	1	-	-	-	-	1	1	2	2	3
5	3	2	2	2	3	2	-	-	-	-	1	1	2	2	1
CO	**3**	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**1**	**2**	**2**	**2**

1-low,2-medium,3-high,'-'-nocorrelation

PRINCIPLES OF MANAGEMENT

4 0 0 4

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   Nature of Management   9

Definitions, meaning, scope, administration and management - Science and art Mgmt as a profession, University of management Hierarchy (Top, middle and supervisory, Levels), Principles of Management

UNIT II   Development of Management Thought   9

Taylor and Scientific Management, Principles of Scientific Management Contributions of fayol,Barnard and social system theory, Contributions of Herbert Simon, Contributions of Peter Drucker, Contributions of behavioral scientists ,Contribution of system scientists

UNIT III   Planning and organizing   9

Definition and features of planning, Nature of planning, Importance of planning
Types of planning, Steps in planning. Management by objectives, Strategies and policies, Definition of organization, Importance of organization, Principles of organization, Span of management

UNIT IV   Direction and Coordination   9

Meaning, definition, principles of direction, Techniques of direction - Meaning of supervision, Functions of supervisor, Meaning of coordination Element and features of coordination, Importance of coordination Cooperation and coordination systems approach Steps for effective coordination Meaning and causes of conflicts, Management of conflicts

UNIT V   Controlling   9

Definition, Meaning .elements, steps in establishing control procedure Control Techniques, Requirements of good control systems Budget –meaning, definitions, types Zero based budgeting, responsibility accounting, budgetary control, Report –meaning types PERT and CPM Management by Exception

TOTAL : 45

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. 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 : sahityabhawan1998
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

CO's-PO's&PSO'sMAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	3	3	3	3	2	1	-	-	-	-	-	1	2	1	1
2	3	2	2	3	2	2	-	-	-	-	-	1	2	1	1
3	3	3	3	2	1	2	-	-	-	-	-	1	2	1	1
4	3	3	2	3	2	2	-	-	-	-	-	1	2	1	1
5	3	2	3	2	2	1	-	-	-	-	-	1	2	1	1
CO	**3**	**3**	**3**	**3**	**2**	**2**	-	-	-	-	-	**1**	**2**	**1**	**1**

1-low,2-medium,3-high,'-'-nocorrelation

OPTICAL COMMUNICATION AND MICROWAVE LAB

0 0 3 2

OBJECTIVES:
- To understand the working principle of optical sources, detector, fibers
- To develop understanding of simple optical communication link
- To understand the measurement of BER, VSWR
- To understand the characteristics of Gunn diode oscillator.

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.

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
- Understand the characteristics of Gunn diode oscillator
- Understand the intricacies in Microwave System design

CO's-PO's&PSO'sMAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1		3										3	2		3
2						3						3		2	
3					3				3					2	3
4		2			3	2	3	2				3	3	2	
5			3			3	3	2							
AVg.		2.5	3		3	2.6	3	2	3			3	2.5	2	3

1-low,2-medium,3-high,'-'-nocorrelation

ENVIRONMENTAL SCIENCE AND ENGINEERING   4 0 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   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

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

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.

CO's-PO's&PSO'sMAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1		3										3	2		3
2						3						3		2	
3					3				3					2	3
4		2			3	2	3	2				3	3	2	
5			3			3	3	2							
AVg.		2.5	3		3	2.6	3	2	3			3	2.5	2	3

1-low,2-medium,3-high,'-'-nocorrelation

ELECTIVE- II

OPTO ELECTRONIC DEVICES   4 0 0 4

OBJECTIVES:

* 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 – Reviewof quantum mechanical concept – Review of solid state physics – Review ofsemiconductor 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 – LiquidCrystal Display (LCD) – Numeric displays – Laser emission – Absorption – Radiation –Population inversion – Optical feedback – Threshold condition – Laser modes – Classesof 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 opticdevices – Acoustoptic devices – Optical – Switching and logic devices.

UNIT V: OPTOELECTRONIC INTEGRATED CIRCUITS   9

Introduction – Hybrid and monolithic integration – Application of opto electronicintegrated circuits – Integrated transmitters and receivers – Guided wave devices.

Total: 45

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.

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.

CO's-PO's&PSO'sMAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1		3										3	2		3
2						3						3		2	
3					3				3					2	3
4		2			3	2	3	2				3	3	2	
5			3			3	3	2							
AVg.		2.5	3		3	2.6	3	2	3			3	2.5	2	3

1-low,2-medium,3-high,'-'-nocorrelation

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RADAR AND NAVIGATIONAL AIDS　　　4 0 0 4

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　　DETECTION OF SIGNALS IN NOISE　　　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   RADIO DETECTION AND RANGES   9

Introduction – Four methods of navigation – Radio direction finding – The loop antenna– Loop input circuits – An aural null direction finder – The goniometer – Errors indirection finding – Adcock direction finders – Direction finding at very high frequencies– Automatic direction finders – The commutated aerial direction finder – Range and accuracy of direction finders – Radio ranges **–** The Lf/Mf four course radio range – Vh fomni 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   SATELLITE NAVIGATION SYSTEM   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

COURSE OUTCOMES:
After successful completion of the course, the students are able to:
- Understand various types of radar equipments.
- Demonstrate and Distinguish the fixed and moving targets using different types of radar systems and also the working of tracking radar.
- Analyze the features of radar receiver's components and their usage in aerospace guidance.
- Summarize noise jamming and different electronic warfare techniques.
- Identify the different navigational aids.

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

CO's-PO's&PSO'sMAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1		3										3	2		3
2						3						3		2	
3					3				3					2	3
4		2			3	2	3	2				3	3	2	
5			3			3	3	2							
AVg.		2.5	3		3	2.6	3	2	3			3	2.5	2	3

1-low,2-medium,3-high,'-'-nocorrelation

ELECTIVE- II
24152E54DP   **SEMESTER V**

DIGITAL IMAGE PROCESSING   4 0 0 4

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 HaarTransfroms

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 –
chair codes- Boundary segments – boundary   descriptors-: simple descriptors-Fourier
descriptors- Regional descriptors- Texture.

TOTAL : 45

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 Book:
1. Rafeel C. Gonzalez, Richard E Woods, Digital Image processing – 2nd edition – Pearson education 2003.

Reference books:
1. William K.Pratt, Digital Image processing, John Wiley (2001)
2. Image processing Analysis and Machine Vision   - MillmanSonka ,Vaclav hlavac,RogerBoyle,Broos/Colic,ThompsonLearnfy(1999)
3. A.K.Jain PHI,(1995) – Fundamentals of Digital Image processing

CO's-PO's&PSO'sMAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1		3										3	2		3
2						3						3		2	
3					3				3					2	3
4		2			3	2	3	2				3	3	2	
5			3			3	3	2							
AVg.		2.5	3		3	2.6	3	2	3			3	2.5	2	3

1-low,2-medium,3-high,'-'-nocorrelation

CO's-PO's&PSO'sMAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1		3										3	2		3
2						3						3		2	
3					3				3					2	3
4		2			3	2	3	2				3	3	2	
5			3			3	3	2							
AVg.		2.5	3		3	2.6	3	2	3			3	2.5	2	3

1-low,2-medium,3-high,'-'-nocorrelation

ELECTIVE- II

24152E54EP   **SEMESTER V**

INTELLECTUAL PROPERTY RIGHTS   4 0 0 4

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.

CO's-PO's&PSO'sMAPPING

CO's	PO's												PSO's		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1		3										3	2		3
2						3						3		2	
3					3				3					2	3
4		2			3	2	3	2				3	3	2	
5			3			3	3	2							
AVg.		2.5	3		3	2.6	3	2	3			3	2.5	2	3

1-low,2-medium,3-high,'-'-nocorrelation

24150S61P   **SEMESTER VI**

INTERNET-OF-THINGS   4 0 0 4

OBJECTIVES:
- To apprise students with basic knowledge of IoT that paves a platform to understand physical and logical design of IOT
- To teach a student how to analyse requirements of various communication models and protocols for cost-effective design of IoT applications on different IoT platforms.
- To introduce the technologies behind Internet of Things(IoT).
- To explain the students how to code for an IoT application using Arduino/Raspberry Pi open platform.
- To apply the concept of Internet of Things in real world scenario.

UNIT I INTRODUCTION TO INTERNET OF THINGS 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

UNIT II COMPONENTS IN INTERNET OF THINGS 9

Functional Blocks of an IoT Ecosystem – Sensors, Actuators, and Smart Objects – Control Units - Communication modules (Bluetooth, Zigbee,Wifi, GPS, GSM Modules)

UNIT III PROTOCOLS AND TECHNOLOGIES BEHIND IOT 9

IOT Protocols - IPv6, 6LoWPAN, MQTT, CoAP - RFID, Wireless Sensor Networks, BigData Analytics, Cloud Computing, Embedded Systems.

UNIT IV OPEN PLATFORMS AND PROGRAMMING 9

IOT deployment for Raspberry Pi /Arduino platform-Architecture –Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.

UNIT V IOT APPLICATIONS 9

Business models for the internet of things, Smart city, Smart mobility and transport, Industrial IoT, Smart health, Environment monitoring and surveillance – Home Automation – Smart Agriculture

TOTAL: 45

COURSE OUTCOMES:

CO1: Explain the concept of IoT.

CO2: Understand the communication models and various protocols for IoT.

CO3: Design portable IoT using Arduino/Raspberry Pi /open platform

CO4: Apply data analytics and use cloud offerings related to IoT.

CO5: Analyze applications of IoT in real time scenario.

TEXTBOOKS:

1. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017
2. Samuel Greengard, The Internet of Things, The MIT Press, 2015.

REFERENCES:

1. Perry Lea, "Internet of things for architects", Packt, 2018
2. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012
3. IOT (Internet of Things) Programming: A Simple and Fast Way of Learning, IOT Kindle Edition.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011.

5. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015
6. https://www.arduino.cc/
7. https://www.ibm.com/smarterplanet/us/en/?ca=v_smarterplanet

CO's-PO's&PSO'sMAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1		3										3	2		3
2						3						3		2	
3					3				3					2	3
4		2			3	2	3	2				3	3	2	
5			3			3	3	2							
AVg.		2.5	3		3	2.6	3	2	3			3	2.5	2	3

1-low,2-medium,3-high,'-'-nocorrelation

24152C62P   **SEMESTER VI**

VLSI DESIGN   3 1 0 4

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   MOS TRANSISTOR PRINCIPLE   9
NMOS and PMOS transistors, Process parameters for MOS and CMOS, Electrical properties of CMOS circuits and device modeling, Scaling principles and fundamental limits, CMOS inverter scaling, propagation delays, Stick diagram, Layout diagrams

UNIT II   COMBINATIONAL LOGIC CIRCUITS   9
Examples of Combinational Logic Design, Elmore"s constant, Pass transistor Logic, Transmission gates, static and dynamic CMOS design, Power dissipation – Low power design principles

UNIT III   SEQUENTIAL LOGIC CIRCUITS   9

Static and Dynamic Latches and Registers, Timing issues, pipelines, clock strategies, Memory architecture and memory control circuits, Low power memory circuits, Synchronous and Asynchronous design

UNIT IV   DESIGNING ARITHMETIC BUILDING BLOCKS   9

Data path circuits, Architectures for ripple carry adders, carry look ahead adders, High speed adders, accumulators, Multipliers, dividers, Barrel shifters, speed and area tradeoff

UNIT V   IMPLEMENTATION STRATEGIES   9

Full custom and Semi custom design, Standard cell design and cell libraries, FPGA building block architectures, FPGA interconnect routing procedures.

    TUTORIAL   15   TOTAL: 60

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.

TEXTBOOKS:

1. Jan Rabaey, AnanthaChandrakasan, B.Nikolic, "Digital Integrated Circuits: A Design Perspective", Second Edition, Prentice Hall of India, 2003.
2. M.J. Smith, "Application Specific Integrated Circuits", Addisson Wesley, 1997

REFERENCES:

1. N.Weste, K.Eshraghian, "Principles of CMOS VLSI Design", Second Edition, Addision Wesley 1993
2. R.Jacob Baker, Harry W.LI., David E.Boyee, "CMOS Circuit Design, Layout and Simulation", Prentice Hall of India 2005
3. A.Pucknell, Kamran Eshraghian, "BASIC VLSI Design", Third Edition, Prentice Hall of India, 2007.

CO's-PO's&PSO'sMAPPING

CO's		PO's											PSO's		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	**6.**	3											3	2		3
2						3							3		2	
3	**7.**				3				3						2	3
4	**8.**	2			3	2	3	2					3	3	2	
5	**9.**		3			3	3	2								
AVg.		2.5	3		3	2.6	3	2	3				3	2.5	2	3

1-low,2-medium,3-high,'-'-nocorrelation

EMBEDDED AND REAL TIME SYSTEMS   3 1 0 4

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 EMBEDDEDSYSTEM 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.

   Tutorial: 15 Hrs   **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, McGraw 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 McGraw Hill, 2004.

CO's-PO's&PSO'sMAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1		3										3	2		3
2						3						3		2	
3					3				3					2	3
4		2			3	2	3	2				3	3	2	
5			3			3	3	2							
AVg.		2.5	3		3	2.6	3	2	3			3	2.5	2	3

1-low,2-medium,3-high,'-'-nocorrelation

VLSI AND EMBEDDED SYSTEMS LAB   0 0 3 2

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
- Learn the working of ARM processor
- Write programs to interface memory, I/Os with processor
- Study the interrupt performance

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 Root and back annotation for FPGA.

PART-II: EMBEDDED LAB

1. Programming using Arithmetic, instruction of 8051microcontroller.
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

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
- 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.

CO's-PO's&PSO'sMAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1		3										3	2		3
2						3						3		2	
3					3				3					2	3
4		2			3	2	3	2				3	3	2	
5			3			3	3	2							
AVg.		2.5	3		3	2.6	3	2	3			3	2.5	2	3

1-low,2-medium,3-high,'-'-nocorrelation

ELECTIVE -III

24152E64AP   **SEMESTER VI**

PROFESSIONAL ETHICS IN ENGINEERING   4 0 0 4

OBJECTIVES:

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

UNIT I   HUMAN VALUES   10
Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue –
Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage –
Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character –
Spirituality – Introduction to Yoga and meditation for professional excellence and stress
management.

UNIT II   ENGINEERING ETHICS   9
Senses of „Engineering Ethics" – Variety of moral issues – Types of inquiry – Moral
dilemmas – Moral Autonomy – Kohlberg"s theory – Gilligan"s theory – Consensus and
Controversy – Models of professional roles - Theories about right action – Self-interest –
Customs and Religion – Uses of Ethical Theories

UNIT III   ENGINEERING AS SOCIAL EXPERIMENTATION   9
Engineering as Experimentation – Engineers as responsible Experimenters – Codes of
Ethics – A Balanced Outlook on Law.

UNIT IV   SAFETY, RESPONSIBILITIES AND RIGHTS   9

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

UNIT V   GLOBAL ISSUES   8

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

TOTAL: 45 PERIODS

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

TEXT BOOKS:
1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES:
1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009
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" McGraw Hill education, India Pvt. Ltd.,New Delhi 2013.
6. World Community Service Centre, "Value Education", Vethathiri publications, Erode, 2011

Web sources:
www.onlineethics.org
www.nspe.org
www.globalethics.org
www.ethics.org

CO's-PO's&PSO'sMAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1		3										3	2		3
2						3						3		2	
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4		2			3	2	3	2				3	3	2	
5			3			3	3	2							
AVg.		2.5	3		3	2.6	3	2	3			3	2.5	2	3

1-low,2-medium,3-high,'-'-nocorrelation

ELECTIVE -III

24152E64BP　　　　　　　　　　　　　　　　　　　　　　**SEMESTER VI**

SATELLITE COMMUNICATION　　　　4 0 0 4

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

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 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

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	2	3	-	-	-	-	-	3	2	3	2
2	3	2	3	2	2	2	-	-	-	-	-	3	3	2	2
3	3	3	3	2	3	2	-	-	-	-	-	3	2	3	2
4	3	3	3	2	2	2	-	-	-	-	-	2	3	2	2
5	3	3	2	2	2	2	-	-	-	-	-	3	2	2	2
CO	3	3	3	2	3	3	-	-	-	-	-	2	3	3	2

1-low,2-medium,3-high,'-'-nocorrelation

24152E64CP

ROBOTICS AND AUTOMATION   4 0 0 4

OBJECTIVES
- To study the various parts of robots and fields of robotics.
- To study the various kinematics and inverse kinematics of robots.
- To study the Euler, Lagrangian formulation of Robot dynamics.
- To study the trajectory planning for robot.
- To study the control of robots for some specific applications.

UNIT I   BASIC CONCEPTS   9
Definition and origin of robotics – different types of robotics – various generations of robots – degrees of freedom – Asimov"s laws of robotics – dynamic stabilization of robots.

UNIT II   POWER SOURCES AND SENSORS   9
Hydraulic, pneumatic and electric drives – determination of HP of motor and gearing ratio – variable speed arrangements – path determination – micro machines in robotics – machine vision – ranging – laser – acoustic – magnetic, fiber optic and tactile sensors.

UNIT III   MANIPULATORS, ACTUATORS AND GRIPPERS   9
Construction of manipulators – manipulator dynamics and force control – electronic and pneumatic manipulator control circuits – end effectors – U various types of grippers – design considerations.

UNIT IV   KINEMATICS AND PATH PLANNING   9
Solution of inverse kinematics problem – multiple solution jacobian work envelop – hill Climbing Techniques – robot programming languages

UNIT V   CASE STUDIES   9
Mutiple robots – machine interface – robots in manufacturing and non- manufacturing applications – robot cell design – selection of robot.

Total: 45

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.

- Describe the impact and progress in AI and other research trends in the field of robotics

TEXT BOOKS:
1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., "Industrial Robotics", McGraw-Hill Singapore, 1996.
2. Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, 1998.

REFERENCES:
1. Deb. S.R.,"Robotics Technology and flexible Automation", John Wiley, USA 1992.
2. Klafter R.D., Chimielewski T.A., Negin M., "Robotic Engineering – An integrated approach", Prentice Hall of India, New Delhi, 1994.
3. McKerrow P.J. "Introduction to Robotics", Addison Wesley, USA, 1991.
4. Issac Asimov "Robot", Ballantine Books, New York, 1986.
5. Barry Leatham - Jones, "Elements of industrial Robotics" PITMAN Publishing, 1987.
6. MikellP.Groover, Mitchell Weiss, Roger N.Nagel Nicholas G.Odrey, "Industrial Robotics Technology, Programming and Applications ", McGraw Hill Book Company 1986.
7. Fu K.S. Gonzaleaz R.C. and Lee C.S.G., "Robotics Control Sensing, Vision and Intelligence" McGraw Hill International Editions, 1987.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	2	3	-	-	-	-	-	3	2	3	2
2	3	2	3	2	2	2	-	-	-	-	-	3	3	2	2
3	3	3	3	2	3	2	-	-	-	-	-	3	2	3	2
4	3	3	3	2	2	2	-	-	-	-	-	2	3	2	2
5	3	3	2	2	2	2	-	-	-	-	-	3	2	2	2
CO	3	3	3	2	3	3	-	-	-	-	-	2	3	3	2

1-low,2-medium,3-high,'-'-nocorrelation

NETWORK SECURITY **4 0 0 4**

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 keyexchange – 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 mailsecurity – 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

COURSE OUTCOMES:
- Know the methods of conventional encryption.
- Understand the concepts of public key encryption and number theory
- Understand authentication and Hash functions
- Know the network security tools and applications.
- Understand the system level security used.

TEXT BOOK

1. William Stallings, "Cryptography and Network Security – Principles andPractices", 3rd Edition, Pearson Education, 2003.

REFERENCES

1. AtulKahate, "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", 3rd Edition, Pearson Education, 2003.

CO's-PO's&PSO'sMAPPING

C	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO	PSO
1	2	-	-	-	-	-	-	-	-	-	1	-	2	1	1
2	2	3	3	2	-	-	-	-	-	-	-	-	2	1	1
3	1	-	-	2	-		-	-	-	-	-	-	2	1	1
4	1	-	-	2	-	-	-	-	-	-	-	-	2	1	1
5	1	2	3	3	-	-	-	-	-	-	-	3	2	1	1
C	1.4	2.5	3	2.2	-	-	-	-	-	-	1	3	2	1	1

1-low,2-medium,3-high,'-'-nocorrelation

24152E64EP

CMOS ANALOG IC DESIGN   4 0 0 4

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. BehzadRazavi, ―Design of Analog CMOS Integrated Circuits‖, Tata McGraw Hill, 2001, 33rd 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

CO's-PO's&PSO'sMAPPING

C	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO	PSO
1	2	-	-	-	-	-	-	-	-	-	1	-	2	1	1
2	2	3	3	2	-	-	-	-	-	-	-	-	2	1	1
3	1	-	-	2	-	-	-	-	-	-	-	-	2	1	1
4	1	-	-	2	-	-	-	-	-	-	-	-	2	1	1
5	1	2	3	3	-	-	-	-	-	-	-	3	2	1	1
C	1.4	2.5	3	2.2	-	-	-	-	-	-	1	3	2	1	1

1-low,2-medium,3-high,'-'-nocorrelation

24160S71P   **SEMESTER VII**

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.

UNIT I   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.

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, PDSA 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 : 45

COURSE OUTCOMES:
- Understand the Total Quality Management concept and principles and the various tools available to achieve Total Quality Management.
- Understand the statistical approach for quality control.
- Create an awareness about the ISO and QS certification process and its need for the industries.

TEXT BOOK
1. Dale H.Besterfiled, et al., Total Quality Management, Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6.

REFERENCES
1. James R.Evans& William M.Lidsay, The Management and Control of Quality, (5th 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 – Hcinemann 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

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	3	3	1	-	-	-	-	-	1	3	1	1
2	3	3	2	1	3	2	-	-	-	-	-	-	3	1	2
3	3	3	3	3	2	2	-	-	-	-	-	1	3	1	2
4	2	3	2	2	2	2	-	-	-	-	-	1	2	1	1
5	2	-	3	3	2	1	-	-	-	-	-	1	2	2	2
CO	**3**	**3**	**2**	**2**	**2**	**2**	-	-	-	-	-	**1**	**3**	**1**	**2**

1-low,2-medium,3-high,'-'-nocorrelation

WIRELESS NETWORKS   3 1 0 4

OBJECTIVES
- To study about Wireless networks, protocol stack and standards.
- To study about fundamentals of 3G Services, its protocols and applications.
- To study about evolution of 4G Networks, its architecture and applications.

UNIT I   WIRELESS LAN   9
Introduction-WLAN technologies: Infrared, UHF narrowband, spread spectrum - IEEE802.11: System architecture, protocol architecture, physical layer, MAC layer, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, Radio Layer, Baseband layer, Link manager Protocol, security - IEEE802.16-WIMAX: Physical layer, MAC, Spectrum allocation for WIMAX

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, Dynamic source routing

UNIT III   MOBILE TRANSPORT LAYER   9
TCP enhancements for wireless protocols - Traditional TCP: Congestion control, fast retransmit/fast recovery, Implications of mobility - Classical TCP improvements: Indirect TCP, Snooping TCP, Mobile TCP, Time out freezing, Selective retransmission, Transaction oriented TCP - TCP over 3G wireless networks**.**

UNIT IV   WIRELESS WIDE AREA NETWORK   9
Overview of UTMS Terrestrial Radio access network-UMTS Core network Architecture: 3G-MSC, 3G-SGSN, 3G-GGSN, SMS-GMSC/SMS-IWMSC, Firewall, DNS/DHCP-High speed Downlink packet access (HSDPA)- LTE network architecture and protocol.

UNIT V   4G NETWORKS   9
Introduction – 4G vision – 4G features and challenges - Applications of 4G – 4G Technologies: Multicarrier Modulation, Smart antenna techniques, OFDM-MIMO systems, Adaptive Modulation and coding with time slot scheduler, Cognitive Radio.
                                                        TOTAL : 45

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

CO's-PO's&PSO'sMAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	3	2	2	3	3	1	-	-	-	-	-	1	3	1	1
2	3	3	2	1	3	2	-	-	-	-	-	-	3	1	2
3	3	3	3	3	2	2	-	-	-	-	-	1	3	1	2
4	2	3	2	2	2	2	-	-	-	-	-	1	2	1	1
5	2	-	3	3	2	1	-	-	-	-	-	1	2	2	2
CO	**3**	**3**	**2**	**2**	**2**	**2**	-	-	-	-	-	**1**	**3**	**1**	**2**

1-low,2-medium,3-high,'-'-nocorrelation

ADHOC AND WIRELESS SENSOR NETWORKS   4 0 0 4

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.

CO's-PO's&PSO'sMAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	3	2	2	3	3	1	-	-	-	-	-	1	3	1	1
2	3	3	2	1	3	2	-	-	-	-	-	-	3	1	2
3	3	3	3	3	2	2	-	-	-	-	-	1	3	1	2
4	2	3	2	2	2	2	-	-	-	-	-	1	2	1	1
5	2	-	3	3	2	1	-	-	-	-	-	1	2	2	2
CO	**3**	**3**	**2**	**2**	**2**	**2**	-	-	-	-	-	**1**	**3**	**1**	**2**

1-low,2-medium,3-high,'-'-nocorrelation

POWER ELECTRONICS   3 0 0 3

OBJECTIVES:
- To study about power electronic circuits for voltage and current control and protection.
- To learn the switching characteristics of transistors and SCRs. Series and parallel functions of SCRs, Programmable triggering methods of SCR.
- To learn controlled rectification AC supplies.
- To study of converters and inverters.
- To learn about motor control, charges, SMPS and UPS.

UNIT I   POWER SEMICONDUCTOR DEVICES   9

Power transistors, Thyristors, Power TRIAC, MOSFET, IGBT, GTO characteristics, rating, Protection circuits.

UNIT II   POWER SUPPLIES   9

Single Phase and Three Phase Controlled rectifiers, Design of Trigger circuits, Switching mode regulators – Boost, Buck, Buck-Boost and Cuk regulators, AC voltage regulator.

UNIT III   INVERTERS   9

Voltage and current source inverters, Resonant, Series inverter, PWM inverter.

UNIT IV   CHOPPERS   9

Type A, B, C and D choppers, Pulse width modulation - Gating requirements.

UNIT V   MOTOR CONTROL & Applications   9

Single Phase DC series motor drives, Induction and Synchronous motor drives, Switched reluctance motor Drive, SMPS and UPS

                                                              TOTAL: 45

COURSE OUTCOMES:
- Study about power electronic circuits for voltage and current control and protection.
- Learn the switching characteristics of transistors and SCRs. Series and parallel functions of SCRs, Programmable triggering methods of SCR.
- Learn about controlled rectification AC supplies.
- Study about converters and inverters.
- Learn about motor control, charges, SMPS and UPS.

TEXT BOOK:
1. M.D.Singh, K.B. Khanchandani, "Power Electronics", Tata McGraw-Hill, 1998.

REFERENCES:

1. Ned Mohan, Tore M.Undeland, William P.Robbins, "Power Electronics, Converters, Applications and Design", John Wiley & Sons, 1994.
2. MuhamedH.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

CO's-PO's&PSO'sMAPPING

C	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO	PSO
1	1	1	-	-	-	-	-	-	-	-	-	-	3	3	3
2	3	2	3	2	-	-	-	-	-	-	-	1	3	3	3
3	2	3	2	3	1	1	-	-	-	-	-	2	3	2	3
4	-	-	1	1	-	-	-	-	-	-	-	3	3	3	2
5	-	-	-	-	-	2	-	-	-	-	1	-	3	2	2
C	2	2	2	2	1	1.5	-	-	-	-	1	2	3	3	3

1-low,2-medium,3-high,'-'-nocorrelation

ELECTIVE – IV

24152E74BP   **SEMESTER VII**

ADVANCED MICROPROCESSORS AND MICROCONTROLLERS

3 0 0 3

OBJECTIVES

- To expose the students to the fundamentals of microprocessor architecture.
- To introduce the advanced features in microprocessors and microcontrollers.
- To enable the students to understand various microcontroller architectures.

UNIT I   HIGH PERFORMANCE CISC ARCHITECTURE – PENTIUM   9

CPU Architecture- Bus Operations – Pipelining – Brach predication – floating point unit- Operating Modes –Paging – Multitasking – Exception and Interrupts – Instruction set – addressing modes – Programming the Pentium processor.

UNIT II   HIGH PERFORMANCE RISC ARCHITECTURE – ARM   9

Arcon RISC Machine – Architectural Inheritance – Core & Architectures - Registers – Pipeline - Interrupts – ARM organization - ARM processor family – Co-processors - ARM instruction set- Thumb Instruction set - Instruction cycle timings - The ARM Programmer"s model – ARM Development tools – ARM Assembly Language Programming - C programming – Optimizing ARM Assembly Code – Optimized Primitives.

UNIT III   ARM APPLICATION DEVELOPMENT   9

Introduction to DSP on ARM –FIR filter – IIR filter – Discrete fourier transform – Exception handling – Interrupts – Interrupt handling schemes- Firmware and bootloader – Embedded Operating systems – Integrated Development Environment- STDIO Libraries – Peripheral Interface – Application of ARM Processor - Caches – Memory protection Units – Memory Management units – Future ARM Technologies.

UNIT IV   MOTOROLA 68HC11 MICROCONTROLLERS   9

Instruction set addressing modes – operating modes- Interrupt system- RTC-Serial Communication Interface – A/D Converter PWM and UART.

UNIT V   PIC MICROCONTROLLER   9

CPU Architecture – Instruction set – interrupts- Timers- I2C Interfacing –UART- A/D Converter –PWM and introduction to C-Compilers.

TOTAL: 45

COURSE OUTCOMES:
After successful completion of the course, student will be able to:
- Understand the generalized architecture of advanced microprocessors and advanced microcontrollers
- Develop algorithm/program of the advanced microcontrollers for a particular task
- Interface advanced microcontrollers with external peripherals

TEXT BOOK:
1. Andrew N.Sloss, Dominic Symes and Chris Wright " ARM System Developer's Guide : Designing and Optimizing System Software" , First edition, Morgan Kaufmann Publishers, 2004.

REFERENCES:
1. Steve Furber , "ARM System –On –Chip architecture", Addision Wesley, 2000.
2. Daniel Tabak , "Advanced Microprocessors", McGraw Hill. Inc., 1995
3. James L. Antonakos , " The Pentium Microprocessor", Pearson Education, 1997.
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", Pearson Education, 1999.
7. Barry.B.Brey,"The Intel Microprocessors Architecture, Programming and Interfacing", PHI,2002.
8. Valvano, "Embedded Microcomputer Systems", Thomson Asia PVT LTD first reprint 2001.

Readings:

Web links www.ocw.nit.edu

www.arm.com

CO's-PO's&PSO'sMAPPING

C	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO	PSO
1	1	1	-	-	-	-	-	-	-	-	-	-	3	3	3
2	3	2	3	2	-	-	-	-	-	-	-	1	3	3	3
3	2	3	2	3	1	1	-	-	-	-	-	2	3	2	3
4	-	-	1	1	-	-	-	-	-	-	-	3	3	3	2
5	-	-	-	-	-	2	-	-	-	-	1	-	3	2	2
C	2	2	2	2	1	1.5	-	-	-	-	1	2	3	3	3

1-low,2-medium,3-high,'-'-nocorrelation

24152E74CP

ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY
3 0 0 3

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 anddetection technique open area site – Shielded anechoic chamber – TEM cell.

UNIT III   **EMC STANDARD AND REGULATIONS**   **8**
National and intentional standardizing organizations – FCC – CISPR – ANSI – DOD – IEC – CENEEC – FCC – CE and RE standards – CISPR – CE and RE standards – IEC/EN – CS standards – Frequency assignment – Spectrum conversion.

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

OUTCOMES:
At the end of the course, the student should be able to:
- Identify the various types and mechanisms of Electromagnetic Interference
- Propose a suitable EMI mitigation technique
- Describe the various EMC Standards and methods to measure them

TEXT BOOKS

1. Prasad Kodali V., "Engineering Electromagnetic Compatibility", S. Chand andCo, 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

CO's-PO's&PSO'sMAPPING

C	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO	PSO
1	1	1	-	-	-	-	-	-	-	-	-	-	3	3	3
2	3	2	3	2	-	-	-	-	-	-	-	1	3	3	3
3	2	3	2	3	1	1	-	-	-	-	-	2	3	2	3
4	-	-	1	1	-	-	-	-	-	-	-	3	3	3	2
5	-	-	-	-	-	2	-	-	-	-	1	-	3	2	2
C	2	2	2	2	1	1.5	-	-	-	-	1	2	3	3	3

1-low,2-medium,3-high,'-'-nocorrelation

ELECTIVE – IV
24152E74DP   **SEMESTER VII**

SOLID STATE ELECTRONIC DRIVES   3 0 0 3

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   CRYYSTAL 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 –Femi 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

COURSE OUTCOMES:

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

- Learn crystal structures of elements used for fabrication of semiconductor devices.
- Study energy band structure of semiconductor devices.
- Understand fermi levels, movement of charge carriers, Diffusion current and Drift current.
- Study behavior of semiconductor junction under different biasing conditions. Fabrication of different semiconductor devices, Varactor diode, Zener diode, Schottky diode, BJT, MOSFET, etc.
- Study the VI Characteristics of devices and their limitations in factors like current, power frequency.
- Learn photoelectric effect and fabrication of opto electronic devices.

TEXT BOOKS

1. Ben. G. Streetman &Sanjan Banerjee, Solid State Electronic Devices, 5th Edition, PHI, 2003.

REFERENCES

1. Donald A. Neaman, Semiconductor Physics and Devices, 3rd Edition, TMH, 2002.
2. YannisTsividis, Operation & Mode line of MOS Transistor, 2nd 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, OxfordUniversity Press, 2007.

CO's-PO's&PSO'sMAPPING

C	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO	PSO
1	1	1	-	-	-	-	-	-	-	-	-	-	3	3	3
2	3	2	3	2	-	-	-	-	-	-	-	1	3	3	3
3	2	3	2	3	1	1	-	-	-	-	-	2	3	2	3
4	-	-	1	1	-	-	-	-	-	-	-	3	3	3	2
5	-	-	-	-	-	2	-	-	-	-	1	-	3	2	2
C	**2**	**2**	**2**	**2**	**1**	**1.5**	**-**	**-**	**-**	**-**	**1**	**2**	**3**	**3**	**3**

1-low,2-medium,3-high,'-'-nocorrelation

24152E74EP

MIXED SIGNAL IC DESIGN   4 0 0 4

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
 IntegratorBuilding 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 BehzadRazavi, McGraw Hill, 33rd Reprint, 2016.

CO's-PO's&PSO'sMAPPING

C	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO	PSO
1	1	1	-	-	-	-	-	-	-	-	-	-	3	3	3
2	3	2	3	2	-	-	-	-	-	-	-	1	3	3	3
3	2	3	2	3	1	1	-	-	-	-	-	2	3	2	3
4	-	-	1	1	-	-	-	-	-	-	-	3	3	3	2
5	-	-	-	-	-	2	-	-	-	-	1	-	3	2	2
C	2	2	2	2	1	1.5	-	-	-	-	1	2	3	3	3

1-low,2-medium,3-high,'-'-nocorrelation